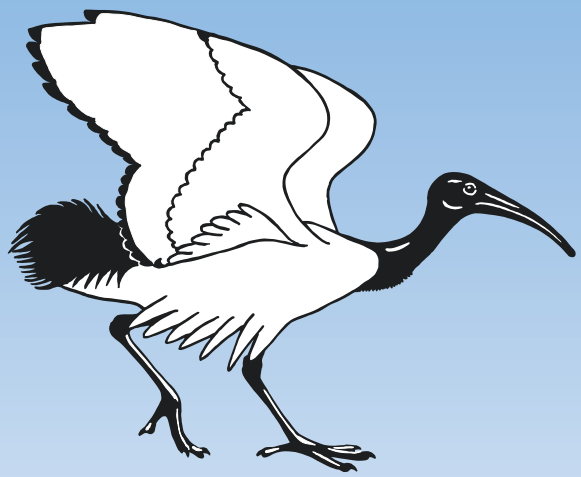
Bulletin of the British Ornithologists' Club



Volume 139 No. 3 (Online)
September 2019

ISSN 2513-9894 (Online)

Bulletin of the
BRITISH ORNITHOLOGISTS' CLUB

Vol. 139 No. 3 Published 20 September 2019

CLUB ANNOUNCEMENTS

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.markettaverns.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. **Talks start at 6.30 pm** and, with questions, last *c*.1 hour.

Saturday 26 October 2019—One-day joint meeting with the Neotropical Bird Club and Natural History Museum in the Flett Theatre, Natural History Museum (NHM), London SW7 5BD. The nearest tube station is South Kensington and attendees should use the NHM entrance on Exhibition Road. There is ***no charge*** to attend, no need to book and all are welcome. The programme is provisionally planned to include the following talks, but a full final programme, including additional talk and speaker details, should be posted at http://www.boc-online.org by about late June.

Avoiding extinctions in the most threatened area in the Neotropics: the Pernambuco Centre of Endemism—Luís Fábio Silveira (University of São Paulo, Brazil)

Diversity in avian mimicry—Alexander Lees (Manchester Metropolitan University)

Frontiers of knowledge: a quarter-century of Neotropical discovery—Joseph Tobias (Imperial College London)

The physiology / behaviour nexus in a Central American cloud forest songbird, Black-headed Nightingale-Thrush Catharus mexicanus—Samuel Jones (Royal Holloway London)

Using science to protect Ecuador's most threatened birds—Martin Schaefer (Fundación Jocotoco)

Conservation of dry forest endemic birds in north-west Peru—Christian Devenish (Manchester Metropolitan University)

Access to NHM is possible from 10.00 h, when coffee / tea will be available adjacent to the Flett Theatre. The meeting will begin at or shortly after 10.30 h, with a break for lunch around 12.30 h; many food outlets are available both within NHM and nearby in South Kensington. The conference will end by 17.00 h and NHM closes at 18.00 h. For up-to-date details, please check the BOC website: http://www.boc-online.org.

Monday 18 November 2019—6.30 pm—Tim Birkhead—*The wonderful Mr Willughby: the start of scientific ornithology*.

Abstract.—The first scientific bird book was *The ornithology of Francis Willughby*, named in Willughby's honour by his friend John Ray after Willughby's death at the age of just 36 in 1672. These two men were pioneers of the scientific revolution and changed the way we think about birds. Until recently it was widely assumed that Ray was the brains and Willughby a mere 'talented amateur', but after a decade of research I have been able to show that Willughby was every bit as brilliant as his co-author and friend John Ray. In this talk I will tell the story of Willughby's short but spectacularly productive life—a story every ornithologist should know.

Biography.—Tim Birkhead is emeritus professor of behavioural ecology at the Univ. of Sheffield. He

ISSN-2513-9894 (Online)

completed a D.Phil. at Oxford on guillemots (Alcidae) in 1976, before taking a lectureship at Sheffield where he has been ever since. Tim is a Fellow of the Royal Society—the UK's most prestigious scientific body. His main research is on promiscuity in birds, but he is also interested in the history of science. He has maintained a long-term study of Common Guillemots *Uria aalge* on Skomer Island, Wales, for the last 47 years and raised UK£150,000 through crowd funding to keep the study going. Tim has won several awards for his undergraduate teaching. He is also an award-winning author and has written 15 books, including several popular science works. He has featured on BBC Radio 4's Life Scientific, The Infinite Monkey Cage and Inside Science, and his book *The most perfect thing: the inside (and outside) of a bird's egg* was made into a TV programme with David Attenborough, who referred to the book as 'Magnificent'.

Monday 23 March 2020—6.30 pm—Beth Okamura—*How birds shape freshwater biodiversity*.

Abstract.—Ever wondered how volcanic islands, garden ponds and gravel pits develop a rich biota? Or why rowan trees grow near pines? The answers in part involve patterns of bird visitations. Darwin appreciated that avian activities might help to explain the widespread distributions of taxa that live in disjunct habitats. This conundrum famously led him to examine the attachment and survival of recently hatched snails on ducks' feet. This talk will consider how our understanding of dispersal of freshwater invertebrates has improved since Darwin's era. I will particularly focus on evidence for waterbird-mediated dispersal of freshwater animals that are poorly known but that have substantial ecological and practical impacts—colonial invertebrates called bryozoans (or 'moss animals') and their myxozoan parasites ('slime animals'). I will illustrate how these unappealingly-named animals serve as 'model systems' that demonstrate the profound effect of waterbird movements on the development and dynamics of freshwater communities, and consequent impacts on water supply and emerging fish diseases.

Biography.—Beth Okamura is a Merit Researcher at the Natural History Museum, London. Prior to this she held positions at the Univ. of Oxford and Bristol, before becoming a Prof. in Aquatic Biology at the Univ. of Reading. Her Ph.D. from the Univ. of California, Berkeley, focused on the ecology and evolution of marine invertebrates, but her move to Oxford led to her long-term interests in how animals that live in isolated lakes and ponds manage to disperse and persist across the landscape. She has particular interests in the role of waterbirds as vectors of dispersal—a question that she is now beginning address in new ways by analysing DNA contained in faeces of ducks, geese and godwits (*Limosa* spp.).

Friends of the BOC

The BOC has from 2017 become an online organisation without a paying membership, but instead one that aspires to a supportive network of Friends who share its vision of ornithology—see: http://boc-online.org/. Anyone wishing to become a Friend of the BOC and support its development should pay UK£25.00 by standing order or online payment to the BOC bank account:

Barclays Bank, 16 High Street, Holt, NR25 6BQ, Norfolk
Sort Code: 20-45-45
Account number: 53092003
Account name: The British Ornithologists' Club

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 136 (2016) are available via the Biodiversity Heritage Library website: www.biodiversitylibrary.org/bibliography/46639#/summary; vols. 132–136 are also 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).

ISSN-2513-9894 (Online)

Old World vagrants on Fernando de Noronha, including two additions to the Brazilian avifauna, and predictions for potential future Palearctic vagrants

by Andrew Whittaker, João Paulo Ferreira da Silva, Breno Lucio & Guy M. Kirwan

Received 31 August 2018; revised 1 September 2019; published 20 September 2019

http://zoobank.org/urn:lsid:zoobank.org:pub:E2A6478A-85A5-46B3-B2F5-202F05EA2C03

Summary.—The archipelago of Fernando de Noronha off north-east Brazil is well known to ornithologists as a hotspot for transatlantic vagrants, primarily for Palearctic-African migrants, but also for its two endemic passerines, Noronha Vireo *Vireo gracilirostris* and Noronha Elaenia *Elaenia ridleyana*. We present important new vagrant records including two species not previously recorded in Brazil, both of them from the Palearctic, of which one—Common Cuckoo *Cuculus canorus*—represents a first record for South America. We list *c*.50 Palearctic species documented from mid-Atlantic islands, the Caribbean region, Trinidad & Tobago or from other mainland South American countries, which are potential future vagrants to Brazil, particularly given improved ornithological coverage of Fernando de Noronha or the even less well-watched archipelago of São Pedro e São Paulo (St Peter and St Paul).

The archipelago of Fernando de Noronha (*c*.03°52′S, 32°25′W) comprises 21 islands and islets of volcanic origin, and are the still-visible peaks of a range of submerged mountains that form part of the Mid-Atlantic Ridge. The archipelago lies in the equatorial Atlantic Ocean *c*.350 km off the coast of north-east Brazil, the nearest mainland being the state of Rio Grande do Norte (for a general description see Teixeira *et al*. 2003, MMA / IBAMA 2005, Silva e Silva 2008). The islands' total area is 26 km^2. The largest and only inhabited island (Fernando de Noronha) has fewer than 3,000 residents.

The resident avifauna, especially breeding seabirds, is well known (Silva e Silva 2008, Mancini *et al*. 2016), but the archipelago is best known ornithologically for its two endemic passerines, Noronha Vireo *Vireo gracilirostris* and Noronha Elaenia *Elaenia ridleyana*.

The islands' remoteness between the African and South American continents make the archipelago also an ideal vagrant trap. The vast majority of vagrants recorded have been European–African migrants such as Purple Heron *Ardea purpurea*, Grey Heron *A. cinerea*, Western Reef Heron *Egretta gularis*, Squacco Heron *Ardeola ralloides*, Eurasian Spoonbill *Platalea leucorodia*, Corncrake *Crex crex*, Eurasian Whimbrel *Numenius p. phaeopus* and Bar-tailed Godwit *Limosa lapponica* (Olson 1982, Ebels 2002, Schulz-Neto 2004, Silva e Silva & Olmos 2006, Davis 2010, Burgos & Olmos 2013, Ferreira *et al*. 2019). Most recently, an immature Allen's Gallinule *Porphyrio alleni* (an intra-tropical African migrant) was photographed there by L. P. Plotecya on 20 February 2018 (www.wikiaves.com.br/2897860), constituting another Brazilian first. This gallinule has also been recorded on multiple occasions on Ascension and St Helena in the equatorial Atlantic (Olson 1971, Bourne & Simmons 1998, Rowlands *et al*. 1998, Prater 2012), as well as far south as South Georgia (Prince & Croxall 1996). Vagrants have possibly also included some overshooting boreal migrants coming from North America such as several Northern Pintails *Anas acuta* (Antas *et al*. 1992, Silva e Silva & Olmos 2006, Burgos & Olmos 2013), although the possibility

ISSN-2513-9894 (Online)

exists that some of these may originate from Eurasia too. Nevertheless, the islands do receive a regular annual passage of North American breeding shorebirds that do not nest in Europe (Olson 1982, Oren 1982, Teixeira *et al*. 1987, Nacinovic & Teixeira 1989, Soto *et al*. 2000, Schulz-Neto 2004, Silva e Silva & Olmos 2006). Here, we report some important opportunistic observations made mainly during a visit to Fernando de Noronha by AW, guided by JPFS, on 27–30 March 2018.

Species accounts

SQUACCO HERON *Ardeola ralloides*

First reported in Brazil on Fernando de Noronha in June 1986 (Teixeira *et al*. 1987), when a single adult was seen. No further records were made until November–December 2004, when up to five were present at Açude do Xaréu (Silva e Silva & Olmos 2006). Since then, a growing population has been photographed annually since 2008 (Davis 2010, Wikiaves 2018). During March 2019 we had a peak daily count of 22, comprising both adults and immatures, at three different freshwater wetlands and along the coast, where they were observed feeding on crabs on the rocky shoreline; in early August 2019, GMK *et al*. recorded up to 16 per day. JPFS has observed adults carrying nest material on several occasions, but has yet to prove breeding. The colonisation and breeding by this heron on the islands were predicted by Silva e Silva & Olmos (2006).

Squacco Heron appears to represent a rare example of a successful transatlantic colonisation event, with the first mainland Brazilian record reported in March 2018 (see

Figure 1. Adult Squacco Heron *Ardeola ralloides*, Fernando de Noronha, Pernambuco, Brazil, March 2018; now a common sight along rocky coasts of the main island and at freshwater pools (Andrew Whittaker)

ISSN-2513-9894 (Online)

www.wikiaves.com.br/2915623), an adult in full breeding plumage, found by J. Amaya, on a lake in Fortaleza, Ceará. The breeding-plumage colours of its bare parts are clearly visible in the photographs, including the bright blue bill (www.wikiaves.com.br/2916775). D. Almeida (pers. comm.) noted that the individual was very territorial and chased off any small white egrets. We suspect it migrated the relatively short distance of 680 km from Fernando de Noronha, rather than coming directly from Africa, although the latter cannot be discounted. The increasing Fernando de Noronha population may well act as a nucleus to aid the colonisation of suitable habitat on the South American mainland. Two other Old World herons have also colonised the New World: firstly Cattle Egret *Bubulcus ibis*, but more recently and less spectacularly Little Egret *Egretta garzetta*. In April 1954 the first Little Egret was found on Barbados (Bond 1966) and breeding was first reported in December 1994, at Graeme Hall Swamp, also on Barbados, the first colony in the Western Hemisphere (Massiah & Frost 1998, Buckley *et al*. 2009). Since then, the number of sightings in the Caribbean has grown, and in 2008 nesting occurred on Antigua (Kushlan & Prosper 2009). More recently, Little Egret has been recorded with increasing frequency in Trinidad & Tobago, where the species is now present year-round in small numbers (Hayes & White 2001, Kenefick *et al*. 2019), and has occurred in all three of the Guianas, with at least 18 records in French Guiana and interbreeding with Snowy Egret *E. thula* reported in Suriname (Ryan 1997, Renaudier & Comité d'Homologation de Guyane 2010, Ottema 2015). In addition, Grey Heron is now effectively resident in the southern Lesser Antilles, principally on Barbados, although there is no evidence of breeding yet (Buckley *et al*. 2009, Kirwan *et al*. 2019), and Black-crowned Night Heron *Nycticorax n. nycticorax* (the Old World race) is known to be nesting on Fernando de Noronha (Silva e Silva & Olmos 2006; pers. obs.).

GREY HERON *Ardea cinerea*

AW & JPFS encountered an adult on Ilha do Chapéu in the evening of 29 March 2019, perched at the edge of the island in the sun *c*.300 m away. Subsequently, the bird took off, gaining height as it flew around the coastal inlet, and was photographed as it flew off west.

Figure 2. Adult Grey Heron *Ardea cinerea*, Fernando de Noronha, Pernambuco, Brazil, March 2018; the main field marks separating it from Great Blue Heron *A. herodias* are the white (vs. cinnamon) carpal joint, yellow bill and white forehead (Andrew Whittaker)

Figure 3. Adult Grey Heron *Ardea cinerea*, Fernando de Noronha, Pernambuco, Brazil, March 2018; lacks the cinnamon on the thighs, separating it from Great Blue Heron *A. herodias* (Andrew Whittaker)

ISSN-2513-9894 (Online)

JP was unfamiliar with this Old World species but had almost certainly seen the same bird on 14 March, at Açude do Xaréu, but thought it was a Cocoi Heron *A. cocoi*. On that occasion no photograph could be taken. However, we subsequently discovered that presumably the same bird had been photographed in the same place on 20 February by L. P. Plotecya (www.wikiaves.com/2895530). Subsequently, JPFS presumably observed our bird again at the same lake on 1 July and the same bird was in the general area until at least 7 August 2018 (GMK *et al*.).

The bird was clearly not a Cocoi Heron given the presence of a distinct white forehead (Fig. 2) and grey neck (unlike Cocoi, which has a white neck). It was distinguished from Great Blue Heron *A. herodias* in lacking the cinnamon wing bend (Fig. 2) and thighs (Fig. 3) of the latter. Instead these parts are both white in Grey Heron. AW has extensive field experience with Grey Heron in Europe, as well as of Great Blue Heron in the USA.

Great Blue Heron (which is yet to be fully documented in Brazil; Piacentini *et al*. 2015) is a regular winter visitor in very small numbers to north-west South America, in Colombia, Ecuador and Venezuela (Ridgely & Greenfield 2001, Hilty 2003). Elsewhere, it has been recorded as a vagrant to, among others, the Azores, Spain, UK and the Netherlands (Martínez-Vilalta *et al*. 2019).

The first published record of Grey Heron in Brazil involved a bird ringed in France in May 1973 and captured in December 1973 at Ourém, Pará, at the mouth of the Amazon (Novaes 1978). Documented Brazilian records remain few, with the second record an immature photographed on Fernando de Noronha, at Açude do Xaréu, in September 2003 (Silva e Silva & Olmos 2006). These authors also noted several other records of large grey *Ardea*; singles in August 2000, February 2003, November and December 2004. However, as these were only presumed to be Grey Herons, the third definite record was a bird photographed by F. Schunck, also at Açude do Xaréu, in September 2013 (www.wikiaves.com/1123959). The record reported above becomes the fourth. The chronology of certain records suggests that, *contra* Silva e Silva & Olmos (2006), this heron is not an especially regular vagrant to Fernando de Noronha.

WOOD SANDPIPER *Tringa glareola*

On 29 March 2019, at 13.30 h, AW discovered an interesting shorebird on a sludge pool at a sewage treatment plant, which he quickly suspected to be a Wood Sandpiper. AW was aware that this species would be new for Brazil and, due to the light and similarity to other *Tringa* spp., especially Solitary Sandpiper *T. solitaria*, knew that he required better views and photographic evidence to confirm the identification. On closer approach, he was able to observe the bird in better light, take notes and photograph it. He could clearly see an obvious white supercilium reaching behind the eye (lacking in Solitary Sandpiper, which has a bold eye-ring), prominently white-spotted upperparts (smaller spots on Solitary), relatively longer yellowish-green legs (vs. greenish) and more obviously spotted and streaked upper breast than Solitary Sandpiper. Figs. 4–5 clearly show all of the characteristics diagnostic of Wood Sandpiper. JPFS & AW observed the bird for another 15 minutes before they had to leave. They returned at 14.45 h, when the bird was roosting on the same sewage pan, but it could not be relocated on the afternoon of 30 March. Overnight weather conditions had been clear and ideal for migration. Further visits by JPFS to the site during April and May were also negative.

Wood Sandpiper breeds in north and central Europe east through Siberia to Anadyrland, Kamchatka and the Commander Islands, as well as in north-east China and, occasionally, on the Aleutian Islands; it winters mainly in tropical and subtropical Africa, and across

ISSN-2513-9894 (Online)

Figures 4–5. Adult Wood Sandpiper *Tringa glareola*, Fernando de Noronha, Pernambuco, Brazil, March 2018; note the long bold white supercilium (reaching well behind the eye), boldly checkered upperparts, long yellowish-green legs, and prominently marked upper breast (Andrew Whittaker)

South and South-East Asia, the Philippines, Indonesia, New Guinea and Australia (van Gils *et al*. 2019).

The only other documented South American record was on Tobago, in December 1996–February 1997 (Hayes & White 2000, Petersen & McRae 2002, Kenefick & Hayes 2006). There are also nine records in the West Indies: seven from Barbados, all between October and April including one long-stayer, with the first in 1955 (Mazar Barnett & Kirwan 2000, 2002, Ebels 2002, Buckley *et al*. 2009, *N. Amer. Birds* 66: 188), and two on Guadeloupe, in September 2000 (Levesque & Jaffard 2002) and September 2014 (*N. Amer. Birds* 69: 169). Also reported once on Ascension, in October 1963 (Bourne & Simmons 1998).

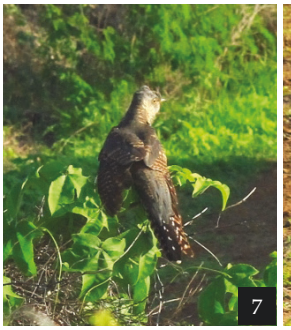
Howell *et al*. (2014) noted that Wood Sandpiper records are very rare in the lower 48 states of the USA, with fewer than eight records at the time of compilation, contrasting with nearly 20 records from the Azores since the year 2000, and three records from Bermuda, the first in October 1981 (Amos & Wingate 1983), followed by two in spring, although whether all of these had crossed the Atlantic from east to west is perhaps doubtful.

Common Cuckoo *Cuculus canorus*

While at the north end of Fernando de Noronha on the afternoon of 27 February 2018, BL encountered an unfamiliar bird at Capela de São Pedro. He managed to photograph it with only a 50 mm lens, as it was obviously a tired migrant (Figs. 6–8). BL sent the photographs to JPFS, who in turn contacted Carlos Goulart. He identified the bird as a Common Cuckoo, a first Brazilian and South American record. JPFS also sent the images to AW, who has ample field experience with the species in Europe and was able to eliminate the faint possibility of a vagrant Oriental Cuckoo *C. optatus* given the pattern of the undertail-coverts (Fig. 8).

Figs. 6–8, although not high quality, clearly show the distinctive Common Cuckoo jizz, shape, brownish-grey upperparts and white underparts boldly barred black; Fig. 8 also

ISSN-2513-9894 (Online)



Figures 6–7. Common Cuckoo *Cuculus canorus*, Fernando de Noronha, Pernambuco, Brazil, February 2018; note long pointed wings and tail, the small amounts of grey plumage already appearing and lack of rufous wash to the upper breast, clearly confirming it to be a first-year male moulting into adult plumage (Breno Lucio)

Figure 8. Common Cuckoo *Cuculus canorus*, Fernando de Noronha, Pernambuco, Brazil, February 2018; the pure white undertail-coverts indicate the present species and eliminate Oriental Cuckoo *Cuculus optatus* in which these feathers are buff (Breno Lucio)

displays its characteristic long-winged and long-tailed, almost raptor-like, appearance in flight. The bird shows substantial rufous-brown feathering admixed with grey on its mantle and wings (Figs. 6–7) confirming that it was a first-year moulting to adult plumage.

The nominate form has a rufous morph found only in females. With good views female plumage can be separated from that of males by a small area of rufous wash on the upper breast extending to the neck-sides. Fig. 6 clearly demonstrates the absence of this feature, confirming the bird as a male. Also, on closer inspection, it is possible to see some grey feathers moulting in amongst the dominant rufous on its wings, mantle (Fig. 7) and tail confirming the bird as a first-year moulting into breeding plumage.

Common Cuckoo has four subspecies: *C. c. canorus* breeds from Ireland to Kamchatka and Japan, with western populations wintering in equatorial Africa; *C. c. bangsi* breeds in Iberia, the Balearics and north-west Africa, and probably winters in Africa south of the equator; *C. c. subtelephonus* breeds in Transcaspia to west Xinjiang (China) and central Mongolia, and south to Iran and Afghanistan, wintering in India; and *C. c. bakeri* breeds in northern India to northern Thailand and Indochina, south and east China, and winters in India and South-East Asia (Erritzøe *et al*. 2012).

The Fernando de Noronha record presumably refers to nominate *canorus* which is a long-distance migrant, with western populations migrating between Europe and equatorial Africa, in the Congo rainforest bloc. This race has already been recorded as a vagrant on Ascension (Bourne & Simmons 1998, Erritzøe *et al*. 2012).

The first vagrant Common Cuckoo for the Western Hemisphere was collected on Barbados in November 1958, where another was observed in November 2014 (Kirwan *et al*. 2019). These are the only other Neotropical occurrences, but there are two mainland North American records, an adult at Martha's Vineyard, Massachusetts, in May 1981, and a juvenile at Watsonville, California, in September–October 2012 (Howell *et al*. 2014). It is also a rare and infrequently recorded visitor to the western Aleutians in late spring and early summer, with all records involving the nominate (Howell *et al*. 2014).

Ongoing work by the British Trust for Ornithology using satellite-tags has, since May 2011, tracked 49 males and one female of the British breeding population of Common Cuckoo. UK cuckoos take different routes in spring and autumn between Europe and Africa. Irrespective of whether they move south via Spain, Italy or even further east, all of them head to West and Central Africa, where they mainly winter in and around the Congo

ISSN-2513-9894 (Online)

rainforest bloc. In spring they mostly return overland across the Sahara to Europe, however others fly almost due west along the southern edge of the Sahara to the coast, then head north to southern Europe (Hewson *et al*. 2016; https://www.bto.org/science/migration/tracking-studies/cuckoo-tracking). This could explain the appearance of a vagrant on Fernando de Noronha at this season; it presumably overshot the west coast of Africa and instead headed out into the Atlantic, possibly aided by strong tail winds, before finally making landfall in Brazil.

Recent satellite tracking of another subspecies, *C. c. subtelephonus* breeding around Beijing, China, led to the discovery that these birds make a non-stop flight of 3,300 km in autumn, crossing the Indian Ocean between the west coast of India to East Africa, making landfall in Somalia then moving south to winter in Tanzania (https://www.bto.org/science/migration/tracking-studies/cuckoo-tracking/about/international-projects). In spring, the return sea crossing follows a similar route. This confirms that Common Cuckoo is easily capable of a non-stop crossing of the Atlantic between West Africa and South America, which distance is less than 2,000 km. It also explains other reports of long-distance vagrancy by the nominate race, as far as Greenland, Iceland and the Azores (Erritzøe *et al*. 2012).

Discussion

Our understanding of avian transatlantic vagrancy to South America is still very poorly understood. Both Common Cuckoo and Wood Sandpiper are long-distance Palearctic migrants that move between breeding grounds in northern Europe and wintering areas in sub-Saharan Africa, even as far as South Africa in the case of *Tringa glareola*. This makes both likely candidates for vagrancy to north-east South America, especially Fernando de Noronha, where the chances of them being found are greater than on the even more under-watched coasts of mainland Brazil. Their arrival probably is due to several related factors combined: inexperience, especially among non-adults; storms; and especially wind-drift in the westerly trade winds that are commoner in more southerly regions off the Atlantic coast of Africa.

Despite the growing number of visiting photographers and birders, Fernando de Noronha is still under-watched and most Palearctic vagrants are probably missed, especially any passerines, due to the very dense vegetation covering much of the island. The sewage treatment ponds on Fernando de Noronha should, almost certainly, yield other new Palearctic shorebirds for Brazil if birders and photographers check them on a regular basis.

Observers in north-eastern and eastern Brazil should be aware of the possibility of finding other transatlantic vagrants, usually Eurasian–African migrants, but potentially intra-tropical African landbird migrants too. In Tables 1–2 we list 47 potential additions to the Brazilian avifauna that have already been recorded on the mid-Atlantic islands of Ascension, St Helena and the Tristan da Cunha group, or in the West Indies, more exceptionally elsewhere in South America, all of which are most likely to be encountered on either Fernando de Noronha or the São Pedro and São Paulo archipelago, rather than the Brazilian mainland. Transatlantic vagrancy is already fairly well documented from French Guiana, the southern West Indies and Trinidad & Tobago (Ebels 2002, Kenefick & Hayes 2006, Restall *et al*. 2006, Buckley *et al*. 2009, Kirwan *et al*. 2019). The majority of the Palearctic vagrants reported in Brazil on Fernando de Noronha and São Pedro e São Paulo have also been recorded in the Caribbean (including Trinidad & Tobago) or the South American mainland in French Guiana. As this list of vagrants already includes one of our two new Brazilian records, we briefly discuss other Brazilian first records from the offshore islands also documented from these other regions. However, we omit Little Egret as it is one of

ISSN-2513-9894 (Online)

the most frequently recorded Palearctic vagrants, with many records from the West Indies (Kirwan *et al*. 2019), Trinidad & Tobago (Hayes & White 2001), the Guianas (Haverschmidt 1983, Murphy 1992, Renaudier & Comité d'Homologation de Guyane 2010, Claessens & Comité d'Homologation de Guyane 2015), and even the USA (Murphy 1992).

Eurasian Spoonbill *Platalea leucorodia*.—First record on Tobago in early November 1986 (Hayes & White 2000), followed by one on Trinidad in November 2010 (Kenefick 2012) and, in Brazil, an immature photographed on Fernando de Noronha in early December 1996 (Schulz-Neto 1998) with another photographed there in January–February 1999 (K. Hazevoet *in* Ebels 2002). Caribbean records (some involving multiple individuals) are from Antigua, St Lucia and Barbados, all since 2007 (Buckley *et al*. 2009, Kirwan *et al*. 2019).

Grey Heron *Ardea cinerea*.—First record in the Caribbean in September 1959 on Montserrat and has been resident on Barbados since 1997, with multiple documented records north to St Kitts, and French-ringed birds recovered on Martinique and Montserrat (Bond 1962, Buckley *et al*. 2009, Kirwan *et al*. 2019). Also a French-ringed individual recovered on Trinidad in August 1959, followed by another nine records in Trinidad & Tobago by 2010 (Badouin-Bodin 1960, ffrench & Kenefick 2003, Kenefick 2012), as well as those from Fernando de Noronha mentioned above.

Purple Heron *Ardea purpurea*.—First New World record an 'immature' on Fernando de Noronha in June 1986 (Teixeira *et al*. 1987), followed by a long-staying bird in the same place, in March 2017–April 2018, which was photographed (Ferreira *et al*. 2019). Six West Indian records, all since autumn 1998, most involving first-year birds, between September and April (Kirwan *et al*. 2019) and three from Trinidad & Tobago (Kenefick 2012, Kenefick *et al*. 2019); also recorded once on St Helena, October 2009 (Beard 2012), with several records from Ascension (Bourne & Simmons 1998).

Western Reef Egret *Egretta gularis*.—First record in the Caribbean on Barbados (June–July 1975), where recorded at least nine times subsequently, with other reports from Puerto Rico (first September 1999), St Lucia (February 1984, January 1985), the Grenadines (Mustique, February 2004), and a possible sight record in Cuba (Buckley *et al*. 2009, Kirwan *et al*. 2019). South American records: Trinidad, January 1986 (Murphy & Nana 1987), December 2000–January 2002 (Ebels 2002) and December 2014–June 2015 (Kenefick *et al*. 2019), and two in Brazil, both on Fernando de Noronha, a dark morph photographed in early December 1996 (Schulz-Neto 2004) and a white-morph photographed in late November 2004 (Silva e Silva & Olmos 2006).

Black Kite *Milvus migrans*.—First report in the Neotropics on Dominica in April 1999 (*N. Amer. Birds* 57: 132), since when there have been at least five additional records from the Bahamas, British Virgin Islands, Guadeloupe and Barbados (Kirwan *et al*. 2019), and one on Trinidad in December 2014 (Kenefick *et al*. 2019). The first Brazilian record was on the São Pedro e São Paulo archipelago, in April–May 2014 (Nunes *et al*. 2014).

Eurasian Kestrel *Falco tinnunculus*.—Two Caribbean records, on Martinique in December 1959 (Pinchon & Vaurie 1961) and Guadeloupe in April 2009 (Kirwan *et al*. 2019), while the first South American record was a subadult male present for ten days in French Guiana in Mar 1991 (LeDreff & Raynaud 1993). This was followed by an immature female photographed on Trinidad in December 2003–January 2004 (Kenefick & Hayes 2006), two records in Brazil, both on the São Pedro e São Paulo archipelago, the first in January 2005 (Bencke *et al*. 2005, Santana & Pinheiro 2010), and another five records in French Guiana, all between late December and late March (Renaudier & Comité d'Homologation de Guyane 2010, Claessens & Comité d'Homologation de Guyane 2015).

ISSN-2513-9894 (Online)

TABLE 1

List of Old World vagrants recorded on the mid-South Atlantic Ocean British Overseas Territory of St Helena (15°57′S, 05°42′W), Ascension (07°57′S, 14°22′W) and Tristan da Cunha (37°15′S, 12°30′W), but not yet recorded in Brazil. St Helena, Ascension and Tristan da Cunha are situated 1,950 km, 1,500 km and 2,432 km from the west African coast and 4,000 km, 2,250 km and 4,046 km from the nearest points of mainland South America, respectively. Unless otherwise stated information pertaining to occurrences on St Helena are taken from Rowlands *et al*. (1998) and Prater (2012), Ascension from Bourne & Simmons (1998) and Tristan da Cunha from Dowsett & Forbes-Watson (1993). Species also represented in the New World, sometimes by separate races, are omitted, even if there is evidence that the individuals concerned wandered from the Old World, e.g. Black-crowned Night Heron *Nycticorax n. nycticorax* has been recorded on St Helena. Where additional records are available from the Caribbean or elsewhere in the Neotropics, these are also listed in the comments column.

English name	**Scientific name**	**Comments**
African Comb Duck	*Sarkidiornis melanotus*	St Helena (Jan–Feb 2013; Kleinjan & Stevens 2016).
European Nightjar	*Caprimulgus europaeus*	Ascension (Nov 1973).
Common Swift	*Apus apus*	Ascension (at least 15 records, all Sep–Mar; Chapin 1954, Bourne & Simmons 1998, White 2002), Suriname (at sea, Jul 202; de Boer *et al*. 2014), Puerto Rico (Nov 2015; Ławicki & van den Berg 2016). Several possible records on St Helena, most recently in 2012/13 (Hillman *et al*. 2016). Bond (1973) considered a claim from Grenada, Aug 1971 (Lack & Lack 1973) to be erroneous.
Striped Crake	*Amaurornis marginalis*	St Helena (Jan 2007; Prater 2012).
African Swamphen	*Porphyrio madagascariensis*	St Helena (Oct 1989).
Common Moorhen	*Gallinula chloropus*	Ascension (Jun 1958, Feb 1993), St Helena (either a natural colonist or introduced, race *G. c. meridionalis*).
White Stork	*Ciconia ciconia*	Ascension (Apr 1987–Jan 1988), St Helena (Aug 1880, Jul–Aug 1958, Oct 2007, Mar–Apr 2011), Antigua (Aug 1993–March 1994; Gricks 1994a,b; perhaps also seen previously on Barbuda), Martinique (Feb 2007; Leblond 2007).
Dwarf Bittern	*Ixobrychus sturmii*	St Helena (Oct 2011–Jan 2012; Hillman & Clingham 2012).
Eurasian Oystercatcher	*Haematopus ostralegus*	Ascension (Jan 1986).
Common Ringed Plover	*Charadrius hiaticula*	Ascension (Jan–Nov 1987, Mar 1988, Nov 1988), Tristan de Cunha (Brooke 1979), Barbados, (Sep 1888; Buckley *et al*. 2009), Guadeloupe (Sep 2010, Jan 2019; *N. Amer Birds* 65: 181, Kirwan *et al*. 2019). Hypothetical Trinidad (Oct 1962; ffrench 1973, Kenefick & Hayes 2006).
Greater Sand Plover	*Charadrius leschenaultii*	Ascension (Aug–Sep 1989). A sand plover sp. in non-breeding plumage (either Lesser *C. mongolus* or *C. leschenaultii*) was photographed at Parque Nacional da Lagoa do Peixe, Rio Grande do Sul, Brazil, in December 2015 (Franz *et al*. 2018).
Blacksmith Plover	*Vanellus armatus*	St Helena (Jul 1995).
Sharp-tailed Sandpiper	*Calidris acuminata*	Tristan de Cunha (Jun 1950; Elliott 1957, Allport 2018), Bolivia (Nov 2014; Knowlton 2016), Panama (Oct 2016; Ławicki & van den Berg 2017).
Little Stint	*Calidris minuta*	Ascension (Oct–Nov 1990), Barbados (Apr–May 1997, May 1997 [another], May 1999 and May 2002; Buckley *et al*. 2009), Montserrat (Aug 2003; *N. Amer. Birds* 58: 159), South Georgia (Dec 1977; Prince & Croxall 1983). While this manuscript was in revision, a Little Stint was photographed on Fernando de Noronha, Oct 2018 (Gussoni 2019).

ISSN-2513-9894 (Online)

English name	Scientific name	Comments
Common Sandpiper	*Actitis hypoleucus*	Ascension (Feb 1962, Nov–Dec 1962, Feb 1964, Oct–Nov 1990, Feb 1991).
Green Sandpiper	*Tringa ochropus*	St Helena (two specimens from 19th century, but provenance uncertain). Possible, Guadeloupe (Sep 2014; *N. Amer. Birds* 69: 169).
Common Greenshank	*Tringa nebularia*	Ascension (Dec 1972), Tobago (Jul 1977, Trinidad, early 1987; Kenefick *et al*. 2019), Puerto Rico (Jul 1993; *Field Notes* 49: 204), Barbados (seven records, first in 1980; Buckley *et al*. 2009, *N. Amer. Birds* 67: 532), French Guiana (Feb 2006; Claessens & Comité d'Homologation de Guyane 2015). Hypothetical Trinidad (Jul 1977; Kenefick & Hayes 2006).
Common Redshank	*Tringa totanus*	Ascension (Jan 1997). There is a sight record for Fernando de Noronha (Schulz-Neto 2004).
European Roller	*Coracias garrulus*	Ascension (Dec 1989).
Amur Falcon	*Falco amurensis*	St Helena (Nov–Dec 1989).
Red-backed Shrike	*Lanius collurio*	Ascension (Nov 1990).
Common House Martin	*Delichon urbicum*	Ascension (Nov 1946, May 1963, Sep–Oct 1997, Apr and May 2002; Chapin 1954, Bourne & Simmons 1998, White 2002), Tristan de Cunha (Nov–Dec 2013; Hillman *et al*. 2016), Barbados (eight, Oct–Nov 1999, singles, Nov 2000 and Jun 2002; Buckley *et al*. 2009), Guadeloupe (Aug 2006).
Willow Warbler	*Phylloscopus trochilus*	Tristan de Cunha (Ryan 2008).

TABLE 2

List of Old World vagrants, or species whose provenance is potentially transatlantic, recorded in the West Indies or South America, but yet to be definitely recorded on any of the mid-Atlantic islands or in Brazil; seabirds are omitted, as are a suite of landbirds reported from Cuba that appear very unlikely to have reached the Caribbean in a wild state (Kirwan *et al*. 2019: 375–376). These are confirmed by either ringing recoveries of European origin, specimens or photographs. One species (Lesser Sand Plover *Charadrius mongolus*) has been recorded only in mainland South America. Most or all records of Northern Wheatear *Oenanthe oenanthe* in the region might involve birds migrating from their North American breeding grounds to their wintering areas in Africa, but the capacity for birds breeding in Europe that also winter in Africa to occur as vagrants in Brazil clearly exists. Glossy Ibis *Plegadis falcinellus* occurs in northern South America (Venezuela), but there is clear evidence of vagrancy, perhaps increasing (Kirwan *et al*. 2019), from the Old World to the Caribbean, and we consider that there is a clearly greater likelihood of the species wandering to the Brazil through transatlantic wandering.

English name	Scientific name	Comments
Common Shelduck	*Tadorna tadorna*	Barbados (first-year female, Nov 2013; *N. Amer. Birds* 68: 162), Martinique (Nov 2015; Belfan & Conde 2016).
Common Pochard	*Aythya ferina*	Barbados (one male and three females, Feb 2011; *N. Amer. Birds* 65: 356, Howell *et al*. 2014).
Tufted Duck	*Aythya fuligula*	Puerto Rico (female, Nov–Dec 2012; *N. Amer. Birds* 67: 356), Barbados (female, Mar 2017; eBird), Guadeloupe (female, Mar 2019; eBird).
Garganey	*Anas querquedula*	Puerto Rico (Jan–Mar 1978), Guadeloupe (male, Jan–Mar 2006, possibly two males, Mar 2007), Martinique (bird shot, *c*. Jan 2000), Barbados (Aug 1960, Dec 2000–Jan 2001, Nov 2006–Mar 2007, Dec 2007) (Kirwan *et al*. 2019).

ISSN-2513-9894 (Online)

English name	Scientific name	Comments
Eurasian Wigeon	*Mareca penelope*	Grand Bahama (Mar 2003; *Cotinga* 21: 82), Cuba (Mar 2014; Stott 2015), Hispaniola (early 1950s, Dec 1972, Dec 1997, Feb 2014, Mar 2015; Keith *et al*. 2003, eBird), Puerto Rico (Feb 1958, Jan 2015, Jan 2016; Bond 1959, *N. Amer. Birds* 69: 306, 70: 241), St Croix (Nov 2003; McNair *et al*. 2006), Anguilla (Dec 2014–Jan 2015; *N. Amer. Birds* 69: 306), Barbuda (Oct 1937; Cooke 1945), Martinique (*c*. Nov 2014; eBird), Barbados (records Oct–Mar; Buckley *et al*. 2009), Grenada (Jan–Feb 2001; eBird), Tobago (Jan 2016; Johnson 2018), Venezuela (Mar 2002; Williams & Beadle 2003).
Common (Eurasian) Teal	*Anas c. crecca*	Bahamas (Feb 2017; eBird), Puerto Rico (Mar 2016; eBird), Guadeloupe (Jan–Feb 2014; *N. Amer. Birds* 68: 290), Barbados (Jan–Mar 1996, Dec 1997–Mar 1998, Jan 1999, Jan 2004; Buckley *et al*. 2009).
Alpine Swift	*Tachymarptis melba*	Barbados (Sep 1955, Jun–Jul 2003, Jul 2005, Jul 2015; Frost & Burke 2005, *N. Amer. Birds* 69: 511), Guadeloupe (Apr 1987; Feldmann & Pavis 1995), Puerto Rico (Jul 1987; Meier *et al*. 1989), St Lucia (Aug 1992; Burke 1994), French Guiana (Jun 2002; Ottema 2004).
Spotted Crake	*Porzana porzana*	St Martin (Oct 1956; Voous 1957), Guadeloupe (Feb 2014; Chabrolle & Levesque 2015). Two doubtful records for St Helena (Rowlands *et al*. 1998).
Glossy Ibis	*Plegadis falcinellus*	Vagrant to Lesser Antilles, apparently in increasing numbers, at least some of which are definite transatlantic vagrants (*N. Amer. Birds* 65: 181, Buckley *et al*. 2009, Kirwan *et al*. 2019).
Black-winged Stilt	*Himantopus h. himantopus*	Guadeloupe (two, Aug 2014; Kirwan *et al*. 2019).
Little Ringed Plover	*Charadrius dubius*	Martinique (Apr 2005; Lemoine 2005).
Lesser Sand Plover	*Charadrius mongolus*	Argentina (Mar 2011; Le Nevé & Manzione 2011).
Northern Lapwing	*Vanellus vanellus*	Bahamas (Nov 1900; Fleming 1901), Puerto Rico (Dec 1978–Jan 1979; Bond 1984), Martinique (Feb 1976, Dec 2015; Pinchon 1976, Kirwan *et al*. 2019), Barbados (Dec 1886, Dec 1963; Buckley *et al*. 2009).
Eurasian Curlew	*Numenius arquata*	Argentina (Jan 2010; Vander Pluym & Sterling 2019). Hypothetical, Bahamas (Jan–Mar 1972; Connor & Loftin 1985).
Black-tailed Godwit	*Limosa limosa*	Trinidad (Sep 2000–Jan 2001; Hayes & Kenefick 2002). Hypothetical St Kitts (Sep 1988; Steadman *et al*. 1997)
Jack Snipe	*Lymnocryptes minimus*	Barbados (Nov 1960; Buckley *et al*. 2009).
Spotted Redshank	*Tringa erythropus*	Puerto Rico (Aug 2000; eBird), Guadeloupe (Aug 1999; Levesque & Jaffard 2002), Barbados (six records, Oct–Mar, first 1963; Buckley *et al*. 2009), Tobago, Feb 1983 (Fisher 1998).
Slender-billed Gull	*Larus genei*	Hypothetical, Antigua (Apr 1976; Holland & Williams 1978).
Audouin's Gull	*Larus audouinii*	Trinidad (Dec 2016–Aug 2017; Lallsingh 2018).
Whiskered Tern	*Chlidonias hybrida*	Barbados (autumn 1847, Apr 1994, Nov 2004), Bahamas (Apr–May 2003; Buckley *et al*. 2009, *Cotinga* 21: 82), Paraguay (Jan 2016; Clay *et al*. 2017).
Western Marsh Harrier	*Circus aeruginosus*	Puerto Rico (Jan–Mar 2004, Jan–Feb 2006; Merkord *et al*. 2006), Guadeloupe (Nov 2002–Apr 2003, Oct 2015–Mar 2016; Levesque & Malglaive 2004, *N. Amer. Birds* 70: 129, 242), Barbados (Nov 2015–Jan 2016; *N. Amer. Birds* 70: 242).
European Bee-eater	*Merops apiaster*	St Lucia (Feb 2014; *N. Amer. Birds* 68: 291).

ISSN-2513-9894 (Online)

English name	Scientific name	Comments
Northern Wheatear	*Oenanthe oenanthe*	Bahamas (Oct 1976, Oct 1981; *Amer. Birds* 36: 224, Connor & Loftin 1985), Cuba (Oct 1903; Robinson 1905), Puerto Rico (Sep 1966, Sep 2011, Sep 2016; Bond 1967, eBird), Guadeloupe (Oct 2012; *N. Amer. Birds* 67: 175), Barbados (Dec 1955–Jan 1956, Oct–Dec 1994; Buckley *et al*. 2009), Leeward Antilles (Nov 1962, Dec 1975; Prins *et al*. 2009), French Guiana (Oct 2006; Renaudier & Comité d'Homologation de Guyane 2010).
White Wagtail	*Motacilla alba*	Barbados (Jan 1987; *Amer. Birds* 41: 335, Ingels *et al*. 2010), Trinidad (Dec 1987–Jan 1988, Sep 2009; Ingels *et al*. 2010, Kenefick *et al*. 2019), French Guiana (Oct 2009, Nov 2009; Claessens & Comité d'Homologation de Guyane 2015).

Final remarks

Transatlantic vagrancy of Palearctic migrants to South America and the Caribbean has been a relatively little-recognised and potentially under-recorded phenomenon, although as evidenced by Tables 1–2 it clearly occurs fairly regularly. By documenting two new Palearctic vagrants and providing a list of potential future Old World vagrants, this should encourage observers to be alert to the possibility of other Palearctic species occurring in Brazil and perhaps other South American countries too.

A few of these 'transatlantic' vagrants may in fact not reach South America by crossing the Atlantic, but instead arrive by flying over North America from north-east Asia. Some predominantly Palearctic species also nest in Alaska and Greenland, e.g. Common Ringed Plover *Charadrius hiaticula* and Northern Wheatear *Oenanthe oenanthe*, both of which have already been recorded in the Neotropics. However, other well-established principally Palearctic breeders such as Bluethroat *Luscinia svecica* and Eastern Yellow Wagtail *Motacilla tschutschensis* (Kessel & Gibson 1978, Kessel 1989, Renner & McCaffery 2006) and very rare breeders like Red-necked Stint *Calidris ruficollis* (DeCicco *et al*. 2013) and Red-throated Pipit *Anthus cervinus* (West 2008) have yet to be recorded in north-east South America, although the latter has been recorded as far south as north-west Ecuador (Brinkhuizen *et al*. 2010) and *C. ruficollis* has been claimed in coastal Peru (Hughes 1988, Schulenberg *et al*. 2007).

It will be nigh-on impossible to confirm how many ship-assisted passages occur. An example was a Redwing *Turdus iliacus* found aboard a seismic research vessel 150 km off the coast of Espírito Santo, Brazil, in December 2001 (Brito *et al*. 2013). On the other hand, as demonstrated by one of the most unexpected and most remarkable vagrants to the Americas, a species yet to be reported in Europe, Siberian Flycatcher *Muscicapa sibirica*, was collected on Bermuda in September 1980 (Wingate 1983), illustrating the potential for even eastern Palearctic migrants to appear in the western Atlantic.

Acknowledgements

The manuscript was significantly improved by the comments, additional information and ideas of Chris Sharpe, Alex Lees, Glayson Ariel Bencke and Jaqueline Rizzi Fortuna to whom we are extremely grateful. AW thanks John & Karen Shrader for the opportunity to travel to Fernando de Noronha, and GMK thanks his travel companions Neil Bostock and Andrew Marshall.

References:

Allport, G. 2018. 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. *Bull. Brit. Orn. Cl.* 138: 307–317.

Amos, E. J. R. & Wingate, D. B. 1983. First record of the Wood Sandpiper, *Tringa glareola*, from Bermuda. *Amer. Birds* 37: 115–116.

ISSN-2513-9894 (Online)

Antas, P. T. Z., Fillipini, A. & Azevedo-Júnior, S. M. 1992. Novos registros de aves para o Brasil. Pp. 79–80 *in* Anais VI Encontro Nac. Anilhadores Aves. Universidade Católica de Pelotas, RS.
Badouin-Bodin, J. 1960. Des hérons cendrés bagues au lac de Grand-Lieu repris aux Antilles. *L'Oiseau et RFO* 30: 270.
Beard, A. 2012. First record of Purple Heron *Ardea purpurea* for St. Helena, South Atlantic. *Bull. Afr. Bird Cl.* 19: 215–216.
Belfan, D. & Conde, B. 2016. *Liste des oiseaux de la Martinique*. Association Le Carouge, Fort de France.
Bencke, G. A., Ott, P. H., Moreno, I. B., Tavares, M. & Caon, G. 2005. Old World birds new to the Brazilian territory recorded in the archipelago of São Pedro and São Paulo, equatorial Atlantic Ocean. *Ararajuba* 13: 126–129.
de Boer, M. N., Saulino, J. T. & Williams, A. C. 2014. First documented record of Common Swift *Apus apus* for Surinam and South America. *Cotinga* 36: 107–109.
Bond, J. 1959. Fourth supplement to the *Check-list of birds of the West Indies* (1956). Acad. Nat. Sci., Philadelphia.
Bond, J. 1962. Seventh supplement to the *Check-list of birds of the West Indies* (1956). Acad. Nat. Sci., Philadelphia.
Bond, J. 1966. Eleventh supplement to the *Check-list of birds of the West Indies* (1956). Acad. Nat. Sci., Philadelphia.
Bond, J. 1967. Twelfth supplement to the *Check-list of birds of the West Indies* (1956). Acad. Nat. Sci., Philadelphia.
Bond, J. 1973. Eighteenth supplement to the *Check-list of birds of the West Indies* (1956). Acad. Nat. Sci., Philadelphia.
Bond, J. 1984. Twenty-fifth supplement to the *Check-list of birds of the West Indies* (1956). Acad. Nat. Sci., Philadelphia.
Bond, J. 1985. *The birds of the West Indies*. Fifth edn. Collins, London.
Bourne, W. R. P. & Simmons, K. E. L. 1998. A preliminary list of the birds of Ascension Island, South Atlantic Ocean. *Sea Swallow* 47: 42–56.
Brinkhuizen, D, M., Brinkhuizen, L., Keaveney, A. & Jane, S. 2010. Red-throated Pipit *Anthus cervinus*: a new species for South America. *Cotinga* 32: 15–17.
Brito, G. R. R., Nacinovic, J. B. & Teixeira, D. M. 2013. First record of Redwing *Turdus iliacus* in South America. *Bull. Brit. Orn. Cl.* 133: 316–317.
Brooke, R. K. 1979. Two overlooked vagrants from the Tristan da Cunha group. *Bull. Brit. Orn. Cl.* 99: 81–82.
Buckley, P. A., Massiah, E. B., Hutt, M. B., Buckley, F. G. & Hutt, H. F. 2009. *The birds of Barbados: an annotated checklist*. BOU Checklist No. 24. British Ornithologists' Union & British Ornithologists' Club, Peterborough.
Burke, W. 1994. Alpine Swift (*Tachymarptis melba*) photographed on St. Lucia, Lesser Antilles - third record for the Western Hemisphere. *El Pitirre* 7(3): 3.
Burgos, K. & Olmos, F. 2013. First record of Corncrake *Crex crex* (Rallidae) for South America. *Rev. Bras. Orn.* 21: 205–208.
Chabrolle, A. & Levesque, A. 2015. Spotted Crake (*Porzana porzana*) at Guadeloupe: second record for the New World. *N. Amer. Birds* 68: 171–173.
Chapin, J. P. 1954. House Martin and Swift from Ascension Island. *Auk* 71: 89–90.
Claessens, O. & Comité d'Homologation de Guyane. 2015. Rare birds in French Guiana in 2008–10. *Cotinga* 37: 66–78.
Clay, R. P., Lesterhuis, A. J. & Smith, P. 2017. Status and distribution of suborder Lari in Paraguay including new country records. *Rev. Bras. Orn.* 25: 128–136.
Connor, H. A. & Loftin, R. W. 1985. The birds of Eleuthera Islands, Bahamas. *Fla. Field Natur.* 13: 77–93.
Cooke, M. T. 1945. Transoceanic recoveries of banded birds. *Bird-Banding* 16: 123–129.
Davis, B. J. W. 2010. Squacco Heron *Ardeola ralloides* in the Fernando de Noronha archipelago: the fourth Brazilian record with comments on the prospects for a colonization event. *Rev. Bras. Orn.* 18: 61–63.
DeCicco, L. H., Warnock, N. & Johnson, J. A. 2013. Breeding history of the Red-necked Stint in North America. *Western Birds* 44: 273–278.
Dowsett, R. J. & Forbes-Watson, A. D. 1993. *Checklist of birds of the Afrotropical and Malagasy regions*, vol. 1. Tauraco Press, Liège.
Ebels, E. B. 2002. Transatlantic vagrancy of Palearctic species to the Caribbean region. *Dutch Birding* 24: 202–209.
Elliott, H. F. I. 1957. A contribution to the ornithology of the Tristan da Cunha group. *Ibis* 99: 545–586.
Erritzøe, J., Mann, C. F., Brammer, F. P. & Fuller, R. A. 2012. *Cuckoos of the world*. Christopher Helm, London.
Fedrizzi, C. E., Carlos, C. J., Vaske, T., Bugoni, L., Viana, D. & Véras, D. P. 2007. Western Reef-Heron *Egretta gularis* (Ciconiiformes: Ardeidae) in Brazil. *Rev. Bras. Orn.* 15: 481–483.
Feldmann, P. & Pavis, C. 1995. Alpine Swift (*Tachymarptis melba*) observed in Guadalupe, Lesser Antilles: a fourth record for the Western Hemisphere. *El Pitirre* 8(2): 2.
Ferreira, E. A., Castro, R., Fernandes, R. & Whittaker, A. 2019. Two Palearctic herons on Fernando de Noronha, Brazil. *Bull. Brit. Orn. Cl.* 139: 160–163.
ffrench, R. 1973. *A guide to the birds of Trinidad and Tobago*. Livingston Publishing Co., Wynnewood, PA.

ISSN-2513-9894 (Online)

ffrench, R. P. & Kenefick, M. 2003. Verification of rare bird records from Trinidad and Tobago. *Cotinga* 19: 75–78.
Fisher, D. 1998. The first record of Spotted Redshank *Tringa erythropus* for South America. *Cotinga* 9: 21.
Fleming, J. H. 1901. European Lapwing in the Bahamas. *Auk* 18: 272.
Franz, I., Agne, C. E., Bencke, G. A., Bugoni, L. & Dias, R. A. 2018. Four decades after Belton: a review of records and evidences on the avifauna of Rio Grande do Sul, Brazil. *Iheringia, Sér. Zool*. 108: e 2018005.
Frost, M. D. & Burke, R. W. 2005. Two observations of Alpine Swift (*Apus melba*) on Barbados. *J. Carib. Orn*. 18: 79–80.
van Gils, J., Wiersma, P. & Kirwan, G. M. 2019. Wood Sandpiper (*Tringa glareola*). *In* del Hoyo, J., Elliott, A., Sargatal, J., Christie, D. A. & de Juana, E. (eds.) *Handbook of the birds of the world Alive*. Lynx Edicions, Barcelona (retrieved from https://www.hbw.com/node/53910 on 20 August 2019).
Gricks, N. P. 1994a. Vagrant White Stork *Ciconia ciconia* (Aves: Ciconiidae) found in Antigua: a first record for the West Indies. *El Pitirre* 7(1): 2.
Gricks, N. P. 1994b. Additional records for Antigua-Barbuda. *El Pitirre* 7(3): 12.
Gussoni, C. O. A. 2019. First record of the Little Stint, *Calidris minuta* (Charadriiformes: Scolopacidae), in Brazil. *Atualidades Orn*. 207: 28.
Haverschmidt, F. 1983. First record of the Little Egret (*Egretta garzetta*) in Suriname. *Wilson Bull*. 95: 315.
Hayes, F. E. & Kenefick, M. 2002. First record of Black-tailed Godwit *Limosa limosa* for South America. *Cotinga* 17: 20–22.
Hayes, F. E. & White, G. 2000. First report of the Trinidad and Tobago Rare Bird Committee. *J. Trinidad & Tobago Field Natur. Cl*. 1999–2000: 39–45.
Hayes, F. E. & White, G. L. 2001. Status of the Little Egret (*Egretta garzetta*) in Trinidad and Tobago. *El Pitirre* 14: 54–58.
Hewson, C. M., Thorup, K., Pearce-Higgins, J. W. & Atkinson, P. W. 2016. Population decline is linked to migration route in the Common Cuckoo. *Nature Comm*. 7: 12296.
Hillman, J. C. & Clingham, E. 2012. First record of Dwarf Bittern *Ixobrychus sturmii* for St. Helena, South Atlantic. *Bull. Afr. Bird Cl*. 19: 213–214.
Hillman, J. C., Hillman, S. M., Ellick, G., George, K., Higgins, D., Lambdon, P. & Beard, A. 2016. Swifts *Apus* sp. and Common House Martins *Delichon urbicum* on St. Helena, South Atlantic, in 2012–13. *Bull. Afr. Bird Cl*. 23: 95–98.
Hilty, S. L. 2003. *Birds of Venezuela*. Princeton Univ. Press.
Holland, C. S. & Williams, J. M. 1978. Observations on the birds of Antigua. *Amer. Birds* 32: 1095–1105.
Howell, S. N. G., Lewington, I. & Russell, W. 2014. *Rare birds of North America*. Princeton Univ. Press.
Hughes, R. A. 1988. Nearctic migrants in southwest Peru. *Bull. Brit. Orn. Cl*. 108: 29–43.
Ingels, J., Claessens, O., Luglia, T., Ingremeau, P. & Kenefick, M. 2010. White Wagtail *Motacilla alba*, a vagrant to Barbados, Trinidad and French Guiana. *Bull. Brit. Orn. Cl*. 130: 224–226.
Johnson, T. 2018. A Eurasian Wigeon *Mareca penelope* in Trinidad and Tobago: first documented record for South America. *Cotinga* 40: 79–80.
Keith, A. R., Wiley, J. W., Latta, S. C. & Ottenwalder, J. A. 2003. *The birds of Hispaniola. Haiti and the Dominican Republic: an annotated checklist*. BOU Check-list 21. British Ornithologists' Union, Tring.
Kenefick, M. 2012. Report of the Trinidad and Tobago Rare Birds Committee: rare birds in 2008–10. *Cotinga* 34: 100–105.
Kenefick, M. & Hayes F. E. 2006. Trans-Atlantic vagrancy of Palearctic birds in Trinidad and Tobago. *J. Carib. Orn*. 19: 61–72.
Kenefick, M., Restall, R. & Hayes, F. 2019. *Birds of Trinidad & Tobago*. Third edn. Christopher Helm, London.
Kessel, B. 1989. *Birds of the Seward Peninsula, Alaska. Their biogeography, seasonality, and natural history*. Univ. of Alaska Press, Fairbanks.
Kessel, B. & Gibson, D. D. 1978. Status and distribution of Alaskan birds. *Stud. Avian Biol*. 1: 1–100.
Kirwan, G. M., Levesque, A., Oberle, M. & Sharpe, C. J. 2019. *Birds of the West Indies*. Lynx Edicions, Barcelona.
Kleinjan, R. & Stevens, N. D. 2015. First record of Knob-billed Duck *Sarkidiornis melanotos* for St. Helena, South Atlantic. *Bull. Afr. Bird Cl*. 22: 227–228.
Knowlton, W. H. 2016. Sharp-tailed Sandpiper *Calidris acuminata* in Bolivia: first documented record for South America. *Cotinga* 38: 20–22.
Kushlan, J. A. & Prosper, J. W. 2009. Little Egret (*Egretta garzetta*) nesting on Antigua: a second nesting site in the Western Hemisphere. *J. Carib. Orn*. 22: 108–111.
Lack, D. & Lack, A. 1973. Birds of Grenada. *Ibis* 115: 53–59.
Lallsingh, N. 2018. A vagrant from the Old World: a mysterious gull in [*sic*] Trinidad. *Neotrop. Birding* 22: 54–58.
Ławicki, Ł. & van den Berg, A. B. 2016. WP reports. *Dutch Birding* 38: 102–116.
Ławicki, L. & van den Berg, A. B. 2017. WP reports. *Dutch Birding* 39: 43–62.
LeDreff, A. & Raynaud, P. 1993. First record of the Eurasian Kestrel (*Falco tinnunculus*) in French Guiana. *J. Raptor Res*. 27: 125.

ISSN-2513-9894 (Online)

Le Nevé, A. & Manzione, M. 2011. First record of the Lesser Sand Plover (*Charadrius mongolus*) in Argentina: a new species for the country and for South America. *Hornero* 26: 177–180.
Leblond, G. 2007. Observation d'une Cicogne blanche *Ciconia ciconia* en Martinique (Petites Antilles). *Alauda* 75: 244–245.
Lemoine, V. 2005. Little Ringed Plover (*Charadrius dubius*) in Martinique: first for the West Indies. *N. Amer. Birds* 59: 669.
Levesque, A. & Jaffard, M.-E. 2002. Fifteen new bird species in Guadeloupe (F.W.I.). *El Pitirre* 15: 5–6.
Levesque, A. & Malglaive, D. L. 2004. First documented record of Marsh Harrier for the West Indies and the New World. *N. Amer. Birds* 57: 564–565.
Mancini, P. L., Serafini, P. P. & Bugoni, L. 2016. Breeding seabird populations in Brazilian oceanic islands: historical review, update and a call for census standardization. *Rev. Bras. Orn*. 24: 94–115.
Martínez-Vilalta, A., Motis, A. & Kirwan, G. M. 2019. Great Blue Heron (Ardea *herodias*). *In* del Hoyo, J., Elliott, A., Sargatal, J., Christie, D. A. & de Juana, E. (eds.) *Handbook of the birds of the world Alive*. Lynx Edicions, Barcelona (retrieved from https://www.hbw.com/node/52675 on 20 August 2019).
Massiah, E. B. & Frost, M. D. 1998. The Little Egrets of Graeme Hall Swamp. *J. Barbados Mus. & Hist. Soc*. 44: 65–67.
Mazar Barnett, J. & Kirwan, G. M. 2000. Published records from the literature: Caribbean. *Cotinga* 14: 105–106.
Mazar Barnett, J. & Kirwan, G. M. 2002. Published records from the literature: Caribbean. *Cotinga* 17: 82–83.
McNair, D. B., Yntema, L. D., Lombard, C. D., Cramer-Burke, C. & Sladen, F. W. 2006. Records of rare and uncommon birds from recent surveys on St. Croix, United States Virgin Islands. *N. Amer. Birds* 59: 536–551.
Meier, A. J., Noble, R. E. & Raffaele, H. A. 1989. The birds of Desecheo Island, Puerto Rico, including a new record for Puerto Rican territory. *Carib. J. Sci*. 25: 24–29.
Merkord, C. L., Rodríguez, R. & Faaborg, J. 2006. Second and third records of Western Marsh-Harrier (*Circus aeruginosus*) for the Western Hemisphere in Puerto Rico. *J. Carib. Orn*. 19: 42–44.
MMA / IBAMA. 2005. *Plano de manejo da Área de Proteção Ambiental de Fernando de Noronha*. Ministério do Meio Ambiente, Brasília.
Murphy, W. L. 1992. Notes on the occurrence of the Little Egret (*Egretta garzetta*) in the Americas, with reference to other Palearctic vagrants. *Colonial Waterbirds* 15: 113–123.
Murphy, W. L. & Nana, W. 1987. First confirmed record of Western Reef-Heron *Egretta gularis* for South America. *Amer. Birds* 41: 392–394.
Nacinovic, J. B. & Teixeira, D. M. 1989. As aves de Fernando de Noronha: uma lista sistemática anotada. *Rev. Bras. Biol*. 49: 709–729.
Novaes, F. C. 1978. Sobre algumas aves pouco conhecidas da Amazonia brasileira II. *Bol. Mus. Para. E. Goeldi, Ser. Zool*. 90: 1–15.
Nunes, G. T., Hoffmann, L. S., Macena, B. C. L., Bencke, G. A. & Bugoni, L. 2015. A Black Kite *Milvus migrans* on the Saint Peter and Saint Paul archipelago, Brazil. *Rev. Bras. Orn*. 23: 31–35.
Olson, S. L. 1971. Two vagrants to Ascension Island. *Bull. Brit. Orn. Cl*. 91: 90–92.
Olson, S. L. 1982. Natural history of vertebrates on the Brazilian islands of the mid-South Atlantic. *Natl. Geogr. Soc. Res. Rep*. 13: 481–492.
Oren, D. C. 1982. A avifauna do arquipélago de Fernando de Noronha. *Bol. Mus. Para. E. Goeldi, Ser. Zool*. 118: 1–22.
Ottema, O. 2004. First sight record of Alpine Swift *Tachymarptis melba* for South America, in French Guiana. *Cotinga* 21: 70–71.
Ottema, O. 2015. Interbreeding Little *Egretta garzetta* and Snowy Egrets *E. thula* in Surinam. *Cotinga* 37: 121–122.
Petersen, W. R. & Mcrae, D. 2002. Noteworthy bird records from Trinidad and Tobago, including first reports of Wood Sandpiper (*Tringa glareola*) and White-eyed Vireo (*Vireo griseus*). *Dept. Life Sci., Univ. West Indies, St. Augustine, Occ. Pap*. 11: 204–206.
Piacentini, V. Q., Aleixo, A., Agne, C. E., Maurício, G. N., Pacheco, J. F., Bravo, G. A., Brito, G. R. R., Naka, L. N., Olmos, F., Posso, S., Silveira, L. F., Betini, G. S., Carrano, E., Franz, I., Lees, A. C., Lima, L. M., Pioli, D., Schunck, F., Amaral, F. S. R., Bencke, G. A., Cohn-Haft, M., Figueiredo, L. F. A., Straube, F. C. & Cesari, E. 2015. Annotated checklist of the birds of Brazil by the Brazilian Ornithological Records Committee / Lista comentada das aves do Brasil pelo Comitê Brasileiro de Registros Ornitológicos. *Rev. Bras. Orn*. 23: 91–298.
Pinchon, P. R. 1976. *Faunes des Antilles Françaises. Les oiseaux*. Second edn. M. Ozanne & Cie, Fort-de-France.
Pinchon, P. R. & Vaurie, C. 1961. The Kestrel (*Falco tinnunculus*) in the New World. *Auk* 78: 92–93.
Prater, T. 2012. Important Bird Areas: St Helena. *Brit. Birds* 105: 638–653.
Prince, P. A. & Croxall, J. P. 1983. Birds of South Georgia: new records and re-evaluations of status. *Bull. Brit. Antarctic Survey* 59: 15–27.
Prince, P. A. & Croxall, J. P. 1996. The birds of South Georgia. *Bull. Brit. Orn. Cl*. 116: 81–104.
Prins, T. G., Reuter, J. H., Debrot, A. O., Wattel, J. & Nijman, V. 2009. Checklist of the birds of Aruba, Curaçao and Bonaire, south Caribbean. *Ardea* 97: 137–268.

ISSN-2513-9894 (Online)

Raffaele, H. A., Wiley, J. W., Garrido, O. H., Keith, A. R. & Raffaele, J. 1998. *Guide to the birds of the West Indies*. Princeton Univ. Press.
Renaudier, A. & Comité d'Homologation de Guyane. 2010. Rare birds in French Guiana in 2005–07. *Cotinga* 32: 75–83.
Renner, H. M. & McCaffery, B. J. 2006. Nesting biology of Eastern Yellow Wagtails at Cape Romanzof, Alaska. *J. Field Orn*. 77: 250–258.
Restall, R., Rodner, C. & Lentino, M. 2006. *Birds of northern South America*. Christopher Helm, London.
Ridgely, R. S. & Greenfield, P. J. 2001. *The birds of Ecuador*. Cornell Univ. Press, Ithaca, NY.
Robinson, W. 1905. An addition to the avifauna of Cuba. *Auk* 22: 315.
Rowlands, B. W., Trueman, T., Olson, S. L., McCulloch, M. N. & Brooke, R. K. 1998. *The birds of St Helena: an annotated checklist*. BOU Checklist No. 16. British Ornithologists' Union, Tring.
Ryan, P. G. 2008. Important Bird Areas: Tristan da Cunha and Gough Island. *Brit. Birds* 101: 586–606.
Ryan, R. 1997. First record of Little Egret *Egretta garzetta* for Guyana. *Cotinga* 8: 92.
Santana, W. & Pinheiro, A. P. 2010. On the occurrence of the Eurasian Kestrel *Falco tinnunculus* Linnaeus, 1758 and Little Egret *Egretta garzetta* (Linnaeus, 1766) in the archipelago of São Pedro e São Paulo, Brazil. *Rev. Bras. Orn*. 18: 118–120.
Schulenberg, T. S., Stotz, D. F., Lane, D. F., O'Neill, J. P. & Parker, T. A. 2007. *Birds of Peru*. Princeton Univ. Press.
Schulz-Neto, A. 1998. Novos registros de aves para o Novo Mundo, para a América do Sul, para o Brasil e para Fernando de Noronha. P. 50 *in* Resumos VII Congr. Bras. Orn. Universidade do Estado do Rio de Janeiro, Rio de Janeiro.
Schulz-Neto, A. 2004. Aves insulares do arquipélago de Fernando de Noronha. Pp. 147–168 *in* Branco, J. O. (org.) *Aves marinhas e insulares brasileiras: a bioecologia e conservação*. Ed. UNIVALI, Itajaí.
Silva e Silva, R. 2008. *Aves de Fernando de Noronha*. Avis Brasilis, Vinhedo.
Silva e Silva, R. & Olmos, F. 2006. Noteworthy bird records from Fernando de Noronha, north-eastern Brazil. *Rev. Bras. Orn*. 14: 470–474.
Steadman, D. W., Norton, R. L., Browning, M. R. & Arendt, W. J. 1997. The birds of St. Kitts, Lesser Antilles. *Carib. J. Sci*. 33: 1–20.
Stott, R. D. E. 2015. First record of Eurasian Wigeon *Mareca penelope* for Cuba. *Cotinga* 37: 107.
Teixeira, D. M., Nacinovic, J. B. & Pontual, F. B. 1987. Notes on some birds of northeastern Brazil (2). *Bull. Brit. Orn. Cl*. 107: 151–157.
Teixeira, W., Cordani, U. G., Menor, E. A., Teixeira, M. G. & Lisker, R. 2003. *Arquipélago Fernando de Noronha: o paraíso do vulcão*. Terra Virgem, São Paulo.
Vander Pluym, D. & Sterling, J. 2019. Eurasian Curlew *Numenius arquata* in Argentina: first record for South America. *Cotinga* 41: 41–43.
Voous, K. H. 1957. A specimen of the Spotted Crake, *Porzana porzana*, from the Lesser Antilles. *Ardea* 45: 89–90.
West, G. C. 2008. *A birder's guide to Alaska*. American Birding Association, Colorado Springs.
Wikiaves. 2018. A enciclopédia das aves do Brasil. http://www.wikiaves.com.br/ (accessed July 2018).
White, R. 2002. Rare and scarce vagrant birds on Ascension, 2001-2002. *Ascension Conserv. Quarterly* 2: 2–3.
Williams, R. S. R. & Beadle, D. D. 2003. Eurasian Wigeon *Anas penelope* in Venezuela: a new bird for South America. *Cotinga* 19: 71.
Wingate, D. B. 1983. A record of the Siberian Flycatcher (*Muscicapa sibirica*) from Bermuda: an extreme extra-limital vagrant. *Auk* 100: 212–213.

Addresses: Andrew Whittaker, Museu Paraense Emílio Goeldi, CP 399, Belém, Pará, Brazil, e-mail: andrew@birdingbraziltours.com. João Paulo Ferreira da Silva, Rua Major Costa 113, Vila do 30, Fernando de Noronha, Pernambuco, Brazil, e-mail: jpnoronhaadventure86@gmail.com. Breno Lucio, Rua Sao Miguel 349, Vila dos Remedios, Fernando de Noronha, Pernambuco, Brazil, e-mail: brenolucio@hotmail.com. Guy M. Kirwan, Research Associate, Field Museum of Natural History, 1400 South Lakeshore Drive, Chicago, IL 60605, USA.

ISSN-2513-9894 (Online)

Galliform diversity in south-west Yunnan, China, with notes on Blood Pheasant *Ithaginis cruentus* and White Eared Pheasant *Crossoptilon crossoptilon* biology

by Daniel M. Brooks, Paul J. Buzzard, Xueyou Li & William V. Bleisch

Received 17 January 2019; revised 10 June 2019; published 20 September 2019

http://zoobank.org/urn:lsid:zoobank.org:pub:E9013386-176C-455F-8ADD-27E8F1978E71

Summary.—We describe gamebird community structure and beta diversity at two sites in the Chinese Himalayas, and describe aspects of the biology of Blood Pheasant *Ithaginis cruentus* and White Eared Pheasant *Crossoptilon crossoptilon*. We deployed cameras from October 2011 to January 2014 at 34 sites in two areas (Langdu and Gehuaqing) within the Three Parallel Rivers UNESCO World Heritage Site (Diqing Autonomous Prefecture, Yunnan). Five of the eight species of gamebirds recorded in this study were pheasants. Despite habitat similarity, beta diversity showed little overlap, with only a single Galliform, Temminck's Tragopan *Tragopan temminckii*, shared between the two sites. Novel information on temporal presence and activity patterns is reported for *I. cruentus* and *C. crossoptilon*, as well as population sex ratios for *I. cruentus*. Additional information for *I. cruentus* (altitudinal migration, flock demography) and *C. crossoptilon* (habitat and altitude association, breeding biology, flock demography) are compared with other studies, and their conservation implications are discussed.

Gamebirds such as pheasants, partridge and quail (Galliformes) are keystone species in Himalayan ecosystems for their role in maintaining forest dynamics by digging and seed dispersal / predation syndromes, as well as their meat and eggs being an important protein source for numerous species. However, gamebirds are often threatened by non-sustainable harvest for food, plumage and the live bird trade, as well as destruction and degradation of the forests on which they largely depend (Fuller & Garson 2000).

Studies of Himalayan avian community structure (e.g., Elsen *et al*. 2017, Srinivasan *et al*. 2018) have been restricted to passerines rather than larger gamebirds. Although community ecology studies of gamebirds are available (e.g., Brooks *et al*. 2001), these have been in relatively homogenous regions such as lowland tropical forest, which contrasts sharply with heterogeneous montane environments such as the Himalayas. Nevertheless, both tropical lowland and Himalayan forests can support high species diversity (Cai *et al*. 2018).

Pheasant communities in the Himalayas are logistically challenging to study due to remote sites, high altitudes leading to hypoxia, and the elusive nature of pheasants in the wild. Consequently there are significant gaps in data for many species, including Blood Pheasant *Ithaginis cruentus* and White Eared Pheasant *Crossoptilon crossoptilon* (McGowan & Kirwan 2019, McGowan *et al*. 2019). Nonetheless, there have been some in-depth studies of these two species, among others, in these high-altitude environments (e.g., Li 1981, Lu 1986, Jia *et al*. 1999, 2004, 2005, Lu *et al*. 2006).

The objective of this study was to assess Galliform community structure and beta diversity (simply defined as similarity of species composition between regions) at two sites in the Chinese Himalayas *c*.125 km apart. Additionally, we describe aspects of the biology of *Ithaginis cruentus* and *Crossoptilon crossoptilon*.

ISSN-2513-9894 (Online)

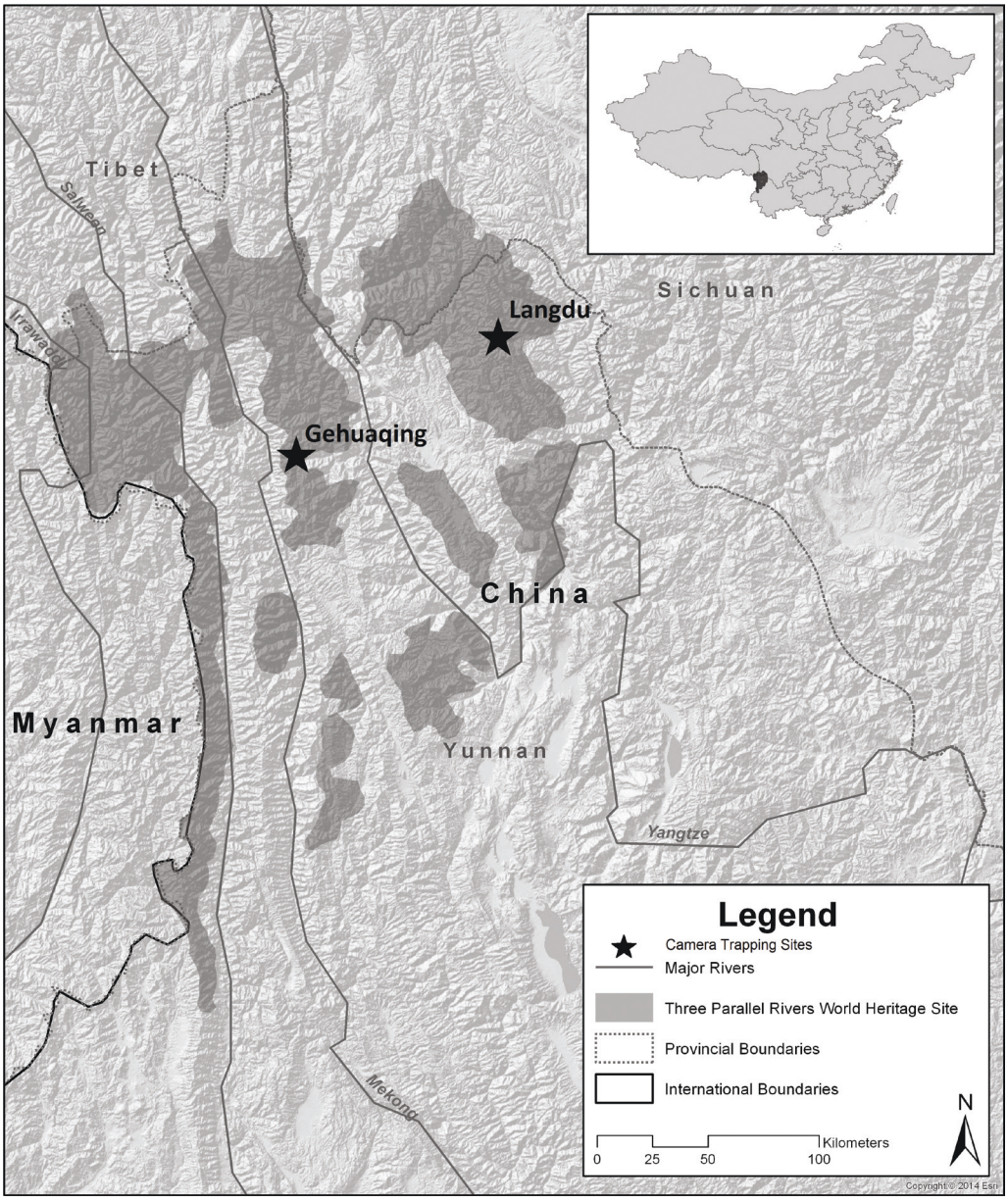


Figure 1. Map of study region showing location of Langdu and Gehuaqing, Yunnan, China.

Methods

Study area.—The study took place in two areas within the Three Parallel Rivers UNESCO World Heritage Site in Diqing Autonomous Prefecture, Yunnan, China: (1) near the Hong Shan part of the World Heritage Site, near Langdu village in Shangri-La county (28°14.87′N, 99°58.28′E); (2) in the southern part of Baimaxueshan National Nature Reserve near Gehuaqing village in Weixi county (27°35.74′N, 99°17.43′E). Hereafter these sites are referred to as Langdu and Gehuaqing, respectively (Fig. 1; Buzzard *et al*. 2018). These two

ISSN-2513-9894 (Online)

sites were selected as each comprised a connected series of intact natural habitats over a range of elevations, believed to be representative of the two regions.

The sites presented differing conservation management regimes as Langdu was not subject to forest guard patrols, although hunting was officially illegal, whereas Gehuaqing benefitted from active conservation management, including regular patrols by forest guards. Langdu was primarily inhabited by Tibetan herders who raise mainly yaks (*Bos gunniens*) and yak-cow hybrids, plus some horses (*Equus caballus*) and mules. Gehuaqing was primarily inhabited by farmers of the Lisu Minority who mainly raise pigs and engage in apiculture, but are well known as skilled hunters.

Elevation at Langdu spanned 4,000–4,800 m, whereas at Gehuaqing habitat sampled ranged from 3,050–3,600 m. In both areas, habitat was primarily forest dominated by conifer trees including spruce (*Picea* spp.), firs (*Abies* spp.) and juniper (*Juniperus* spp.), as well as hardwoods including birch (*Betula* spp.), oaks (*Quercus* spp.), and rhododendrons (*Rhododendron* spp.). Distinct vegetation changes occurred with elevation and aspect (whether the slope is north- or south-facing). As elevation increased, trees and shrubs diminished in height and alpine meadows occurred at their upper limits, above which rock and scree were the dominant land cover.

Camera trapping.—To document presence we used heat- / motion-activated camera traps (Bushnell Trophy Cam) for >3 years, spanning October 2011–January 2014. We deployed cameras in all seasons, at 34 sites (22 at Langdu, 12 at Gehuaqing) separated from each other by at least 500 m along wildlife trails or routes likely to be used (Table 1). For subsequent pictures of the same species, we considered independent captures as those that occurred at least one hour apart (Rovero & Marshall 2009). We calculated relative abundance index values by dividing the value of independent captures by the number of trap-days where the species was confirmed as present. We estimated the age of *Crossoptilon crossoptilon* by sending camera-trap images to aviculturists familiar with the species' developmental growth stages, and polled them to estimate ages of offspring in the images.

Results

Beta diversity.—Five of the eight species of Galliformes recorded were pheasants, with an additional two to three species of large passerines (Table 2). Despite habitat similarity between the two sites, beta diversity showed little overlap, with only a single Galliform (Temminck's Tragopan *Tragopan temminckii*) shared between the two sites. Five species (Chinese Grouse *Bonasa sewerzowi*, Buff-throated Partridge *Tetraophasis szechenyii*, Tibetan Snowcock *Tetraogallus tibetanus*, Blood Pheasant and White Eared Pheasant) were found only at Langdu, and two (Koklass Pheasant *Pucrasia macrolopha* and Lady Amherst's Pheasant *Chrysolophus amherstiae*) were exclusive to Gehuaqing (Table 2). A sixth species, Sclater's Monal *Lophophorus sclateri*, was visually detected at Langdu (PJB unpubl.) but not captured by a camera-trap.

BLOOD PHEASANT *Ithaginis cruentus*

A total of 36 independent photographs of Blood Pheasants were taken at six different camera-trap sites representing primarily a component of *Rhododendron* forest, including ($n = 1$ unless otherwise noted) mixed *Rhododendron* forest ($n = 2$ sites), mixed *Rhododendron*–conifer forest, *Rhododendron*–oak scrub, *Rhododendron* forest scrub and mixed conifer–broadleaf forest. Microhabitat characteristics varied and comprised forest (sparse to dense, at times mesic) to mesic clearings (covered by moss and some sticks), understorey completely lacking to present at edges, with substrate (moss, dried leaves and twigs, pebbles and boulders). Topography was level to sloping and *Ithaginis* occurred at 4,028–4,407 m.

ISSN-2513-9894 (Online)

TABLE 1
Location, altitude, habitat and number of trap-days of 20 camera traps at Langdu (L) and Gehuaqing (G), Yunnan, China.

Camera	# Ind. photos	Location	Latitude	Longitude	Habitat	Altitude (m)	Days
ctrp2		L	28°24.35′N	99°96.45′E	mixed conifer	4,243	161
ctrp3		L	28°24.09′N	99°97.15′E	*Rhododendron* / oak	4,290	164
ctrp4		L	28°24.12′N	99.96.65′E	*Rhododendron* / oak	4,313	164
ctrp5		L	28°24.32′N	99°96.65′E	*Rhododendron* / oak	4,217	160
ctrp8		L	28°25.81′N	99°97.61′E	*Rhododendron* / oak	4,333	19
ctrp10		L	28°23.97′N	99°97.62′E	meadow	4,040	66
ctrp11	6	L	28°23.58′N	99°97.30′E	mixed conifer	4,133	66
ctrp12		L	28°25.84′N	99°97.25′E	meadow	4,265	66
ctrp14	3	L	28°23.72′N	99°98.27′E	mixed conifer	4,029	64
ctrp15	4	L	28°23.50′N	99°97.95′E	mixed conifer	4,196	64
ctrp17	3	L	28°24.59′N	99°98.53′E	*Rhododendron* / oak	4,151	134
ctrp18	9	L	28°24.52′N	99°98.71′E	mixed conifer	4,173	134
ctrp19	24	L	28°24.45′N	99°98.92′E	*Rhododendron* / oak	4,164	134
ctrp 22	12	L	28°23.19′N	99°97.63′E	mixed conifer	4,407	132
ctrp23	8	L	28°23.59′N	99°97.54′E	mixed conifer	4,148	132
ctrp24	1	L	28°24.95′N	99°99.24′E	meadow	4,359	122
ctrp25	2	L	28°25.05′N	99°98.19′E	mixed conifer	4,148	116
sl1		L	28°25.11′N	99°94.31′E	alpine	4,579	140
sl2		L	28°25.26′N	99°94.15′E	alpine	4,763	130
sl3	1	L	28°25.32′N	99°94.17′E	alpine	4,815	143
sl4		L	28°28.86′N	99°93.43′E	alpine	4,692	120
sl6	1	L	28°27.78′N	99°93.05′E	alpine	4,670	173
ghq1	1	G	27°59.66′N	99°31.55′E	*Rhododendron*	3,403	28
ghq3	2	G	27°59.24′N	99°31.78′E	*Rhododendron*	3,356	29
ghq5		G	27°59.43′N	99°27.19′E	conifer / hardwood	3,318	26
ghq6	1	G	27°59.42′N	99°26.57′E	conifer / hardwood	3,246	26
ghq7		G	27°59.54′N	99°26.20′E	*Rhododendron*	3,187	27
ghq8	1	G	27°59.88′N	99°31.01′E	conifer / hardwood	3,190	120
ghq9		G	27°60.61′N	99°31.06′E	*Rhododendron*	3,442	120
ghq10		G	27°60.96′N	99°30.62′E	*Rhododendron*	3,606	120
ghq12		G	27°59.81′N	99°30.37′E	conifer / hardwood	3,176	120
ghq13		G	27°59.26′N	99°26.22′E	conifer / hardwood	3,055	118
ghq15	1	G	27°59.94′N	99°26.20′E	conifer / hardwood	3,369	118
ghq16		G	27°59.71′N	99°26.15′E	conifer / hardwood	3,244	118

This species shows sharp elevational migration, being present only mid spring to early autumn (April–October), retreating to lower elevations in winter. While peak occurrence

ISSN-2513-9894 (Online)

TABLE 2
Species presence, abundance and trap-days at Langdu (22 sites) and Gehuaqing (12 sites), Yunnan, China.

Species	Scientific name	Trap-days	Langdu Ind. events	No. of individuals	No. of sites	Trap-days	Gehuaqing Ind. events	No. of individuals	No. of sites
Chinese Grouse	*Bonasa sewerzowi*	66	1 (0.015)	1 (0.015)	1				
Buff-throated Partridge	*Tetraophasis szechenyii*	400	6 (0.040)	8 (0.015)	3				
Tibetan Snowcock	*Tetraogallus tibetanus*	173	1 (0.006)	2 (0.012)	1				
Blood Pheasant	*Ithaginis cruentus*	592	36 (0.061)	46 (0.077)	6				
Koklass Pheasant	*Pucrasia macrolopha*					146	2 (0.013)	2 (0.013)	2
Temminck's Tragopan	*Tragopan temminckii*	143	1 (0.007)	1 (0.007)	1	58	2 (0.034)	2 (0.034)	2
White Eared Pheasant	*Crossoptilon crossoptilon*	836	15 (0.018)	53 (0.063)	7				
Lady Amherst's Pheasant	*Chrysolophus amherstiae*					120	2 (0.016)	1 (0.008)	1
Giant Laughingthrush	*Garrulax maximus*	402	15 (0.037)	18 (0.045)	3				
Long-tailed Thrush	*Zoothera dixoni*	134	1 (0.007)	1 (0.007)	1				
unidentified thrush	*Zoothera* sp.					26	1 (0.038)	1 (0.038)	1

Relative abundance index values are shown in parentheses and were computed by dividing the value of independent captures or number of individuals by number of trap-days where the species was confirmed as present.

was in August–September, records declined dramatically to just one in October, followed by none in November–March (Fig. 2).

Ithaginis was active at dawn (06.00 h) until after nightfall (19.00 h). Bimodal peaks of activity were 08.00–10.00 h, with a stronger peak in late afternoon / early evening (16.00–19.00 h; Fig. 3). It was active during temperatures from -3ºC to 22ºC (mean = 7.5ºC), and snow was visible on the ground in some photos. A limited sample size (n = 7), suggests the species was not more active during any particular phase of the moon, with three photos (43% combined) during both new / near new moon and half-moon cycles, and a single photo (14%) during a full moon.

Flock size was 1–4 birds, with a mean of 1.2 (n = 36). The total ratio of adult males to females was 32:14 (2.3 males / female; per Karanth *et al*. 2011). The commonest social group was solitary adult males (n = 21, 58%) followed by lone adult females (n = 7, 19%), male–female (presumably bonded) pairs (n = 4, 11%), adult male 'pairs' (n = 2, 6%) with single records (3%) of adult female pairs and a quad of three adult males and one adult female.

WHITE EARED PHEASANT *Crossoptilon crossoptilon*

Fifteen independent photographs of White Eared Pheasant were taken at seven different camera-trap sites representing primarily *Rhododendron* or conifer forest, including (n = 1 unless otherwise noted) *Rhododendron*–oak scrub (n = 2), mixed *Rhododendron*–conifer forest, mixed conifer forest, mixed conifer–broadleaf forest, mixed forest and high-elevation meadow. Microhabitat characteristics comprised primarily forest (open to dense), lacking or with a dry leaf litter / herbaceous understorey, and substrate from dried leaves and twigs, to pebbles and boulders on bare ground bordering forest edge. Open habitats were mesic, from moss-covered clearings to herbaceous slopes with rocky outcrops. Topography was level to sloping and *Crossoptilon* was recorded at 4,028–4,359 m.

ISSN-2513-9894 (Online)

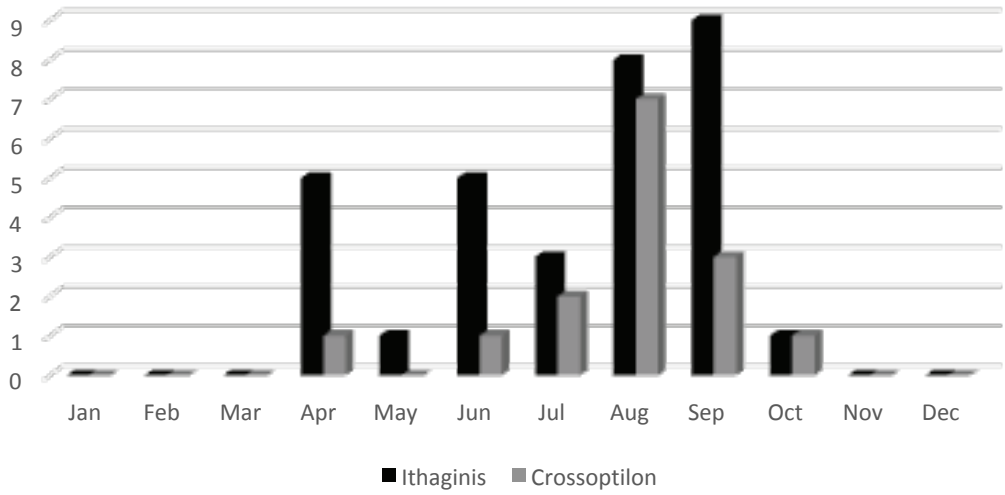


Figure 2. Seasonal presence of Blood Pheasant *Ithaginis cruentus* and White Eared Pheasant *Crossoptilon crossoptilon* at Langdu, Yunnan, China.

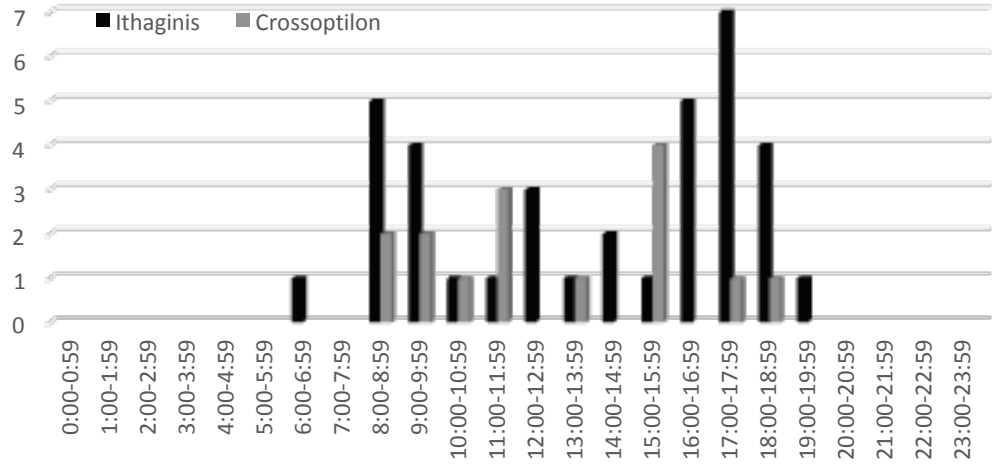


Figure 3. Activity patterns of Blood Pheasant *Ithaginis cruentus* and White Eared Pheasant *Crossoptilon crossoptilon* at Langdu, Yunnan, China.

Similar to *Ithaginis*, this species displayed a sharp elevational migration, being present only in April–October, moving to lower elevations in winter. Peak occurrence was during August, with at most one record each in the months of April–June and October (Fig. 2).

Crossoptilon was active from morning (08.00 h) until after nightfall (19.00 h). While a sharp peak of activity occurred in mid afternoon (15.00–16.00 h), it was primarily active in the morning (08.00–12.00 h; Fig. 3). The species was active during temperatures of 5–24ºC (mean = 9.6ºC), and snow was visible on the ground in some photos.

Photos were obtained between 27 July and 21 August of three different broods each of 2–4 young that were estimated to be four months of age (E. Benhardt, J. Berger, K. Landig, J. Pfarr *in litt*. 2019) foraging with 2–4 adults, suggesting hatch dates in late March–late April. Additionally, we obtained a photo of a copulation between a pair in the presence of three other adults on 11 August.

ISSN-2513-9894 (Online)

Flock size was 1–13 birds, with a mean of 3.5 (n = 15). Total ratio of adults to subadults was 43:10 (4.3 adults / subadult). The most common social group was lone adults (n = 8, 53%) followed by both (n = 3 each, 20%) groups of 4–5 adults, and groups of adults (2–4) with subadults (2–4), with a single group of ≥ 13 adults (n = 1, 7%).

Discussion

Beta diversity.—At a site *c*.1,600 km north of Langdu in Qi-Lian Xian (Qinghai province), an extremely similar community of six species of gamebirds was recorded (Li 1981), comprising three of the same species (*Bonasa sewerzowi*, *Tetraogallus tibetanus*, *Ithaginis cruentus*), two congeners (Chestnut-throated Partridge *Tetraophasis obscurus*, Blue Eared Pheasant *Crossoptilon auritum*) and a partridge (Tibetan Partridge *Perdix hodgsoniae*), instead of *Tragopan temminckii*. Similar to our findings at Langdu, *Ithaginis* and *Crossoptilon* were the most abundant species (Li 1981).

In contrast, despite being just *c*.125 km distant and sharing similar physiognomic characteristics and forest attributes, gamebird species composition between Langdu and Gehuaqing was dramatically different, with only *Tragopan temminckii* shared between the two sites. Unless conservation management at Gehuaqing is ineffective, the factors responsible for the very different species composition were probably not a product of conservation management regimes, as Langdu, without any formal forest guards, harboured three times the number of Galliformes as Gehuaqing.

One of the most relevant factors distinguishing Langdu from Gehuaqing was a difference of several hundred metres in elevation, with the Langdu site at 4,000–4,800 m and Gehuaqing at 3,050–3,600 m. This change in altitude results in different temperature gradients and plant species composition, which are strong factors determining avian community structure, as has been shown elsewhere in the Himalayas (Elsen *et al*. 2017, Srinivasan *et al*. 2018). Others (e.g., Thiollay 1996) have also found elevation to play a role in predicting species turnover in other montane regions.

One must also consider the cultural differences between Langdu and Gehuaqing (Li *et al*. 2016). Tibetans in Langdu are traditionally transhumance herders and Buddhists, and hunting is considered morally questionable. In contrast, gathering forest products and hunting is important in the Lisu culture, suggesting that they might have hunted some Galliform species to local extinction in Gehuaqing. In north-west Yunnan, such cultural differences had a significant influence on Musk Deer *Moschus* spp. distribution, for example, more than the protected status of an area (Li *et al*. 2016).

Ithaginis cruentus.—We report novel information on temporal presence, activity patterns and population sex ratios. Additional findings are compared with other studies, below.

From spring to early autumn *Ithaginis* was present at 4,000–4,400 m, whereas Lu *et al*. (2006) found this species at 3,400–3,700 m in south-west Shiqu county (Sichuan province). However, both of these ranges fall within the overall elevational range (3,200–4,700 m) provided by Delacour (1951) and MacKinnon & Phillipps (2000).

Delacour (1951) indicated that flocks of 10–20 splinter into monogamous pairs during the breeding season. Others have indicated *Ithaginis* occurs in small to large flocks numbering five individuals to as many as 70 post-breeding (Madge *et al*. 2002) or 8–19 with a mean of 10.67 (Lu *et al*. 2006). In contrast, the majority of our records were of lone individuals, followed by a small number of male–female pairs. This is probably due to our records being outside winter when larger flocks form.

Our population sex ratio data are novel being slightly more than two males per female during the breeding season. Others have found breeding pairs to associate with young

ISSN-2513-9894 (Online)

bachelor flocks (Jia *et al*. 1999), or polyandrous groups of two males and a female rearing broods together (Ludlow & Kinnear 1944). One theory for the evolution of polyandry is a response to an abundance of males in a given population (Willson & Pianka 1963), such as the disparate sex ratio we observed of >2 males/female.

Crossoptilon crossoptilon.—Similar to *Ithaginis cruentus*, we report novel information on temporal presence and activity patterns for this species. Additionally, we report some notes on reproductive period; these and additional findings are compared with other studies.

Lu (1986) indicated that *C. crossoptilon* is found in coniferous forest during spring, whereas in the summer McGowan (1994) stated that it occurs in alpine meadows, and Madge *et al*. (2002) reported it in subalpine birch and *Rhododendron* scrub above the treeline. In contrast to these authors reports of the species being restricted primarily to one or two specific habitats in spring and summer, we found *Crossoptilon* associated with at least six different habitats during these seasons, some of which (e.g., subalpine coniferous and mixed forests) were thought to be used only in winter by McGowan (1994) and Madge *et al*. (2002). Jia *et al*. (2005) found this species to be negatively associated with distance to nearest permanent water and herb cover, but positively with shrub cover, tree cover and tree height.

While most prior references indicate *C. crossoptilon* occurs below 3,900 m (Delacour 1951, Lu 1986, MacKinnon & Phillipps 2000), we found it only above 4,000 m to nearly 4,400 m, i.e. closer to the max. summer altitudes of 4,300 m (Madge *et al*. 2002) or 4,600 m (McGowan 1994).

Very little to no reliable information is available for *C. crossoptilon* reproduction in the wild (McGowan 1994). It is presumed that monogamous pairs (Madge *et al*. 2002) split off from larger groups in spring (Delacour 1951) to nest and lay eggs in May–June (McGowan 1994). However, Lu (1986) noted small flocks during the breeding season, rather than just solitary birds and monogamous pairs (Delacour 1951). We observed the same pattern, with a copulating pair in a small flock, broods of young foraging with multiple adults, and flocks of up to 13 birds (mean = 3.5).

The largest flock we observed was 13, consistent with others (e.g., MacKinnon & Phillipps 2000, Madge *et al*. 2002). However larger flocks of up to 30 are found in winter (Madge *et al*. 2002), and historically flocks of several hundred (Lu 1986) to 1,000 birds (Wang *et al*. 2012) have been reported, although these estimates are primarily from Buddhist monasteries where the birds are provided regular food by the monks in these regions.

Conservation implications.—While humans are the primary predators of Galliformes, other potential predators of adult and young birds and their eggs include several species recorded by our camera-traps (Buzzard *et al*. 2018). Macaques (*Macaca* sp.), Leopard Cat *Prionailurus bengalensis*, Yellow-throated Marten *Martes flavigula*, Masked Palm Civet *Paguma larvata*, domestic dog *Canis lupus familiaris* and Wild Boar *Sus scrofa* were present at both sites, and Yunnan Snub-nosed Monkey *Rhinopithecus bieti* only at Gehuaqing. Additionally, local people report that Snow Leopard *Panthera uncia* occurs at Langdu, although this has not been confirmed (Buzzard *et al*. 2017).

All of the gamebirds recorded in this study are currently classified as Least Concern (LC) by BirdLife International / IUCN (2018), with the exception of two Near Threatened species (*Bonasa sewerzowi* and *Crossoptilon crossoptilon*) found only at Langdu. *C. crossoptilon* was not only the most abundant species in our study, but was also observed to be breeding well. Although the species was treated as Vulnerable 25 years ago (Collar *et al*. 1994), it was considered abundant nearly 70 years ago (Delacour 1951). McGowan (1994) indicated the primary threats to be forest destruction and hunting.

ISSN-2513-9894 (Online)

The robust population of Near Threatened species such as *C. crossoptilon*, coupled with the fact that Langdu harboured much higher abundance, as well as three times as many species, of Galliformes, is surprising given that conservation management is weak at Langdu compared to Gehuaqing, with no formal forest guard patrol in place. One possible explanation is the majority of Langdu occupants are Tibetans more focused on herding, whereas Gehuaqing inhabitants include the Lisu Minority who are traditionally hunters (Li *et al*. 2016). Supporting this, all but one of the photos at Gehuaqing were taken during crepuscular periods (n = 3) or at night (n = 5). Game species often shift their activity to darker photoperiods to avoid hunters who are more active by day (e.g., Brooks *et al*. 2001). In cases of communities actively harvesting wildlife (e.g., Gehuaqing Lisu), it is assumed that hunting has only increased over the decades of economic development since the 1970s. Additionally a collapse of traditional wildlife management practices (e.g., refuges, rotation and hunting seasons) may have been a contributing factor. Thus increased availability of firearms and markets led to a decline in biodiversity, which may have recovered somewhat since legal bans on guns and sales of wildlife came into effect in the 1990s.

Comparing species-presence data from a nearby site in north-west Yunnan, all of the species of pheasants photo-trapped herein, plus Silver Pheasant *Lophura nycthemera*, were also recently camera-trapped at Baima Snow and Wuliang Mountains (XL unpubl.). Of these seven species, nearly a century ago Beebe (1936) mentioned anecdotally that *Tragopan temminckii*, *Crossoptilon crossoptilon* and *Chrysolophus amherstiae* were present at sites in north-west Yunnan, while *Ithaginis* occurred nearby. It is surprising that Beebe (1936) did not mention the other three species recorded, as they were not rare in our study, comprising a combined 46% of photos (*Lophura nycthemera* n = 19, *Tetraogallus tibetanus* and *Pucrasia macrolopha* n = 7 each). Another historical example from the region is provided by Andrews & Andrews (1918), who repeatedly remarked how rare game was in the region, especially birds; nonetheless they recorded *Tragopan temminckii* and *Chrysolophus amherstiae*, plus Red Junglefowl *Gallus gallus* and *Lophura nycthemera*. Although not quantitative, the differences in species turnover over time provided in these simple analyses help to provide insight into historic hunting pressure in the region.

Acknowledgements

We thank Howman Wong, founder and President of the China Exploration and Research Society (CERS) for help with logistics and site access, as well as the CERS interns and local field assistants who helped with field work. We also thank Prof. Jiang Xuelong for guidance and support, and Kim Williams-Guillén for help with the map. Funding came from Symrise Inc., Eu Yan Sang International Limited, and a 2013 conservation grant from the Snow Leopard Network. This research had the necessary approvals and permits from the appropriate institutions of the People's Republic of China, and we adopted IUCN/Species Survival Commission guidelines as a framework for professional procedure and study design.

References:

Andrews, R. C. & Andrews, Y. B. 1918. *Camps and trails in China: a narrative of exploration, adventure, and sport in little-known China*. D. Appleton, New York.

Beebe, W. 1936. *Pheasants: their lives and homes*. Doubleday, Doran & Co., New York.

BirdLife International. 2018. Species factsheets. http://datazone.birdlife.org/species/search (accessed 23 May 2018).

Brooks, D. M., Pando-V., L., Ocmin-P., A. & Tejada-R., J. 2001. Resource separation in a Napo-Amazonian gamebird community. Pp. 213–225 *in* Brooks, D. M. & Gonzalez-F., F. (eds.) *Biology and conservation of cracids in the new millennium*. *Misc. Publ. Houston Mus. Nat. Sci*. 2.

Buzzard, P. J., Li, X. & Bleisch, W. V. 2017. The status of snow leopards *Panthera uncia* and high altitude use by common leopards *P. pardus* in northwest Yunnan, China. *Oryx* 51: 587–589.

Buzzard, P. J., Li, X. & Bleisch, W. V. 2018. High altitude ungulate communities in southwest China. *Mammalia* 82: 415–422.

ISSN-2513-9894 (Online)

Cai, T., Fjeldså, J., Wu, Y., Shao, S., Chen, Y., Quan, Q., Li, X., Song, G., Qu, Y., Qiao, G. & Lei, F. 2018. What makes the Sino-Himalayan mountains the major diversity hotspots for pheasants? *J. Biogeogr*. 45: 640–651.

Collar, N. J., Crosby, M. J. & Stattersfield, A. J. 1994. *Birds to watch 2: the world list of threatened birds*. BirdLife International, Cambridge, UK.

Delacour, J. 1951. *The pheasants of the world*. Allen Publishing Co., Salt Lake City.

Elsen, P. R., Tingley, M. W., Kalyanaraman, R., Ramesh, K. & Wilcove, D. S. 2017. The role of competition, ecotones, and temperature in the elevational distribution of Himalayan birds. *Ecology* 98: 337–348.

Fuller, R. A. & Garson, P. J. 2000. *Pheasants: status survey and conservation action plan 2000–2004*. IUCN, Gland.

Jia, C., Zheng, G., Zhou, X. & Zhang, H. 1999. Social organization of blood pheasant (*Ithaginis cruentus*) in Wolong Nature Reserve. *Acta Zool. Sinica* 45: 135–142.

Jia, C., Zheng, G., Zhou, X. & Zhang, H. 2004. Home range and habitat characteristics of blood pheasant in summer. *Sichuan J. Zool*. 23: 349–352.

Jia, C., Wang, N. & Zheng, G. M. 2005. Winter habitat requirements of White Eared Pheasant *Crossoptilon crossoptilon* and Blood Pheasant *Ithaginis cruentus* in south-west China. *Bird Conserv. Intern*. 15: 303–312.

Karanth, K. U., Nichols, J. D., Kumar, N. S. & Jathanna, D. 2011. Estimation of demographic parameters in a tiger population from long-term camera trap data. Pp 145–161 *in* O'Connell, A. F., Nichols, J. D. & Karanth, K. U. (eds.) *Camera traps in animal ecology*. Springer Verlag, Tokyo.

Li, D. 1981. Blue-eared Pheasant and Blood Pheasant in the forest of Qi-Lian Xian, Qinghai. *Zool. Res*. 1: 16.

Li, X., Bleisch, W. V. & Jiang, X. 2016. Effects of ethnic settlements and land management status on species distribution patterns: a case study of endangered Musk Deer (*Moschus* spp.) in northwest Yunnan, China. *PLoS ONE* 11(5): e0155042.

Lu, Q. B., Wang, X. M. & Wang, Z. H. 2006. Correlation of group and habitat requirement for alpine Blood Pheasants in the initial mating period in Shiqu, Sichuan. *Zool. Res*. 27: 243–248.

Lu, T. 1986. On breeding ecology of the Tibetan eared pheasant *Crossoptilon crossoptilon*. *Acta Zool. Sinica* 4: 11.

Ludlow, F. & Kinnear, N. B. 1944. The birds of south-eastern Tibet. *Ibis* 86: 43–91.

MacKinnon, J. & Phillipps, K. 2000. *Field guide to the birds of China*. Oxford Univ. Press.

Madge, S., McGowan, P. J. K. & Kirwan, G. M. 2002. *Pheasants, partridges and grouse*. Christopher Helm, London.

McGowan, P. J. K. 1994. Family Phasianidae (pheasants, partridges, turkeys and grouse). Pp 434–553 *in* del Hoyo, J., Elliott, A. & Sargatal, J. (eds.) *Handbook of the birds of the world*, vol. 2. Lynx Edicions, Barcelona.

McGowan, P. J. K. & Kirwan, G. M. 2019. Blood Pheasant (*Ithaginis cruentus*). *In* del Hoyo, J., Elliott, A., Sargatal, J., Christie, D. A. & de Juana, E. (eds.) *Handbook of the birds of the world Alive*. Lynx Edicions, Barcelona (retrieved from https://www.hbw.com/node/53475 on 14 August 2019).

McGowan, P. J. K., Kirwan, G. M. & Christie, D. A. 2019. White Eared-pheasant (*Crossoptilon crossoptilon*). *In* del Hoyo, J., Elliott, A., Sargatal, J., Christie, D. A. & de Juana, E. (eds.) *Handbook of the birds of the world Alive*. Lynx Edicions, Barcelona (retrieved from https://www.hbw.com/node/53499 on 14 August 2019).

Srinivasan, U., Elsen, P. R., Tingley, M. W. & Wilcove, D. S. 2018, Temperature and competition interact to structure Himalayan bird communities. *Proc. Roy. Soc. B* 285: 20172593.

Thiollay, J. M. 1996. Distributional patterns of raptors along altitudinal gradients in the northern Andes and effects of forest fragmentation. *J. Trop. Ecol*. 12: 535–560.

Wang, N., Zheng, G. & McGowan, P. J. K. 2012. Pheasants in sacred and other forests in western Sichuan: their cultural conservation. *Chinese Birds* 3: 33–46.

Willson, M. F. & Pianka, E. R. 1963. Sexual selection, sex ratio, and mating system. *Amer. Natur*. 97: 405–407.

Addresses: Daniel M. Brooks, Houston Museum of Natural Science, Dept. of Vertebrate Zoology, 5555 Hermann Park Drive, Houston, TX 77030-1799, USA, e-mail: dbrooks@hmns.org. Paul J. Buzzard, Detroit Zoological Society, Royal Oak, MI 48067, USA. Xueyou Li, State Key Laboratory of Genetic Resources and Evolution, Kunming Institute of Zoology, Chinese Academy of Sciences, Kunming, Yunnan, China. William V. Bleisch, China Exploration & Research Society, Hong Kong, China.

ISSN-2513-9894 (Online)

Rise and fall of the Harlequin Hummingbird '*Trochilus multicolor*': a species that never was

by Robert Prŷs-Jones & Rick Wright

Received 6 February 2019; revised 13 June 2019; published 20 September 2019

http://zoobank.org/urn:lsid:zoobank.org:pub:DC32FAA6-F6A8-4A53-8618-67A276CFE82E

Summary.—Based on a plate and descriptions in Latham (1782, 1787), Gmelin (1788) formally named a new species of hummingbird, *Trochilus multicolor*. Prior to the early 1830s, this novelty was discussed and depicted by various authors and artists, but mention of it then largely vanished from the literature. This paper reviews available literature and artwork on the supposed species, reaching the conclusion that the entire corpus probably stems from a single composite specimen present in the British Museum collection from at least the early 1780s, but which was recognised as a fabrication and then destroyed in around 1819. A central role in the affair played by the then well-known, but subsequently neglected, ornithologist and artist, Thomas Davies, is highlighted, though there is no evidence of any fraud on his part.

The 1904 edition of *The encyclopedia Americana*, the authoritative North American encyclopaedia of its day (Ingersoll 1904), gave its general readership a glimpse into the vast variety of colour and adornment so typical of the family Trochilidae (Fig. 1). One of the 13 species (no. 12) depicted on this striking plate is, however, conspicuously absent from modern lists of hummingbirds, namely the Harlequin Hummingbird *Trochilus multicolor* J. F. Gmelin, 1788.

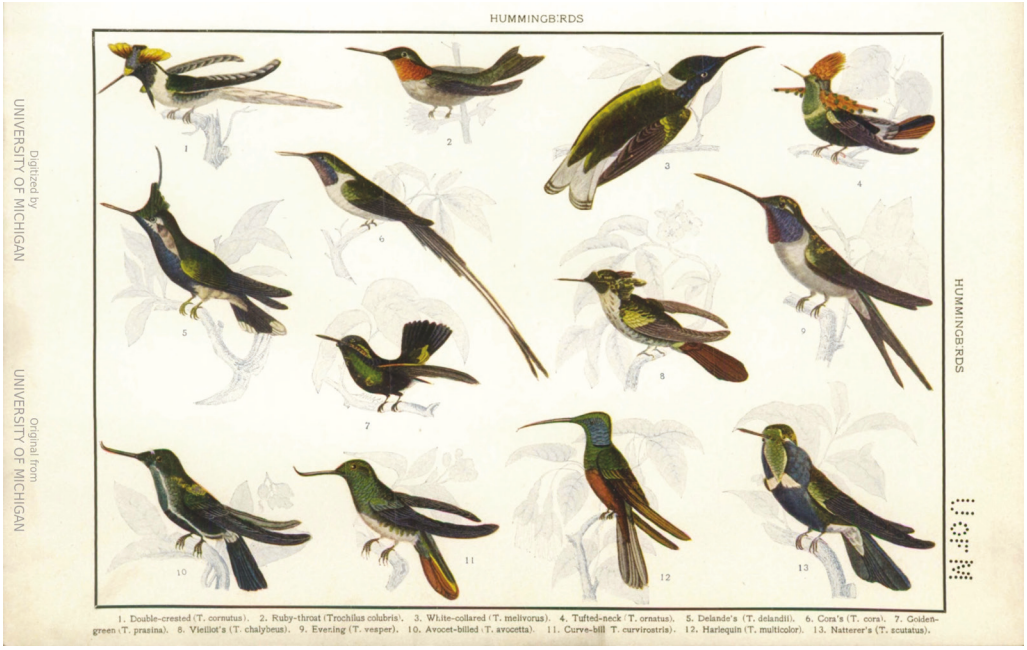


Figure 1. Plate of hummingbird species from Ingersoll (1904), including the Harlequin Hummingbird (no. 12, centre-right, bottom).

ISSN-2513-9894 (Online)

This supposed species had been introduced to science well over 100 years earlier, when it was described as the Harlequin Humming-Bird by Latham (1782: 760) from a specimen in the collections of the British Museum (BM), but not illustrated. His description ran: '*Length four inches and a half. Bill bent, an inch and a quarter in length, and of a brown colour: crown of the head, chin, breast, and middle of the back, green: from the bill, through the eye, is a stripe of fine blue, passing behind almost to the nape; the lower part of this is edged with black: the upper parts of the body and wings are brown: the belly and vent of the colour of cinnabar, but not glossy like the rest of the plumage: the tail even at the end, and of a brown colour: the legs are also pale brown.*' Latham further noted that the unique skin had '*no history annexed to it*', and he was unable to offer any information about the bird's range or habits.

Review of the literature

Writing five years later, Latham (1787: 135) had come across another source of information, noting in his text on the Harlequin Hummingbird that: '*Among the drawings of Colonel Davies, I observe one of these which measures full five inches. The colours of the plumage are much the same as before described, except that beneath the black at the back part of the neck is a narrow band of blue green: the wing coverts and upper part of the back incline to green; and the under part of the tail verges to purple. The plate herewith given is a good representation.*' In fact this plate (Fig. 2), which is unsigned and undated, partly reflects Latham's original description (e.g. no blue-green below the black on back of neck, upper part of back brown) and partly differences suggested by Davies (e.g. wing-coverts green and the inner undertail feathers tending to very pale purplish), while departing from both in showing the blue on the head not passing from the bill through the eye, but rather being confined to an area behind the eye and extending downwards towards the nape.

In revisiting the species, Latham (1822) gave essentially an identical description to that of Latham (1782), and he added very similar comments to those in Latham (1787) when going on to mention Davies' drawing. Likewise, his accompanying plate (Fig. 3) is in outline that from his 1787 work, but now coloured somewhat differently, at least comparing the copies of his works consulted here, held in the Rothschild Library of the Natural History Museum at Tring: the area of coverts previously green is now brown; the inner undertail has lost its purplish hue; and, most striking, the stripe of blue is now depicted passing through the eye from the base of the bill, in conformity with his 1782 text.

Something puzzling is clearly occurring. Fortunately a search has revealed what is apparently Latham's original copy of Davies' depiction among the 888 original watercolours of birds, in six volumes, formerly in the possession of Latham but since 1920 held by the Natural History Museum (NHMUK), which holds the life and earth sciences collections formerly in the BM (Sawyer 1949, Jackson 1999). Although most are attributed to John Latham himself (Jackson 1999), who was a more than adequate artist (Jackson 1985), some are signed by other artists, including T. Davies. However, the Harlequin Hummingbird picture (Fig. 4) is not so signed and, despite the tentative pencilled attribution on it to Davies in an unknown hand, other evidence demonstrates that it is most unlikely to be by him (R. Tovell *in litt*. 2019; see below). This image is in precisely the same pose as the reproductions in Latham (1787, 1822), but in a mirror-reversed stance and set against a roughly sketched background. Most strikingly, the plumage coloration in this painting differs from the description in Latham (1782) in much the same features that Latham (1787) attributed to the Davies drawing, vindicating Latham's (1787: 135) statement that '*The plate herewith given is a good representation* [of Davies']*.*' Seemingly the plumage coloration discrepancies noted earlier in Latham's printed reproductions may have crept in due to poor rendition of the original by the colourists employed.

ISSN-2513-9894 (Online)

Figure 2. Plate of the Harlequin Hummingbird from Latham (1787, pl. 111).

Latham's 1782 and 1787 descriptions and his 1787 plate provided the entire source material on which Gmelin (1788) based his brief Latin type description of *Trochilus multicolor*. Subsequently, Latham (1790: 308) adopted Gmelin's scientific name, while including in his Latin species outline an enigmatic phrase that translates as '*in some of which there is a blue-green patch below the nape*'.

The following year, Shaw & Nodder (1791) felt able to narrow the range of the Harlequin Hummingbird, '*among the rarest species of its genus*', to South America, hardly a bold conjecture for a large, colourful hummingbird. Shaw's Latin account was accompanied by a plate by Frederick Nodder (Fig. 5) painted, according to the text, from the BM specimen, which seems likely to be true as Shaw had been appointed an assistant Keeper of Natural History there earlier in the year (Harrison & Smith 2008). Unlike Latham's earlier published painting (Fig. 2), Nodder's plate does show the blue on the head passing through the eye, and also resembles Latham's (1787) account of Davies' painting in having blue-green below

ISSN-2513-9894 (Online)

Figure 3. Plate of the Harlequin Hummingbird from Latham (1822, pl. 76).

the black on the back of the neck, the upper part of the back greenish and the underside of the tail verging to purplish on its inner feathers.

The Harlequin Hummingbird was subsequently painted again, by Sydenham Edwards (Fig. 6) for Audebert & Vieillot (1802), who also claimed that Edwards had worked directly from the BM skin. Whether true or not, this image's overall close similarity to the bird depicted in Nodder's plate suggests that Edwards was also familiar with the latter. It does, however, differ from Nodder's in omitting the nape patch that Latham had noted in Davies' drawing, something that Audebert & Vieillot regarded as being indicative of a 'variety' of

ISSN-2513-9894 (Online)

Figure 4. Original watercolour of the Harlequin Hummingbird, now held among six volumes of Latham's drawings in the NHMUK Dept. of Library and Archives (vol. 3, no. 447) (© Natural History Museum, London)

the Harlequin, and in having the green on the crown extend a short distance down the back of the neck. Unfortunately, the originals of neither Nodder's nor Edwards' paintings seem to be available for study, so the extent to which differences may be attributable to

ISSN-2513-9894 (Online)

Figure 5. Plate of the Harlequin Hummingbird by Frederick Nodder in Shaw & Nodder (1791, pl. 81).

the colourists employed cannot be judged. It was Edwards' image that was used by *The encyclopedia Americana* (Fig. 1).

The first published intimation that the Harlequin Hummingbird specimen might not be all it appeared to be came as a footnote to the account of Latham (1822: 317), in which he noted that: '*It has been suggested to me, that this is no other than a bird made up by the ingenuity of some whimsical person, who has fabricated it from the feathers of others; but which, by every attention paid to it, I cannot detect; yet should it prove to be so, it is not the only deception among the many thousands of Natural History Curiosities in the place where it is yet to be seen.*' A few years later, Lesson (1829) included the species, along with the Edwards drawing taken from

ISSN-2513-9894 (Online)

Figure 6. Plate of the Harlequin Hummingbird by Sydenham Edwards in Audebert & Vieillot (1802, pl. 69).

Audebert & Vieillot (1802) and coloured similarly, but explicitly stated that he did so with great reservation and merely for the sake of completeness. He even wondered, largely on the basis of its plumage colours, whether it was actually a sunbird that had been described; seemingly, he was not at this point aware of Latham's (1822) footnote. Subsequently, however, Lesson (1831: xiii) stated unambiguously that (translation): '*M. Stokes writes to us that the bird that served as the type for Latham's description and for the figure copied by Vieillot was the product of a fabrication, and that it had been discovered on deconstructing the specimen preserved in the British Museum.*'

Two years later again, Jardine (1833), having definitely read Latham (1822) and Lesson (1829), but seemingly not Lesson (1831), again reproduced the Edwards drawing (with a little background foliage added) and was still prepared to posit that the species might be valid, writing: '*… we have ventured a third time to introduce it* [Edwards' figure], *with the view of attracting the attention of British naturalists, for it has been hinted that the specimen in the British*

ISSN-2513-9894 (Online)

Figure 7. (a) Original watercolour by Thomas Davies that includes the Harlequin Hummingbird, held by the NHMUK Dept. of Library and Archives (Davies volume, sheet 107, no. 147); (b) close-up of the Harlequin Hummingbird from (a) (© Natural History Museum, London)

ISSN-2513-9894 (Online)

Museum was a specimen made up from the feathers of different birds. … If there is a specimen in the British Museum, and a drawing in the possession of General Davis [sic], *corresponding and evidently done from an individual of the same species, there will be no doubt of its existence.'*

Despite Jardine's sanguine assessment, Gould (1861) essentially wrote the swan-song of the Harlequin Hummingbird in the ornithological literature within his great monograph on the Trochilidae. For this work, he had been '*at all times favoured … with both information and the loan of specimens*' from the collections of the BM (Gould 1861: viii), but could find no evidence of any extant skin attesting to its existence. Indeed, he concluded that Gmelin (1780) had described the Harlequin Hummingbird as a new species based on '*characters … taken from a plate which must have been drawn from the imagination and not from any real specimen.*' (Gould 1861: ix). As a final nail in its coffin, Salvin (1892) made no mention at all of either specimen or species in his comprehensive account of the Trochilidae for the relevant volume of the *Catalogue of birds in the British Museum*.

This largely chronological synopsis of the scientific literature leaves two key questions unresolved. It seems apparent that a specimen, quite possibly fraudulent, must have existed that was studied by Latham (1782), and very probably also seen by Shaw and the artists Nodder and Edwards, but what happened to it and when? It further appears certain from Latham (1787) that a picture by Davies, putatively of a different specimen, also existed, but who exactly was Davies, on what did he base his picture, and what happened to render it unavailable to any author or artist subsequently? A further, less central but nevertheless intriguing uncertainty surrounds the identity of Lesson's (1831) correspondent 'M. Stokes', not least because resolving this could assist in answering the first of the main questions.

Fate of the specimen

Regarding the specimen, some printed evidence was in fact available but of which Gould (1861) was seemingly unaware, and it serves to vindicate Latham's (1822) footnote. In 1835–36, a major Parliamentary enquiry, involving a Select Committee, was conducted into the (unsatisfactory) state of the 'Condition, Management and Affairs' of the BM, during which many staff and others were called to give evidence. In late April of the 1836 session, John Edward Gray (1800–75), a zoologist on the BM curatorial staff since late 1824, appeared before the committee and was questioned by Sir Robert Inglis concerning, among other things, the stated French taxidermy practice of improving the appearance of exhibition specimens by having them 'made up', i.e. bringing together parts from more than one bird. Included within this encounter was the following exchange (Parliamentary Papers 1836, paragraphs 2953–2954):

'2953. Looking at that practice [making up] *as a man of science, do you consider it advisable or reprehensible? – It is very wrong. We had formerly in the collection of the Museum a made-up specimen, called the harlequin hummingbird, which I believe was destroyed by Dr. Leach. It was ejected before my time.*

2954. Can you state the reason why you have not adopted it in the British Museum? – I never would adopt it, because it would be impossible to depend upon a description made from a bird so stuffed; and if I knew that any bird in the British Museum was in that state, I should recommend its being destroyed.'

William Elford Leach (1791–1836) was appointed as BM curator with responsibility for zoology in February 1814, following the death of his predecessor, George Shaw (Harrison & Smith 2008). He nominally served until being pensioned off on the grounds of ill health in April 1822, but his active involvement in the work of the museum almost entirely ceased from September 1820, when he had a mental collapse. Although Gray was not employed by the BM until 1824, he had in fact assisted Leach on an *ad hoc* basis since around 1816,

ISSN-2513-9894 (Online)

and therefore both knew him well personally and had first-hand knowledge of his working practices. It thus seems highly probable that his reply to the parliamentary enquiry, though phrased in a less than definitive manner, should be taken as a factual statement.

When then might the Harlequin Hummingbird specimen have been destroyed? Clearly not before Leach joined the BM in early 1814; indeed, Harrison & Smith (2008) adduce evidence that the specimen was on public display in Room XI, the BM Bird Room at Montagu House, until at least 1808. Clearly also, it seems highly unlikely to have been after autumn 1820, when Leach suffered his mental collapse. Limited circumstantial evidence suggests that it may have been sometime between mid 1819 and mid 1820. In early 1819, Leach had attended the major auction of specimens resulting from Bullock disposing of his famous museum, with a brief to purchase material for the BM collection (Harrison & Smith 2008). On 18 May 1819, he had acquired, expensively, an unusual petrel that had feet resembling those of a duck; it subsequently transpired that this was because the legs *were* those of a duck, which must have brought home to him rather forcibly the problems inherent in 'made up' specimens! At least one other Bullock specimen on sale, a bird-of-paradise, apparently had a similar problem, proving to be a composite of several species (Harrison & Smith 2008).

The identification of the mysterious 'M. Stokes' may also lend support to a thesis that the deconstruction, and subsequent destruction, of the BM Harlequin Hummingbird specimen happened around this time, assuming that he was, as seems likely, '*Charles Stokes (1783–1853), Member of the Stock Exchange and enthusiastic collector. Elford* [Leach] *described molluscs he collected at Lymington, Southampton (Leach 1852: 319)*' (Harrison & Smith 2008: 397). Although the Leach paper referred to was not published until long posthumously, when it was put to press by Gray, Leach had essentially finalised it during the period leading up to his mental collapse: the plates are dated 1820 and the paper was then at proof stage. Moreover, as well as describing his molluscs for his paper, we know that Leach was in close touch with Charles Stokes during 1818/19, as the latter contributed towards Leach's ultimately unsuccessful attempt to raise funds to buy the Dufresne collection for the BM (Harrison & Smith 2008). As a scientific friend with an interest in the BM, it therefore seems very probable that Stokes was aware of the ongoing Harlequin Hummingbird investigation, and thus may well have been the informant of Latham (1822) in addition to Lesson (1831).

The important role of Thomas Davies

The Colonel Davies mentioned by Latham (1787) was the talented watercolourist Thomas Davies (1737/38–1812)[1], a British army officer who served for extended periods of time in North America and attained the rank of Lieutenant-General (Stacey 1972, Jackson 1999). He had studied drawing during his military training and is probably best known for his watercolour depictions of military operations and landscapes, notably in North America (Hubbard 1972). However, it was '*birds that were the consuming interest of his later life*' (Hubbard 1972: 38). His interests in this direction really became apparent from about 1770, when a letter from him on the preparation and preservation of bird specimens was read at the Royal Society and published in their *Philosophical Transactions* (1770: 184–187), by chance in the same year that Latham published his first article in the same journal (Jackson 1985). Davies' subsequent published output was small, but included illustrated descriptions of new bird species (Hubbard 1972). A Fellow of the Linnean Society, he was elected a Fellow of the Royal Society in 1781, and clearly consorted with, and was admired by, the

[1] *The Gentleman's Magazine* 82(1): 394, 1812, notes the death of Davies as 'March 16 – At Blackheath, in his 75th year, Lieut. Gen. Thomas Davies, R.A.'

ISSN-2513-9894 (Online)

leading gentleman scientists of the day (Hubbard 1972, Stacey 1972). Among these was John Latham, who in his first major work commented that: '*In this gentleman's* [Captain Davies'] *elegant collection will be found many scarce specimens, especially from North America, which he has been at the pains to collect and arrange himself. His friends too are obliged to him for the free communication of every knowledge or observation in Natural History in his power*.' (Latham 1781: 100; see also Stacey 1972: 62). Subsequently, in his later works, Latham repeatedly referred to Davies' illustrations and specimen collection (e.g., see Mathews & Iredale 1920).

After his death, appreciation of General Davies as an ornithologist and natural historian began to fade, to the point that 100 years later the highly knowledgeable Mathews & Iredale (1920: 122) commented '*We have not yet attempted to work out the life-history of General Davies, but … the interest of this old-time ornithologist … has suffered neglect so that his name is scarcely known*.' Likewise, discussing his importance as an artist, Hubbard (1972: 18–20) noted that '*any direct influence by him on later art was precluded by the fact that his work was for such a long time hidden away in private collections in England*'. This began to change in 1953, when more than 50 of Davies' views and landscapes came on the market from the famous library at Knowsley, near Liverpool, assembled by the natural historian Edward Smith Stanley (1775–1851), the 13th Earl of Derby, who had acquired a large collection of Davies' watercolours either at 'Van Holde's Sale' in 1817 (Fisher & Jackson 2002: 46) or more probably earlier, at the sale of Davies' specimen collection in June 1812 (R. Tovell *in litt*. 2019).

Although Sawyer (1949) had drawn attention to the fact that Knowsley held a further portfolio of Davies' paintings, including 126 delineations of birds with their names and localities, Hubbard (1972: 20) surprisingly stated that '*This collection* [Knowsley] *is also said to have contained a great many of his* [Davies'] *drawings of birds but no trace of these remain today*.' This must have been based on a misunderstanding, because the portfolio certainly remained there until 2017, when it passed to NHMUK under the UK Government Acceptance in Lieu scheme (Arts Council England 2017: 31). A search through this collection has now revealed an original Harlequin Hummingbird watercolour signed by Davies, part of a composition of three different hummingbird species (Fig. 7a), with the top figure labelled 'Harlequin' in ink, apparently in Davies' own hand (Fig. 7b). The additional pencil annotation beneath this is probably by the 13th Earl of Derby (C. Fisher *in litt*. 2019).

Comparison of Latham's depiction (Fig. 4) of the Harlequin Hummingbird specimen with that in Davies' original drawing (Fig. 7b) shows the former indeed to be an almost exact copy of the latter. As regards coloration, Davies' watercolour clearly shows the features that Latham attributed to it and included in his own representation, namely a narrow band of blue-green below the black at the back of the neck, the wing-coverts and upper back green, and the underside of the tail purplish; in addition, it depicts the blue on the head passing from the base of the bill though the eye. It is only in the printed versions of Latham's painting that coloration differences become apparent.

Finally, on what did Davies base his picture? Latham (1787, 1790) clearly implied that he thought Davies had made use of a different individual from that in the BM, which differed in certain plumage characteristics. In addition to travelling widely on military duty in eastern North America between 1757 and 1790, Davies also visited the West Indies in 1786 (Stacey 1972). Moreover, he received numerous bird specimens from elsewhere for his own collection, and also worked widely in other collections. Latham (1821: x–xi) noted that *'from* [Davies'] *faithful pencil I have been furnished with many very exact representations of new subjects, taken from the different Ornithological collections of his friends, independent of those in his own well-chosen cabinet of subjects in Natural History*.' Unfortunately, Davies' own collection was dispersed by a sale in June 1812 (Fisher 2002), immediately after his death earlier in the year, so its contents cannot now be determined; however, and unlike for some other

ISSN-2513-9894 (Online)

species, Latham in his various writings never stated that Davies himself had a specimen of the Harlequin Hummingbird.

Conclusions

Overall, probability argues against there ever having been more than one Harlequin Hummingbird. Available evidence demonstrates that the BM specimen was all but certainly a fraudulent composite that was destroyed when this was discovered, and it strains credibility that a different but very similar one should somehow have been available to Davies. He certainly worked in the BM on at least one occasion, as indicated by a note on one of his drawings in the portfolio acquired by NHMUK in 2017, and Davies is known to have been in England during 1785 and early 1786 (Stacey 1972). Furthermore, although Latham (1787) laid stress on the apparent plumage coloration differences between Davies' drawing and his own prior description, the recording of plumage coloration in specimens that are largely iridescent—in this case, according to Latham (1782), all except the cinnabar belly and vent of the Harlequin Hummingbird—is problematic, as structural colours can appear to alter according to how light strikes them. In this context, when formerly in charge of the NHMUK bird collections, RP-J had personal experience more than once of being asked to check coloration on iridescent species by publishers of illustrated bird guides who had found that their artist's depiction did not match their author's description! Potentially supporting this supposition, the published depictions by Nodder and by Edwards, both of which were stated to be based on the BM specimen, have colorations closely (Nodder) or somewhat more loosely (Edwards) similar to that of Davies.

The presumption that only one specimen of the Harlequin Hummingbird existed does however leave one puzzling point unanswered; namely, why Latham should not have realised that Davies might actually have used the BM specimen for his illustration. Did he possibly just assume this could not be the case because of the differences in plumage depiction between Davies' image and his own 1782 description? Resolution of this matter will likely remain impossible unless relevant writings by and between the two men become available. Regardless, Latham should certainly not be viewed too critically for mistaking a composite hummingbird specimen for a new species—he would certainly not be the last excellent ornithologist to make this error (e.g. Chapman 1889a,b).

Drawing a more general conclusion, it is worth emphasising that even where fraud is suspected or seemingly proven, museum curators should not, and hopefully nowadays would not, destroy the offending specimen(s) as happened in the case of the Harlequin Hummingbird, but rather merely flag their concerns clearly. Otherwise much of the evidence that might potentially inform future investigation, in particular that based on novel technological developments, would be lost, as has already been highlighted by detailed investigation of the large-scale fraud perpetrated by Richard Meinertzhagen, for which the survival of specimens that a former NHMUK bird curator considered should be burnt has proved vital (Rasmussen & Prŷs-Jones 2003).

Acknowledgements

We are extremely grateful to NHMUK Library staff, in particular Paul Cooper, Alison Harding and Hellen Pethers, for their invaluable assistance, and also for the facilities made available to all by the free online Biodiversity Heritage Library. Other than Fig. 1, published artwork figured above was photographed from the relevant volumes held in the Rothschild Library, Natural History Museum at Tring; we thank staff of the NHMUK Photography Studio for undertaking both this and the original artwork photography. We are further most grateful for comments on drafts of our text from Paul Cooper, Christine Jackson, Julian Hume and Rosemarie Tovell, as well as for those by referees Tim Birkhead, Clem Fisher and André Weller.

ISSN-2513-9894 (Online)

References:
Arts Council England. 2017. *Cultural gifts scheme & acceptance in lieu: report 2017.* Arts Council England, Manchester.
Audebert, J. B. & Vieillot, L. P. 1802. *Oiseaux dorés, ou à reflets métalliques*, vol. 1. (*Supplément a l'histoire naturelle et générale des colibris.*) Desray, Paris.
Chapman, F. M. 1889a. Description of a new species of hummingbird of the genus *Amazilia*. *Bull. Amer. Mus. Nat. Hist*. 2: 163–164.
Chapman, F. M. 1889b. Further note on *Amazilia aeneobrunnea*. *Bull. Amer. Mus. Nat. Hist*. 2: 182.
Fisher, C. (ed.) 2002. *A passion for natural history: the life and legacy of the 13th Earl of Derby*. National Museums & Galleries on Merseyside, Liverpool.
Fisher, C. & Jackson, C. E. 2002. The 13th Earl of Derby as a scientist. Pp 44–51 *in* Fisher, C. (ed.) *A passion for natural history: the life and legacy of the 13th Earl of Derby*. National Museums & Galleries on Merseyside, Liverpool.
Gmelin, J. F. 1788. *Systema naturae,* vol. 1. Georg Emanuel Beer, Lipsiae.
Gould, J. 1861. *A monograph of the Trochilidae or family of humming-birds*, vol. 1. Privately published, London.
Harrison, K. & Smith, E. 2008. *Rifle-green by nature: a Regency naturalist and his family, William Elford Leach*. The Ray Society, London.
Hubbard, R. H. (ed.) 1972. *Thomas Davies c. 1737–1812.* National Gallery of Canada, Ottawa.
Ingersoll, E. 1904. Humming-birds. Unpaginated *in* Rines, G. E. & Beach, F. C. (eds.) *The encyclopedia Americana*, vol. 8. The Americana Company, New York.
Jackson, C. E. 1985. *Bird etchings: the illustrators and their books, 1655–1855.* Cornell Univ. Press, Ithaca, NY.
Jackson, C. E. 1999. *Dictionary of bird artists of the world*. Antique Collectors' Club, Woodbridge.
Jardine, W. 1833. *The naturalist's library*, vol. 6. *Ornithology. Humming-birds*, pt. I. Chatto & Windus, London.
Latham, J. 1781. *A general synopsis of birds*, vol. 1(1). Benjamin White, London.
Latham, J. 1782. *A general synopsis of birds*, vol. 1(2). Benjamin White, London.
Latham, J. 1787. *Supplement to the general synopsis of birds.* Leigh & Sotheby, London.
Latham, J. 1790. *Index ornithologicus*, vol. 1. Leigh & Sotheby, London.
Latham, J. 1821. *General history of birds*, vol. 1. Jacob & Johnson, Winchester.
Latham, J. 1822. *General history of birds*, vol. 4. Jacob & Johnson, Winchester.
Lesson, R. P. 1829. *Histoire naturelle des oiseaux-mouches.* Arthus Bertrand, Paris.
Lesson, R. P. 1831. *Les Trochilidées ou les colibris et les oiseaux-mouches.* Arthus Bertrand, Paris.
Mathews, G. M. & Iredale, T. 1920. Forgotten bird-artists and an old-time ornithologist. *Austral Avian Rec*. 4: 114–122.
Parliamentary Papers, House of Commons. 1836. *Report from the Select Committee appointed to inquire into the condition, management and affairs of the British Museum*, vol. 2. House of Commons, London.
Rasmussen, P. C. & Prŷs-Jones, R. P. 2003. History *vs* mystery: the reliability of museum specimen data. *Bull. Brit. Orn. Cl*. 123A: 66–94.
Salvin, O. 1892. Upupae and Trochili. Pp. 1–433 *in Catalogue of the birds in the British Museum*, vol. 16. Trustees of the British Museum, London.
Sawyer, F. C. 1949. Notes on some original drawings of birds used by Dr. John Latham. *J. Soc. Bibliogr. Nat. Hist*. 2: 173–180.
Shaw, G. & Nodder, F. P. 1791. *Vivarium naturae or The naturalist's miscellany,* vol. 3. Nodder & Co., London.
Stacey, C. P. 1972. Lieutenant-General Thomas Davies: soldier, painter and naturalist. Pp. 44–71 *in* Hubbard, R. H. (ed.) 1972. *Thomas Davies c. 1737–1812.* National Gallery of Canada, Ottawa.

Addresses: Robert Prŷs-Jones, Bird Group, Dept. of Life Sciences, Natural History Museum, Akeman St, Tring, Herts HP23 6AP, UK, e-mail: r.prys-jones@nhm.ac.uk. Rick Wright, 128 Evans Road, Bloomfield, NJ 07003, USA, e-mail: birdaz@gmail.com

ISSN-2513-9894 (Online)

Provisional identification of historical grasswren (*Amytornis*: Maluridae) specimens in European collections draws attention to the incomplete phylogeny of the group

by Andrew B. Black, Justin J. F. J. Jansen, Sylke Frahnert & Ulf S. Johansson

Received 22 February 2019; revised 7 July 2019; published 20 September 2019

http://zoobank.org/urn:lsid:zoobank.org:pub:4461A840-BB31-4645-8619-72BAE670A551

Summary.—The phylogeny and systematics of grasswrens *Amytornis* species are incompletely resolved, in particular for three widely distributed members of the genus. In part this is a consequence of the dispersal to European and North American collections of early specimens of now extinct populations. We describe three historical grasswren specimens from museums in Berlin and Stockholm, all of which represent taxa for which phylogenetic and / or other data are incomplete. We further identify other specimens that might contribute towards greater resolution of grasswren phylogeny.

Grasswrens of the genus *Amytornis* constitute a largely arid-zone continental Australian subfamily Amytornithinae within the family Maluridae of the basal Australian oscine infraorder Meliphagides (Marki *et al*. 2017). Eleven grasswren species are currently recognised (Black *et al*. 2010, Christidis *et al*. 2010, Black & Gower 2017, Gill & Donsker 2019) but there remain many unanswered questions concerning their systematics. Such uncertainty applies even to three of the most familiar and widely distributed: the Striated Grasswren *A. striatus* group and the sister species Western *A. textilis* and Thick-billed Grasswrens *A. modestus*.

A. striatus occurs in many isolated populations (Fig. 1) and shows widespread subtle phenotypic variation. Its infraspecific taxonomy is unsettled and division into three or four species has been proposed (Christidis *et al*. 2013, Black & Gower 2017). The group is widely disjunct across the Eyrean Barrier (Ford 1974, 1987, Schodde & Mason 1999), a periodic Plio-Pleistocene arid intrusion responsible for vicariance and speciation among several southern Australian birds (Dolman & Joseph 2015). Eastern populations include *A. s. striatus* (Gould, 1840) in central New South Wales, western Victoria and eastern South Australia, *A. s. rowleyi* Schodde & Mason, 1999, in central Queensland, and a small, isolated and undescribed form in south-west Queensland at the South Australia border (Ford & Parker 1974, Schodde 1982, Black & Gower 2017). Western populations include the large-bodied and large-billed *A. s. whitei* (Mathews, 1910) of the Pilbara in Western Australia, smaller forms on the North West Cape Peninsula (Western Australia) and through the sandy western and central Australian deserts, and isolated populations of larger individuals on the Eyre Peninsula, South Australia. In a phylogenetic study, Christidis *et al*. (2013) proposed to elevate the western desert form to species level as *A. oweni* (Mathews, 1911) on the basis of genetic distance (4.2% ND3) between an individual of that population and one of *A. s. striatus*. The form *A. s whitei* was not included in the study and the group's systematics therefore remain incomplete.

A. textilis (Quoy & Gaimard, 1824) was described from collections made on the Peron Peninsula in Shark Bay, north-west Western Australia during the Baudin (1801–03) and Freycinet (1818) expeditions. Gould (1841) believed that the very similar birds that he collected on the lower Namoi River of inland New South Wales, in eastern Australia, in 1839 were the same 'Textile Wrens' *A. textilis*. Subsequently, Gould (1847) named grasswrens

ISSN-2513-9894 (Online)

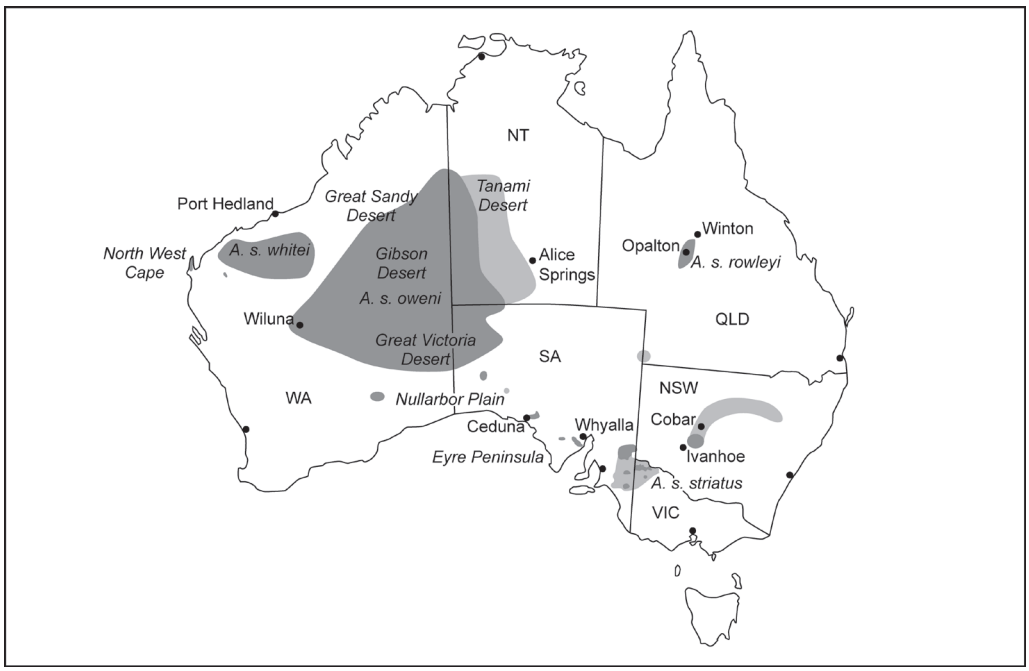


Figure 1. Distribution of Striated Grasswren *Amytornis striatus*. All known populations and named subspecies are shown. Paler shading indicates former or possible occurrence, recently unconfirmed. The Eyrean Barrier is understood to have run north–south through the present-day South Australia gulfs east of the Eyre Peninsula (© Belinda Cale)

taken by John Gilbert in south-west Western Australia *A. macrourus*. Gould's Namoi River birds in eastern Australia continued to be identified as *A. textilis*, as he had termed them (e.g. Ramsay 1888). Two further grasswren taxa were discovered in central Australia in 1894. One, *A. purnelli* (Mathews, 1914), was initially also assigned to *A. textilis*. The other, *A. modestus* (North, 1902), appeared to its author to be the same as Gould's inland New South Wales birds and these latter were consequently included in *A. modestus*. The accepted split between *A. textilis* and *A. modestus* was contested by Parker (1972), who recognised that *A. purnelli* was both phenotypically and ecologically distinct from the other two. He combined *A. textilis* and *A. modestus*, while observing pronounced variation across their vast distribution, with those in the far east and the west being very similar, whereas specimens from the intervening Lake Eyre Region tended to be paler and to have deeper bills.

Today, *A. textilis* and *A. modestus* are again considered species (Black *et al*. 2010, Christidis *et al*. 2010) and each is polytypic (Figs. 2–3). Darker, longer tailed and more heavily streaked *A. textilis* includes up to five subspecies (Black 2011, Austin *et al*. 2013), of which only *A. t. textilis* and *A. t. myall* are extant, while smaller, paler and truly thick-billed *A. modestus* comprises seven named subspecies (Black 2016), all but two of which are extant. Extinctions within *A. modestus* include the nominate subspecies from central Australia and the easternmost populations, comprising Gould's Namoi River birds and others in the Willandra Creek district of New South Wales *c*.600 km to the south-west. These latter were observed and sampled in the 1880s by K. H. Bennett, and the two New South Wales populations were implicitly combined as Eastern Grasswren *A. inexpectatus* (Mathews, 1912). Mathews (1922–23) subsequently included the Eyre Peninsula (South Australia) population *A. textilis myall* in that species. By combining into a single taxon

ISSN-2513-9894 (Online)

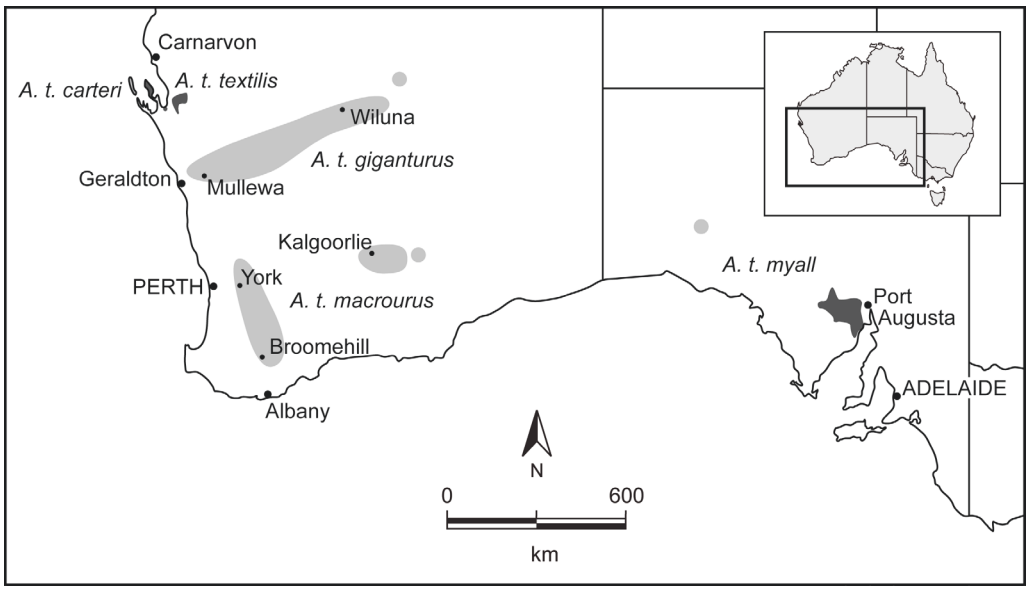


Figure 2. Distribution of Western Grasswren *Amytornis textilis*. Extant populations are: *A. t. textilis* on and near the Peron Peninsula, Western Australia, and *A. t. myall* on the northern Eyre Peninsula, South Australia. Widespread probable extinction of intervening populations is evident (© Belinda Cale)

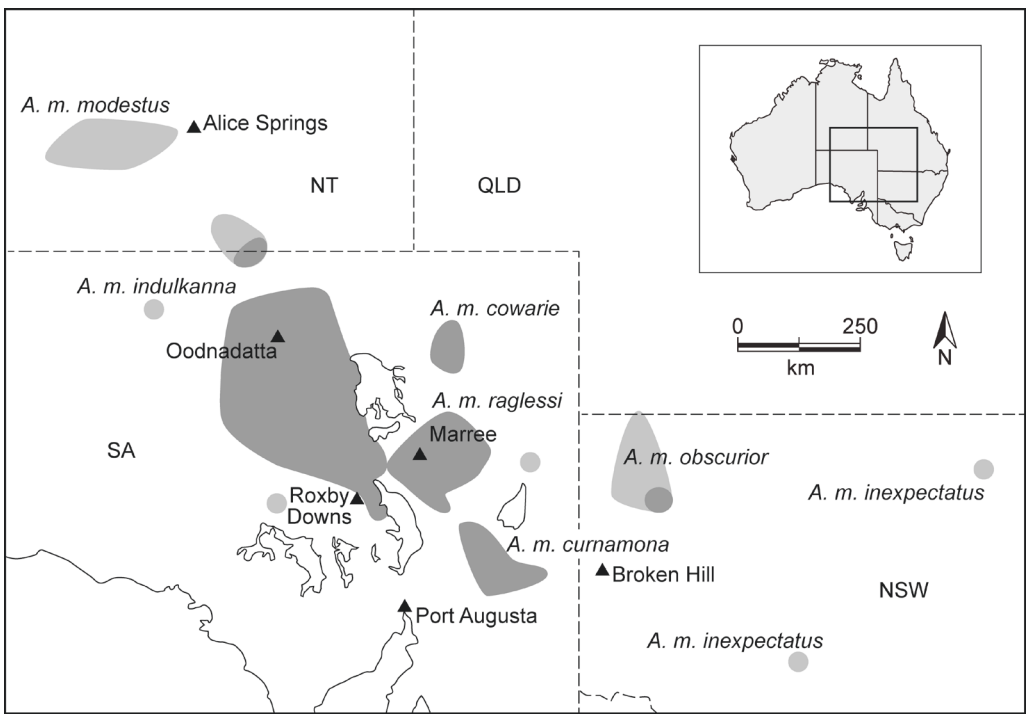


Figure 3. Distribution of Thick-billed Grasswren *Amytornis modestus*. Gould's 'Textile Wrens' were taken from the more easterly locality of *A. m. inexpectatus*. Extant populations occur either side of Lake Eyre and Lake Torrens, shown north of Port Augusta, at the longitude of the Eyrean Barrier (© Belinda Cale)

ISSN-2513-9894 (Online)

these representatives of what are now accepted as different species, he had unwittingly highlighted the confounding similarity of eastern and western examples of the sister species.

In a phylogenetic study of the *A. textilis* / *modestus* species group, Austin *et al*. (2013) sequenced the mitochondrial gene ND2 and found a net nucleotide divergence between *A. textilis* and *A. modestus* of 3.3%. Two clades within *A. textilis* showing a nucleotide divergence of 1.2% largely represented Western Australian and South Australian populations. Sampling among Western Australian representatives was restricted to between one and five specimens from each of four long presumed extinct populations, thus limiting interpretation of the extent of lineage sorting. Resolution was greater within *A. modestus*. A nucleotide divergence of 1.7% was present across the Eyrean Barrier, with two subspecies forming a western clade and four an eastern clade. Ironically, the only specimen in an Australian collection of what is now known as *A. m. inexpectatus* (Australian Museum Sydney; AM O.10581) alone failed to yield DNA, perhaps because it had spent 'many years in spirits' (Parker 1972). The phylogenetic placement within *A. modestus* of the extinct Namoi and Willandra populations of *A. m. inexpectatus* is therefore uncertain, whether they were indeed part of a single gene pool, and how they are related to other taxa. We do not know whether *A. m. inexpectatus* forms part of the eastern *A. modestus* clade, is sister to both clades within *A. modestus* or, conceivably, is sister to the species pair of *A. modestus* and *A. textilis*.

The answer to questions concerning these three species, as currently recognised, can only be realised via further DNA sequencing of all pertinent populations. In the case of the *A. striatus* group, much work remains to be undertaken among specimens present in Australian collections, but many of these are of unknown provenance and will remain so until knowledge of the phylogeny is further advanced. Moreover, the small and isolated North West Cape population is known from just three specimens in the American Museum of Natural History (AMNH), New York. Further sampling among the extinct populations of *A. textilis* is required to clarify its phylogeny, while resolving the placement of *A. m. inexpectatus* will depend on sampling known examples in European and North American museum collections.

Historical specimens of all three species, those of the *A. textilis* / *modestus* complex generally labelled *A. textilis*, include those of the Gould collection in the Academy of Natural Sciences of Drexel University, Philadelphia (ANSP) and the Mathews collection at AMNH. Others have been identified in the Western Australian Museum, Perth (WAM), Muséum national d'Histoire naturelle, Paris (MNHN) (Black *et al*. 2013), Naturalis Biodiversity Center (Naturalis), Leiden, formerly Rijksmuseum voor Natuurlijke Historie (RMNH) (Black *et al*. 2014), Institut royal des Sciences naturelles de Belgique, Brussels (IRSN), and the Natural History Museum, Tring (NHMUK) (Black 2014). More recently, we have examined historical grasswren specimens in Museum für Naturkunde, Berlin (ZMB) and Naturhistoriska Riksmuseet, Stockholm (NRM). We briefly describe these specimens, including measurements of bill (length from skull attachment of maxilla to tip, plus depth at frontal feathering); wing (max. flattened chord) and tail (central rectrix from point of emergence to tip). We assess their probable identifications and discuss their potential place in our overall understanding of the genus.

The Berlin grasswren specimens

ZMB 55/478

Recent label (at the time of examination): *Amytornis textilis modestus* Maluridae age? Sex?
Old museum label: *Amytornis goyderi* [erased] Gould [erased] *modesta* [added].

ISSN-2513-9894 (Online)

Figure 4. Berlin specimen ZMB 55/478 (relabelled); juvenile Thick-billed Grasswren of the extinct nominate subspecies *Amytornis m. modestus*. Note combination of Old German and modern notations, the latter used for the indigenous language word (© Carola Radke, Museum für Naturkunde, Berlin)

Original label: Ntjulkuta fem. Vogel Rötl.[iche] Eier. Frisst: grün. Futter. [= female, reddish eggs, eats green food—*sic*]; on reverse: ritjirberitjerbere. Nest in Erdhöhle Weibl.[iche] Lerche [= nest in hollow in ground; female lark—*sic*].
On examination (ABB, 1 June 2016): skin of a young bird of the *Amytornis textilis* / *modestus* group, loose plumage, foxed, bill small, mandible pale proximally (Fig. 4); bill 9.7 × 4.9 mm, wing 59 mm, tail 75.1 mm.

The specimen was not inventoried until 1955, when curator Erwin Stresemann wrote that it had reached the collection pre-1921. The combination of early German script and Australian indigenous words suggests it was collected by a Lutheran missionary, perhaps from Killalpaninna Cooper Creek, South Australia, but neither word belongs to the Dieri language of the area (H. Kneebone pers. comm.); 'ntjulkuta' was recognised as an Aranda word from Central Australia (P. Sutton pers. comm.) and appears in Carl Strehlow's Aranda-Loritja-German-English Dictionary (G. Breen pers. comm.) as the name of a local bird described with rufous plumage, tail movement and 'porcupine' [*sic* presumably porcupine grass *Triodia* spp.; see below]. G. Breen was unable to identify 'ritjirberitjerbere'. The handwriting was identified by John Strehlow, grandson of the dictionary author, as that of Oskar Liebler who worked at Hermannsburg Mission on the upper Finke River between 1910 and 1913.

Initially obscure wording on the original label therefore proved crucial in identifying this specimen as a juvenile male Thick-billed Grasswren of the extinct central Australian subspecies *A. m. modestus*. *Triodia* spp. is habitat for another locally occurring grasswren, the more rufous-plumaged Striated Grasswren *A. striatus*.

ZMB 19496 [also B 7143 (March 1869) *Amytornis striatus* South Australia]
Label 1: *Amytornis striatus* Gould S. Australien. Waterhouse.

ISSN-2513-9894 (Online)

Label 2: *Amytornis striatus merrotsyi* Zoolog Museum Berlin.
Label 3: *Amytornis merrotsyi* Maluridae loc. Australien Oceania leg. Waterhouse, Frederick George det. Age? Sex? Museum für Naturkunde, Berlin.

On examination (ABB, 1 June 2016): skin, former mount, of an adult Striated Grasswren, foxed, with heavily streaked upper breast, unstreaked chin, amber breast-sides; bill 11.9 × 4.4 mm, wing 64 mm, tail 95.7 mm.

Adult female *Amytornis s. striatus*. The attribution '*merrotsyi*' is an unexplained misidentification (but see Discussion), its tail length being incompatible with that taxon, long treated as a subspecies of *A. striatus* but recognised now as a species. F. G. Waterhouse, curator at the South Australian Museum, Adelaide, between 1859 and 1882, exchanged at least eight Striated Grasswren specimens of presumed South Australian provenance between September 1867 and March 1869 when this example was received in Berlin, but their collector and precise origin are unknown (Horton *et al*. 2018). This specimen formed part of a shipment of 18 and was one of a total of 126 specimens in four shipments received from Waterhouse between 1866 and 1871 representing different Australian regions.

The Stockholm grasswren specimen

NRM 537674
Accession Register: among a collection of mostly Australian specimens, listed under 'Frank i[n] Amsterdam Cont. inköp. [bought with cash] 1841 - för 1 fl. [florin = guilder] per stycke [piece] (utom 7 dyrare [except 7 dearer])'; '*Amytis textilis*; Lesson [*sic*] do [refers to species above 'N. Holl.' = New Holland] (c [illegible] aff. *Malurus*) 5004 [catalogue number in 'Aves Exotica'] t d [ditto, referring to 'Saml.' above [= to the exhibitions] 1867'.
Pedestal label: Grässmyg *Amytornis t. textilis* (Dumont) Västaustralien [Western Australia] 1841 G. A. Frank 5004.
Earlier pedestal label, under current label: *Amytis* [erased] *textilis* Qu. & G. *Amytornis* [added in pencil] (Australia) (Frank 1841) 5004.
On examination (USJ, 3 December 2018): a mounted grasswren of the *textilis* / *modestus* group in good condition (Fig. 5), bill 8.7 mm, tail 76 mm, amber breast-side patches.

Figure 5. Stockholm mount NRM 537674; female probable Thick-billed Grasswren of the extinct subspecies *Amytornis modestus inexpectatus* (Ulf S. Johansson)

Identification of this female grasswren is challenged by documentation suggesting its origin in Western Australia and acquisition via the Frank dealership in 1841. The only Western Australian grasswren specimens known to have been present in Europe in

ISSN-2513-9894 (Online)

that year were the type series in Paris (Black *et al*. 2013). Gilbert sent his two grasswrens from Western Australia to Gould in December 1843 (Sauer 1999: 260) and they were not described until 1847. A possible source of a Western Australia grasswren at the time was George Grey (1841), who explored Western Australia and travelled to Shark Bay in February 1839. Grey provided more than 400 natural history specimens to the British Museum but fewer than 60 of these prior to February 1842, following his appointment as Governor of South Australia in October 1840 (Sharpe 1906; ABB review of NHMUK zoological accession registers). Grey sent his earliest collections, including specimens from north-west and south-west Western Australia, to Gould, who forwarded them to the British Museum on 12 October 1840, noting nine species of interest but these did not include a grasswren (Sauer 1998: 217). Nor did Gould include a grasswren in Grey's (1841) appendix list of birds known from Western Australia. Grey's largest donation of around 267 specimens contained some Western Australia material and included a specimen of *A. textilis* of unstated provenance (Black *et al*. 2014; see also Sharpe 1883) but was not received until July 1843 (ABB as above). Grey's extensive correspondence with Gould (Sauer 1998, 1999) makes clear that all of his specimens were intended ultimately for the national collection. We can find no evidence that Grey sold any natural history material and it seems improbable that NRM 537674 came from him.

The current pedestal label must post-date Mathews' (1917) proposal that Dumont was the species' author (see Black *et al*. 2014 for its rebuttal) and the locality information probably reflects contemporaneous distributional knowledge. The original documentation named Australia (as New Holland) as did the earlier label. More likely, this specimen is from the other side of the continent and is *A. modestus inexpectatus*, of which Gould obtained 'many examples' on the lower Namoi. After retaining them for depiction in his *Birds of Australia* (as *Amytis textilis*), Gould disposed of the excess in December 1840, sending one to C. J. Temminck; others were evidently sold through the Frank agency (Black *et al*. 2014). Gould traded extensively with Frank, via whom many of his specimens reached Naturalis (JJFJJ review of archival documents; Jansen & van der Mije 2015).

Discussion

Uncertainty in grasswren identification.—Gould was only the first of many to misidentify grasswrens (Black & Gower 2017), giving eastern birds the name of a western species and western birds a new and separate name. He even mistook Lesson's illustration of *A. textilis* as *A. striatus*, but he was not alone in such uncertainty (Black *et al.* 2013). While much of the earlier difficulty is now resolved and specimens of *A. striatus* can be confidently identified to species, this is not the case for subspecific identification, which is hampered by still unresolved taxonomy. In addition, *A. merrotsyi* was long included within *A. striatus* and has caused diagnostic uncertainty. The reason why ZMB 19496 was re-identified as *A.* (*striatus*) *merrotsyi*, described in 1913 and then long undetected, is unknown. It is possible that its renaming followed Mathews' (1922–23) view that *A. merrotsyi* was a distinctive South Australian form close to *A. striatus* but not part of that species, which he listed only from New South Wales and Victoria. The distinction between the sister species *A. textilis* and *A. modestus* remains a challenge, especially in the case of old museum specimens, as illustrated here. Another enigma is the uncertain phylogenetic placement of the distinctive, extinct and as yet unsequenced *A. modestus inexpectatus*, the longest-tailed and least thick-billed subspecies, and the only one to separate fully from all others in factor analysis of morphometrics (Black 2016). The answer to that question can only be determined by sampling known specimens of this taxon. We list them here, together with some that are

ISSN-2513-9894 (Online)

probably of that subspecies, and others whose uncertain identity might be resolved via genetic analysis.

Known and probable specimens of *A. modestus inexpectatus*

ANSP 16887, male (Gould collection)
ANSP 16888, female (Gould collection)
ANSP 16889, male (Gould collection)
AMNH 598073, male, holotype (Mathews collection)
AMNH 598072, male (Mathews collection)
RMNH AVES 172018, female (Gould to Temminck; Black *et al*. 2014)
RMNH AVES 172019, male (via Frank dealership 1873; Black *et al*. 2014)
RMNH AVES 172020, male (via Frank 1858, Black *et al*. 2014)
AM O.10581, male
NRM 537674, female (via Frank 1841)

Other historical specimens of uncertain subspecific identity or of poorly sampled taxa

A. modestus specimens

1. MNHN GC 10697B (CG 1879-715) male; labelled *Amytis striata*, but certainly *A. modestus*, it was received from the South Australian Museum but is of unknown provenance. A speculative subspecific identification of *A. m. inexpectatus* (Black *et al*. 2013) is now thought less likely given its relatively unstreaked underparts and tail length of 68.9 mm. All known male specimens of this taxon have tails longer than 79.5 mm (Black 2016).
2. NHMUK 1881.11.7.1229 female; this Cockerell collection specimen is of unknown provenance but bears a label *Amytornis modestus inexpectatus* and, being darker than most *A. modestus* and having a tail of 79.7 mm (ABB, 30 September 2011), it might represent that taxon.
3. NHMUK 1881.11.7.1230 male; the second Cockerell specimen, similarly labelled, is paler than that just mentioned and has a tail of only 73.2 mm (ABB, 30 September 2011), well below known measurements for the taxon, as above, but within the range (66.4–74.7 mm) for males of *A. m. raglessi*, a specimen of which Cockerell is thought to have acquired (Black 2014).

A. textilis **specimens**

The following extinct taxa were only lightly sampled by Austin *et al*. (2013) and historical specimens will contribute further to resolving the phylogeny of the species.

1. *A. textilis carteri* (Dirk Hartog Island, Western Australia)
   AMNH 284760, 2984761, 2984763–766
2. *A. textilis giganturus* (inland Western Australia)
   WAM 11474–477, 11843–844, AMNH 598058–059
3. *A. textilis macrourus* (southern Western Australia)
   ANSP 16892–893 (syntypes), AMNH 598060–062, NHMUK 1931.8.1.3

A. striatus **specimens**

1. AMNH 598124 juvenile male; labelled *Amytis striata* Striated Grass Wren NW Cape 21.5.1900 Tom Carter.

ISSN-2513-9894 (Online)

2. AMNH 598125 male; labelled as above. On examination (ABB, 10 April 2013): skin; bill 12.1 mm × ? (damaged), wing 60 mm, tail 82.7 mm.
3. AMNH 598126 female; labelled as above, plus '*oweni*?'. On examination (ABB, 10 April 2013): skin; bill 12.1 mm × ? (damaged), wing 57 mm, tail 82.1 mm.

The above three *A. striatus* are the only skins known to have been collected from the North West Cape Peninsula, Western Australia population. They are of uncertain taxonomic status, although currently included in *A. striatus whitei* of the Pilbara. When compared concurrently with four AMNH Pilbara *A. s. whitei* and eight western sand desert *A. striatus* '*oweni*', their bills (12.1 mm) were shorter than the former (14.8–15.8 mm, $n = 4$) but within the range of the latter (11.8–12.9 mm, $n = 7$). Wing lengths (57 and 60 mm) were perhaps intermediate (57–62 mm and 52–57 mm, respectively) and tail lengths (82.7 and 82.1 mm) were within the range of both (72.1–88.0 mm and 76.8–88.1 mm, respectively). As with Pilbara *A. s. whitei*, their habitat is spinifex on rocky ground, unlike the spinifex on sand of *A. s.* '*oweni*', but it is on a dissected limestone plateau, not the rugged ironstone hills of the Pilbara ranges (Johnstone *et al*. 2013). No phylogenetic study yet published has sampled either the Pilbara or North West Cape specimens.

ZMB 19496 (B 7143) is one of eight known *A. striatus* specimens exchanged by F. G. Waterhouse via the South Australian Museum between 1867 and 1869. While most likely to represent eastern South Australia *A. s. striatus*, the provenance of all eight is uncertain and they warrant sampling in any future phylogenetic study.

Acknowledgements

We thank Heidi Kneebone, Peter Sutton and Gavan Breen for advice on indigenous names and John Strehlow for information concerning the Hermannsburg Mission collector. Heidi Kneebone and Pascal Eckhoff assisted in interpreting the old German and Erik Åhlander helped decipher the Naturhistoriska Riksmuseet accession register. Leo Joseph made constructive suggestions that improved an early draft of this paper. We are also most grateful to Belinda Cale, who prepared the maps, and photographer Carola Radke. We acknowledge the constructive suggestions made by Walter Boles, the editor and two anonymous reviewers towards improving the submitted manuscript.

References:

Austin, J. J., Joseph, L., Pedler, L. P. & Black, A. B. 2013. Uncovering cryptic evolutionary diversity in extant and extinct populations of the southern Australian arid zone Western and Thick-billed Grasswrens (Passeriformes: Maluridae: *Amytornis*). *Conserv. Genet*. 14: 1173–1184.

Black, A. 2011. Western Australia, home of the Grass-Wren (*Amytornis textilis*). *Amytornis: West. Austr. J. Orn*. 3: 1–12.

Black, A. 2014. Early South Australian records of the Western Grasswren *Amytornis textilis myall*. *Austr. Field Orn*. 31: 43–49.

Black, A. 2016. Reappraisal of morphological and plumage diversity in Thick-billed Grasswren *Amytornis modestus* (North, 1902), with description of a new subspecies. *Bull. Brit. Orn. Cl*. 136: 58–68.

Black, A. & Gower, P. 2017. *Grasswrens: Australian outback identities*. Axiom Publishing, Stepney, South Australia.

Black, A. B., Joseph, L., Pedler, L. P. & Carpenter, G. C. 2010. A taxonomic framework for interpreting evolution within the *Amytornis textilis-modestus* complex of grasswrens. *Emu* 110: 358–363.

Black, A., Schodde, R. & Préviato A. 2013. Early grasswren specimens in Muséum nationale d'Histoire naturelle, Paris and the types of *Amytornis textilis* (Maluridae). *Bull. Brit. Orn. Cl*. 133: 24–30.

Black, A. B., Jansen, J. J. F. J., van der Mije, S. D. & Fisher, C. T. 2014. On the identification and provenance of some early specimens of grasswrens (Maluridae: *Amytornis*) and their significance for taxonomy and nomenclature. *Bull. Brit. Orn. Cl*. 134: 53–62.

Christidis, L., Rheindt, F. E., Boles, W. E. & Norman, J. A. 2010. Plumage patterns are good indicators of taxonomic diversity but not of phylogenetic affinities in Australian grasswrens *Amytornis* (Aves: Maluridae). *Mol. Phyl. & Evol*. 57: 868–877.

Christidis, L., Rheindt, F. E., Boles, W. E. & Norman, J. A. 2013. A re-appraisal of diversity within the Australian grasswrens *Amytornis* (Aves: Maluridae). *Austr. Zool*. 36: 429–437.

ISSN-2513-9894 (Online)

Dolman, G. & Joseph, L. 2015. Evolutionary history of birds across southern Australia: structure, history and taxonomic implications of mitochondrial DNA diversity in an ecologically diverse suite of species. *Emu* 115: 35–48.
Ford, J. 1974. Speciation in Australian birds adapted to arid habitats. *Emu* 74: 161–168.
Ford, J. 1987. Hybrid zones in Australian birds. *Emu* 87: 158–178.
Ford, J. & Parker, S. A. 1974. Distribution and taxonomy of some birds from south-western Queensland. *Emu* 74: 177–194.
Gill, F. & Donsker, D. 2019. IOC World Bird List (v 9.1). http://www.worldbirdnames.org/ (accessed January 2019)
Gould, J. 1840. Letter from Van Diemen's Land, accompanied with descriptions of some new Australian birds. *Proc. Zool. Soc. Lond*. 1839: 139–145.
Gould, J. 1841. *Birds of Australia*, vol. 1. Privately published, London.
Gould, J. 1847. *Birds of Australia*, vol. 3. Privately published, London.
Gould, J. 1865. *Handbook to the birds of Australia*. Privately published, London.
Grey, G. 1841. *Journal of two expeditions of discovery in north-west and Western Australia during the years 1837, 38, and 39*. T. & W. Boone, London.
Horton, P., Black, A. & Blaylock, B. 2017. Ornithology at the South Australian Museum, Adelaide: 1856–1939. Pp. 241–458 *in* Davis, W. E., Boles, W. E. & Recher, H. F. (eds.) *Contributions to the history of Australasian ornithology*, vol. 4. Nuttall Orn. Soc., Cambridge, MA.
Jansen, J. J. F. J. & van der Mije, S. D. 2015. Review of the mounted skins and skulls of the extinct Falkland Islands Wolf *Dusicyon australis* held in museum collections. *Arch. Nat. Hist*. 42: 91–100.
Johnstone, R. E., Burbidge, A. H. & Darnell, J. C. 2013. Birds of the Pilbara region, including seas and offshore islands, Western Australia: distribution, status and historical changes. *Rec. West. Austr. Mus., Suppl*. 78: 343–441.
Marki, P. Z., Jønsson, K. A., Irestedt, M., Nguyen, J. M. T., Rahbek, C. & Fjeldså, J. 2017. Supermatrix phylogeny and biogeography of the Australasian Meliphagides radiation (Aves: Passeriformes). *Mol. Phyl. & Evol*. 107: 516–529.
Mathews, G. M. 1911. [*Amytornis striatus oweni* subsp. n.]. *Bull. Brit. Orn. Cl*. 27: 48.
Mathews, G. M. 1912. A reference-list to the birds of Australia. *Novit. Zool*. 18: 171–656.
Mathews, G. M. 1914. Additions and corrections to my list of the birds of Australia. *Austral Avian Rec*. 2: 83–107.
Mathews, G. M. 1922–23. *The birds of Australia*, vol. 10. H. F. & G. Witherby, London.
North, A. J. 1902. On three apparently undescribed birds. *Victorian Natur*. 19: 101–104.
Parker, S. A. 1972. Remarks on distribution and taxonomy of the grass wrens *Amytornis textilis*, *modestus* and *purnelli*. *Emu* 72: 157–166.
Ramsay, E. P. 1888. *Tabular list of all the Australian birds at present known to the author*. Privately published, Sydney.
Schodde, R. 1982. *The fairy-wrens*. Lansdowne, Melbourne.
Schodde, R. & Mason, I. J. 1999. *The directory of Australian birds: passerines*. CSIRO Publishing, Collingwood, Victoria.
Sauer, G. 1998. *John Gould the bird man: correspondence*, vol. 2. Maurizio Martino, Mansfield Centre, CT.
Sauer, G. 1999. *John Gould the bird man: correspondence*, vol. 3. Maurizio Martino, Mansfield Centre, CT.
Sharpe, R. B. 1883. *Catalogue of the birds in the British Museum*, vol. 7. Trustees of the British Museum, London.
Sharpe, R. B. 1906. *The history of the collections contained in the natural history departments of the British Museum*. Trustees of the British Museum, London.

Addresses: Andrew B. Black, Ornithology Section, South Australian Museum, North Terrace, Adelaide SA, 5000, Australia, e-mail abblack@bigpond.com. Justin J. F. J. Jansen, Naturalis Biodiversity Center, P.O. Box 9517, 2300 RA Leiden, the Netherlands. Sylke Frahnert, Museum für Naturkunde, Invalidenstr. 43, D-10115, Berlin, Germany. Ulf S. Johansson, Naturhistoriska Riksmuseet, Stockholm, Sweden.

ISSN-2513-9894 (Online)

The misidentification of *Turdus ustulatus* Nuttall, and the names of the nightingale-thrushes (Turdidae: *Catharus*)

by Matthew R. Halley

Received 26 March 2019; revised 8 August 2019; published 20 September 2019

http://zoobank.org/urn:lsid:zoobank.org:pub:A87065CD-E464-4A13-95C8-F4F207BE9106

Summary.—An extensive review of *Turdus ustulatus* Nuttall, 1840, and *T. swainsoni* Cabanis *in* Tschudi, 1845, and comparison of John K. Townsend's extant study skins (1835–36) to freshly prepared skins of *Catharus ustulatus* (Nuttall), *C. swainsoni* (Cabanis) and *C. guttatus* (Pallas, 1811), reveals that the original description of *T. ustulatus* Nuttall, 1840, was most likely based on a single specimen (now lost) of Hermit Thrush *C. guttatus* (Pallas, 1811). The original description of *T. swainsoni* Cabanis *in* Tschudi, 1845, is also not unambiguously identifiable and the type material is untraceable. To resolve and stabilise nomenclature, (1) a petition will be filed with the International Commission of Zoological Nomenclature (ICZN) to set aside Art. 75.3.5 of the *Code* (ICZN 1999) so that a neotype of *T. ustulatus* Nuttall, 1840, can be designated; and (2) the name *C. swainsoni* (Cabanis *in* Tschudi, 1845) is herein rescued via neotypification. Finally, updated common names are proposed to standardise the English group name of the genus to 'nightingale-thrush' and reduce further confusion with respect to common names that have been applied to multiple taxa. This is the second in a series of papers concerning historical aspects of *Catharus* taxonomy and nomenclature.

The convoluted nomenclature of the nightingale-thrushes (Aves: Turdidae: *Catharus*) began with a taxonomically composite species (*Turdus minor* J. F. Gmelin, 1789) that was a source of widespread confusion until the mid-19th century. In a recent paper, I reviewed the early history of *T. minor* and demonstrated that Alexander Wilson (1766–1813), who split the composite *T. minor* into two species that were also composites (*T. solitarius* and *T. mustelinus*; Wilson, 1812), did not correctly distinguish any of the five species now recognised as breeders in eastern North America (Halley 2018). Those species are: Hermit Thrush *Catharus guttatus* (Pallas, 1811), Veery *C. fuscescens* (Stephens, 1817; for neotypification see Halley 2018), Swainson's Thrush *C. ustulatus* (Nuttall, 1840), Grey-cheeked Thrush *C. minimus* (Lafresnaye, 1848) and Bicknell's Thrush *C. bicknelli* (Ridgway, 1882). The confusion of Wilson's composites had downstream effects on the understanding of Charles Lucien Bonaparte (1803–57) and John James Audubon (1785–1851), who likewise failed to distinguish the five eastern species (Halley 2018).[1] The number of species in eastern North America was gradually resolved by Giraud (1844), Brewer (1844), Baird *et al*. (1858) and Ridgway (1882).

Here, I disentangle the taxonomic history of Western Thrush *T. ustulatus* Nuttall, 1840, which has long been recognised as the first description of the western (coastal) subspecies of Swainson's Thrush *C. u. ustulatus* (AOU 1998: 505, Mack & Yong 2000, Ruegg 2007). The Swainson's Thrush complex is comprised of two genetic clades (recognised as species

[1] Another factor, overlooked by Halley (2018), which probably exacerbated the confusion of Wilson's composite thrushes is that Sir William Jardine (1800–74) inadvertently switched the plate numbers for 'Tawney Thrush' [*sic*] and 'Hermit Thrush' in his edition of Wilson's *American ornithology* (Wilson *et al*. 1832). Audubon, who considered Jardine's work 'an enormous quantity of trash, all compilation' (Corning 1969, 2: 29), nevertheless consulted it.

ISSN-2513-9894 (Online)

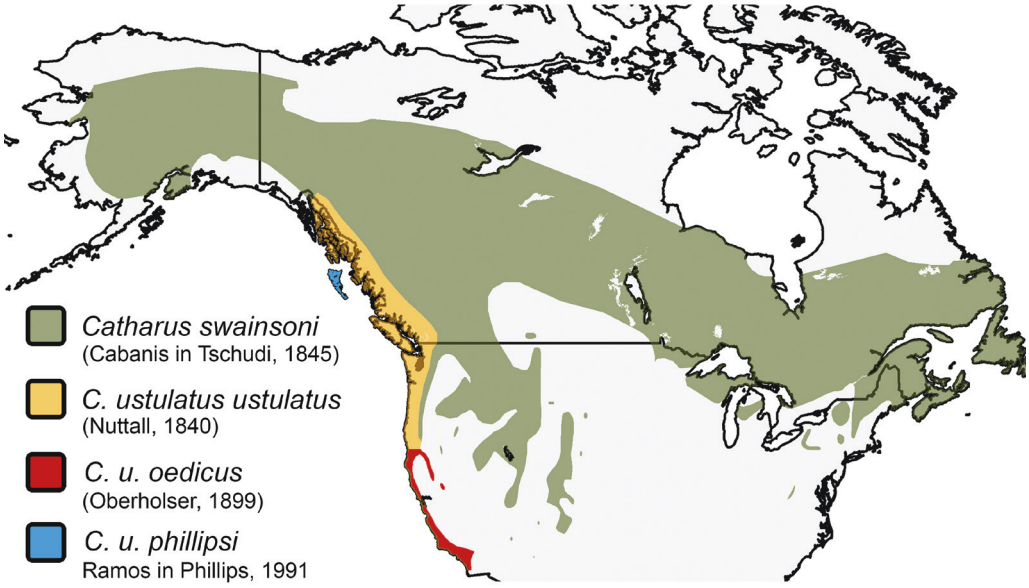


Figure 1. Map of the North American breeding ranges of *Catharus swainsoni* (Cabanis *in* Tschudi, 1845), *C. u. ustulatus* (Nuttall, 1840), *C. u. oedicus* (Oberholser, 1899) and *C. u. phillipsi* Ramos *in* Phillips, 1991. The contact zone of *C. u. ustulatus* and *C. u. oedicus* in northern California is poorly defined and requires further study (see Bond 1963: 378). Data provided by BirdLife International and *Handbook of the birds of the world Alive* (2018). Bird species distribution maps of the world. V. 2018.1. Available at http://datazone.birdlife.org/species/requestdis.

or subspecies) that were evidently geographically isolated (during the breeding season) in forested refugia during the Last Glacial Maximum (LGM). Following deglaciation, the populations expanded and came into secondary contact in the mountains of northern Washington and British Columbia, where they formed a narrow hybrid zone that persists to the present day (Ruegg & Smith 2002). Many recent authors (e.g., Mack & Yong 2000, Ruegg 2007) have classified the western (coastal) clade as *C. u. ustulatus* (Nuttall, 1840) and the eastern (inland) clade as *C. u. swainsoni* (Cabanis *in* Tschudi, 1845), although some authors have elevated the two clades to species rank (e.g, Piacentini *et al*. 2015, del Hoyo & Collar 2016). Speciation has occurred in *Catharus* multiple times despite periodic episodes of gene flow between incipient (and even non-sister) species (Bay & Ruegg 2017, Everson *et al*. 2019) and the taxa in question meet the criteria for species rank under nearly every species concept including 'relaxed' approaches to the biological species concept (BSC) that permit some gene flow between species (de Queiroz 2007). For these reasons, the two clades are herein classified as sister species: *C. ustulatus* (coastal) and *C. swainsoni* (inland). Their generalised breeding ranges are shown in Fig. 1.

History of Townsend's specimens of western thrushes

The original description of *T. ustulatus* was based on two specimens that John K. Townsend (1809–51) collected during the second Wyeth expedition (1834–37) while camped on the Columbia River near Vancouver, Washington. They were the first *Catharus* specimens from western North America to reach the eastern seaboard, and they arrived before the confusion surrounding the eastern species was resolved.

Thomas Nuttall (1786–1859), the seasoned botanist, explorer and author of *Manual of the ornithology of the United States* (1832, 1834; hereafter, *Manual*), was Townsend's companion

ISSN-2513-9894 (Online)

and mentor on the first part of the expedition. However, the two naturalists parted ways in September 1835, which had consequences for the fate of Townsend's specimens. Nuttall sailed to the Sandwich Islands (Hawaii) and then 'around the Horn' of South America to eastern North America, where he landed in summer 1836 (Graustein 1967). Meanwhile, Townsend stayed in the Pacific Northwest for another year, and eventually returned to Philadelphia in November 1837 (Mearns & Mearns 2007).

A collection of specimens that Townsend shipped in September 1835, which included two study skins labelled '*Turdus Wilsoni*?' and one labelled '*Turdus minor*,' reached the Academy of Natural Sciences of Philadelphia (ANSP) in July 1836, shortly before Nuttall's return. The invoice from Townsend's 1835 shipment is preserved at the American Philosophical Society (APS) Library, Philadelphia, PA (Mss.B.M843). Nuttall and Audubon examined the three western specimens of *Catharus* from Townsend's consignment at ANSP in September 1836, but neither recognised them as new species. This was a consequence of their general confusion with respect to Wilson's composites (see Halley 2018). Audubon purchased duplicates with Nuttall's approval, including (presumably) one of the two '*Turdus Wilsoni*?' specimens, which he took to London in July 1837. Audubon then remained in Europe until summer 1839, supervising the completion of *The birds of America* (1827–38) and writing the final two volumes of *Ornithological biography* (1838–39) (Fries 2006).

Meanwhile, Townsend returned to Philadelphia in November 1837 with an additional collection, approximately three times larger than the 1835 shipment (Mearns & Mearns 2007: 324). Edward Harris (1799–1863) purchased more duplicates for Audubon, and Townsend also sent many specimens directly to Audubon so that he could sell them to European collectors (see Derby List, in which one specimen of '*T. Wilsonii*' is mentioned; Mearns & Mearns 2007: 330). Thus, Audubon had access to multiple specimens of western *Catharus* from the Townsend collection in 1838, when he wrote:

> 'I have by me a female specimen of a Thrush sent me by Dr Townsend, who procured it on the Columbia River on the 19th June 1838, and which he considered as new,* but which I find to differ in no other respect from specimens of *Turdus Wilsonii* than in having some of the spots on the sides of the neck and the breast of a darker brown. This skin measures seven inches two and a half twelfths in length.' (Audubon 1839: 203–204)

An annotation (*) by Townsend in the margin of the ANSP copy of *Ornithological biography* vol. 5 (Audubon 1839: 204, ANSP Library, QL674.A915) reads: '*mistake. The specimen was marked <u>*Turdus Wilsonii*</u>? J.K.T.' (Fig. 2). This annotation was later mis-

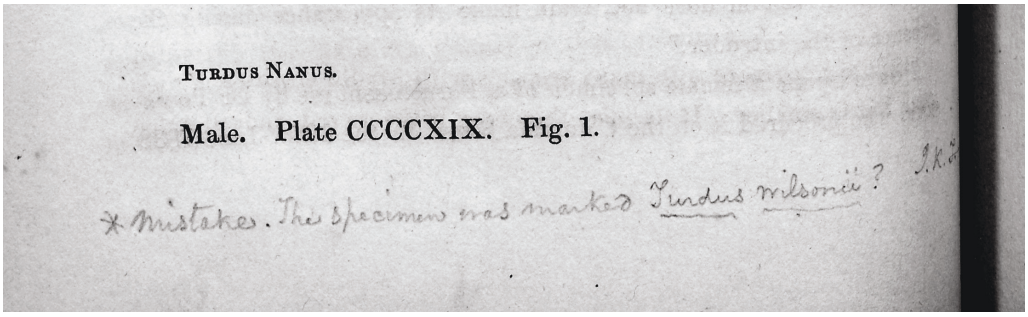


Figure 2. Annotation by John K. Townsend in the ANSP copy of *Ornithological biography*, vol. 5 (Audubon 1839: 204, ANSP Library: QL674.A915): '*mistake. The specimen was marked *Turdus Wilsonii*? J.K.T.' The image contrast has been boosted to render Townsend's faint pencil markings more visible. (Matthew R. Halley)

ISSN-2513-9894 (Online)

transcribed by Stone (1906: 312), who inadvertently replaced Townsend's question mark with a period. Townsend included question marks on his labels and specimen invoice because he was uncertain about the identifications of some specimens ('*Turdus Wilsoni*?'), not because, as Audubon presumed, he thought they represented a new species (APS Library, Mss.B.M843).

Townsend's original data are missing from all extant specimens of *Catharus* attributed to him, except one (USNM 2040), which bears a label in Townsend's hand with the name *Merula silens* Swainson (*in* Swainson & Richardson 1831)—not *T. Wilsoni*. Therefore, the specific identity of the specimen mentioned by Audubon (1839: 203) cannot be verified. The year '1838' in Audubon's comment is a typographical error, because Townsend had already returned to Philadelphia by late 1837. Nevertheless, a handwritten '5' is easily mistaken for an '8,' and Townsend's 1835 specimen invoice included the same uncertain identification: '*Turdus Wilsoni*?' (APS Library, Mss.B.M843). For these reasons, it is plausible (but not certain) that the specimen referenced by Audubon (1839: 203–204) was the duplicate he purchased in 1836 (without Townsend's knowledge, despite Audubon's claim that Townsend 'sent' it to him), rather than one of the specimens he acquired in 1838.

Meanwhile, from 1838 to early 1840, Nuttall was in Philadelphia preparing his next major botanical work, a 200-page tome that would eventually be peer-reviewed and published by the APS (Nuttall 1841). Botany was Nuttall's primary focus and expertise; his ornithological work was not executed with the same breadth of experience or attention to detail (Graustein 1967). His *Manual* was a commercial venture that, unlike most of his botanical writings, was published without peer review and contained 'long passages without acknowledgment and with but comparatively slight verbal changes from [Alexander] Wilson' ... '[Nuttall] probably knew less about birds than has been commonly supposed' (Brewster 1906: 79–80). George Ord (1781–1866), a capable ornithologist and editor of Wilson's final (posthumous) volumes, upon the publication of the *Manual*, wrote in private correspondence: 'I know that [Nuttall] is ignorant of ornithology; and I further know that he is a sorry scoundrel' (APS Library, Mss.B.Or2).

During his residency in Philadelphia in 1838–40, or perhaps earlier, Nuttall made a cursory study of the remnants of Townsend's collection of western birds. However, by that time, relatively few of Townsend's specimens remained at ANSP; most had been dispersed among private collectors (Mearns & Mearns 2007). Townsend had shipped dozens of specimens to Audubon, to be sold in Europe, and generously supplied the cabinets of his friends including Ezra Michener (1794–1887), with whom he stayed while preparing the manuscript of his travelogue, *Narrative of a journey* (Townsend 1839).

Audubon visited Philadelphia on 10–13 February 1840, according to a letter ('I left New York on the 10th Inst. spent a few days in Philadelphia…,' Corning 1969, 2: 231), but there is no evidence that he saw Nuttall during that short trip. Nor is there evidence that Audubon knew of Nuttall's intention to describe a new species of thrush from Townsend's collection. Audubon usually stayed at Harris' home in Moorestown, NJ, when he visited the Philadelphia region (see Corning 1969), and probably spent very little time in Philadelphia itself. Meanwhile, Nuttall was busy with preparations to relocate from Philadelphia to Cambridge, Massachusetts, because he had been hired to give a series of botanical lectures for the Lowell Institute in Boston. Nuttall departed in late February 1840, approximately two weeks after Audubon passed through Philadelphia (Graustein 1967).

The publishers of Nuttall's *Manual* were based in Cambridge and they expressed interest in publishing an updated (second) edition (Nuttall 1840). Nuttall's new ornithological material included *c*.150 pages of information from his Wyeth expedition journals (now lost) and various notes concerning specimens he had examined during his residency in

ISSN-2513-9894 (Online)

Philadelphia. There is no evidence that Nuttall took a collection of bird skins to Cambridge. The manuscript that contained the description of Western Thrush *T. ustulatus* Nuttall, 1840, was drafted rapidly, without specimens at hand, and published within four months of Nuttall's arrival in Cambridge (Graustein 1967: 350).

The material basis of *Turdus ustulatus* Nuttall, 1840

The scientific description of *T. ustulatus* was based on a female specimen collected by Townsend on 'the 10th of June' (1835 or 1836) on the Columbia River, presumably near Vancouver, Washington. Nuttall (1840) also described vocalisations given by multiple birds that were apparently neither collected nor clearly observed ('as soon as seen [it] flits rapidly through the thicket') and a nest found 'about the close of July [1835]…in the prairies of Wahlamet' (=Willamette River valley, Oregon). However, there is no evidence that the nest or vocalising birds were collected. Nuttall (1840) also cited Audubon's (1839: 203–204) note about the 'female specimen of a Thrush [collected]…on the 19th June [1835]' among the synonyms of *T. ustulatus*. As explained above, Audubon's specimen was likely the duplicate sold to him in 1836, which may explain Nuttall's comment that 'now' he had only one specimen for description:

> '… the only specimen from which I am now able to describe the species [*T. ustulatus*] is that of a female procured on the banks of the Columbia on the 10th of June by my friend Mr. Townsend. This neglect arose from the too hasty conclusion that it was no other than the well known Wilson's Thrush.' (Nuttall 1840: 401)

Therefore, the description of *T. ustulatus* Nuttall, 1840, was based on two female syntypes: one mentioned by Audubon (1839: 203–204) and the other described directly by Nuttall himself. Two of Townsend's study skins of *C. ustulatus* are extant: USNM 2040 (Fig. 3) and ANSP 23644 (Fig. 4). Both have been promoted as 'the only specimen' described by Nuttall (1840). However, paradoxically, neither specimen matches Nuttall's description of the dorsal plumage, which actually presents a closer match to *C. guttatus* than to *C. ustulatus*: 'Above olive-brown, a little darker on the head; the tail strongly tinged with rufous.' Just a few pages prior to his description of *T. ustulatus*, Nuttall (1840: 394–395) used those exact words to describe the dorsal plumage ('olive-brown') and tail ('strongly tinged with rufous') of Hermit Thrush *T. solitarius* Wilson, 1812; and he considered the bird in Audubon's Pl. 58 (= *C. g. faxoni* Bangs & Penard, 1921) to be an 'excellent' representation of *T. solitarius* (see Nuttall 1840: 393, and Fig. 6 in Halley 2018).

Spencer F. Baird (1823–87), who acquired USNM 2040 from Audubon, assumed incorrectly that it was Nuttall's syntype (Baird *et al*. 1858: 215). A plate (81) depicting USNM 2040 was published by Baird *et al*. (1860: VII) and claimed as 'Mr. Nuttall's type' in the introductory pages (Fig. 5). Baird also pencilled 'Type of Nuttall?' in the margin of his personal copy of Pl. 81, deposited in the Smithsonian Library (see Deignan 1961: 432). This claim was later repeated by Hellmayr (1934: 457, 'type [of *T. ustulatus*] in U. S. National Museum') and Deignan (1961: 431, 'it may be assumed that [USNM 2040] is indeed the type, and that it is a female collected on June 10, 1835, as stated in Nuttall's description').

However, one label attached to USNM 2040, written in Baird's own hand, records the sex of the bird as male ('m,' see Fig. 3) and his description of that specimen ('uniform reddish brown [dorsal plumage and tail], with a faint olivaceous tinge,' Baird *et al*. 1858) does not match Nuttall's (1840) description of the *T. ustulatus* type ('above olive-brown, a little darker on the head; the tail strongly tinged with rufous'). The illustration of USNM 2040 in Pl. 81 matches Baird *et al*.'s (1858) description, showing a more or less uniform reddish-brown

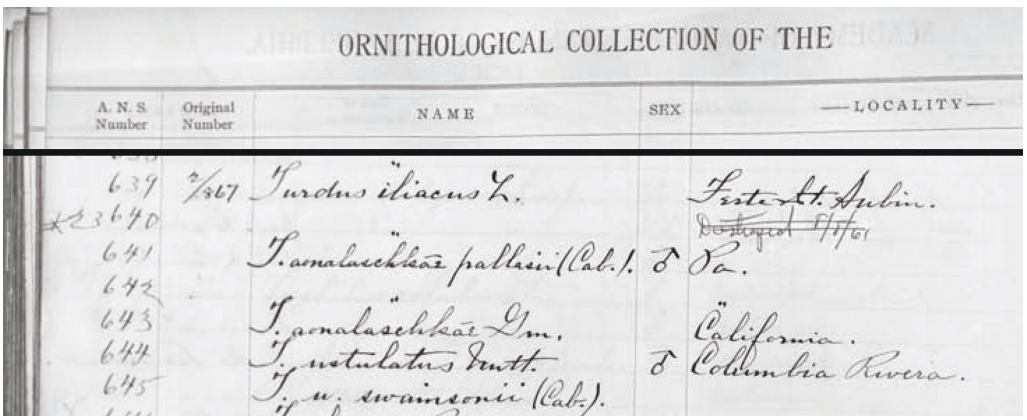
ISSN-2513-9894 (Online)

Figure 3. USNM 2040 and its two oldest labels. The top label was apparently written by John K. Townsend: 'Silent Thrush.– / *Merula silens*. Swainson p. 186. / Columbia River. Townsend.' The bottom label was written by Spencer F. Baird: '*Turdus wilsonii* Sw. / 2040 / Columbia River / J. K. Townsend / m[ale]' (Matthew R. Halley)

Figure 4. ANSP 23644 and its label. See text for information concerning provenance. The text '♀ JKT' was purportedly copied from the base of the mount on which the bird was displayed during the mid-19th century, but the sex is recorded as male ('♂') in the ANSP specimen ledger (ANSP Archives, coll. 54, box 3). Furthermore, the red type label has been defaced and there are no data linking this specimen to Nuttall (Matthew R. Halley)

ISSN-2513-9894 (Online)

Figure 5. Cropped lithographic image of USNM 2040 ('*Turdus ustulatus*') from Pl. 81 in Baird *et al*. (1860), ostensibly depicting 'Mr. Nuttall's type' (see Baird *et al*. 1860: VII). Produced by [J. T.] 'Bowen & Co. lith & col.' in Philadelphia, Pennsylvania. It is reproduced here courtesy of Smithsonian Libraries (QL681.B138). Portions of another image (*T. aliciae*) have been digitally removed from the upper right of this figure for clarity.


ORNITHOLOGICAL COLLECTION OF THE

A. N. S. Number	Original Number	NAME	SEX	LOCALITY
639	2/367	Turdus iliacus L.		Fürstenth. Anhalt.
23640				Portugal 5/11/61
641		T. amalaschkae pallasii (Cab.).	♂	Ka.
642				
643		T. amalaschkae Gm.		California.
644		T. ustulatus Nutt.	♂	Columbia Rivera.
645		T. u. swainsonii (Cab.).		

Figure 6. Digital scan of the ANSP Ornithology specimen ledger No. 3 (ANSP Archives, coll. 54, box 3), in which the sex of ANSP 23644 is recorded as male ('♂'). This contradicts the 'original' data on the defaced specimen label (see Fig. 4).

ISSN-2513-9894 (Online)

coloration and no contrast between the back and tail (Fig. 5). There is no colour contrast in the plumage of this specimen today, after 160 years (Fig. 3). Thus, the discrepancy between Nuttall's (1840) and Baird *et al*.'s (1858) descriptions cannot be explained as a by-product of post-mortem change.

Stone (1899: 19) claimed that ANSP 23644, which is similarly coloured to USNM 2040, was Nuttall's study skin of *T. ustulatus*, but not because the skin bore a label indicating its type status or because it matched Nuttall's (1840) description. Stone merely assumed that the specimen was at ANSP because Nuttall had worked there after returning from the west, and it was the only specimen of *C. ustulatus* from Townsend's collection that could be located: '...[*T. ustulatus* was] based on a Townsend specimen in the ANSP collection which I have identified as…' (Stone 1899: 19). In an unpublished memorandum dated 1893 and entitled 'Explanations in regard to the Cataloguing of the Collection', Stone confided that 'no numbers were placed on the specimens to fix their identity' when he began his work on the ANSP bird collection in March 1888 (ANSP Archives, coll. 54, box 4). His determination of Nuttall's type of *T. ustulatus* was apparently not based on evidence, but guesswork.

The remnants of a wire armature are visible, evidence that ANSP 23644 was once mounted for display. However, there is no original label or stand, only a secondary label that bears the following information, purportedly copied from the base of the (now missing) stand: '♀ JKT.' However, Stone unambiguously recorded the sex of the bird as male ('♂') in the ANSP specimen ledger (Fig. 6, ANSP Archives, coll. 54, box 3) and some additional text was (later?) forcibly scratched off the red type label (Fig. 4). The ledger is the oldest available primary source. This begs the question whether the original sex data was scratched off the type label and replaced with false data that matched Nuttall's description. In any case, there is no provenance with ANSP 23644 that connects the specimen to Nuttall, nor does the plumage of the bird match Nuttall's (1840) description of the *T. ustulatus* syntype.

Specimen comparisons

More than a century after Nuttall's description of *T. ustulatus*, Bent (1949: 167) aptly summarised the field marks that distinguish *C. ustulatus* and *C. guttatus* in the region where Townsend collected Nuttall's type, though it appears that he too overlooked the paradox:

> 'The russet-backed thrush [*C. ustulatus*] is not likely to be confused with any other bird on the Pacific slope except with one of the hermit thrushes, but the uniform russet-brown of its back is easily distinguished from the contrasted brown back and rufous tail of the hermits; furthermore, the haunts of the two, during the breeding season at least, are quite different.' (Bent 1949: 167)

To further investigate the identity of *T. ustulatus* Nuttall, 1840, I prepared a fresh series of adult specimens of *C. ustulatus* (n = 10) and *C. guttatus* (n = 10) from coastal Washington, west of the Cascade Mountains, and directly compared them to ANSP 23644 (*C. ustulatus*) and ANSP 16091 (*C. guttatus*), two of the four *Catharus* specimens from Townsend's collection now extant. I also prepared a series of *C. swainsoni* adults (n = 5) from eastern North America, yielding a total sample of 27 specimens for direct colour comparison (Table 1; 25 fresh, two historical). I used the rectangular (card-stock) window provided in *Color standards and color nomenclature* (Ridgway 1912) to match the capitalised colour names to the plumage just below the nape, and to the anterior and posterior portions of the tail. Most of the fresh specimens were 1–6 years old when they were scored, about the same age as the *T. ustulatus* syntype when Nuttall examined it in 1838–39. I also examined USNM 2040 (*C. ustulatus*) and compared it to other historical specimens in the USNM

ISSN-2513-9894 (Online)

TABLE 1
Specimens used for colour comparison of *Catharus ustulatus* (*n* = 10), *C. swainsoni* (*n* = 5) and *C. guttatus* (*n* = 10). All specimens were prepared by Matthew R. Halley and deposited in the ornithology collection at the Academy of Natural Sciences of Drexel University (ANSP). Sex categories are female (F), male (M) and unknown (U). Localities are given as state abbreviation (PA = Pennsylvania; WA = Washington): county: town or site. The table is organised by species and date.

Species	ANSP No.	Sex	Date	Locality
C. ustulatus	204296	F	25 Aug 2013	WA: Skagit: Burlington
C. ustulatus	204297	F	1 Sep 2014	WA: King: Vashon
C. ustulatus	204299	U	14 Sep 2014	WA: King: Vashon
C. ustulatus	204300	M	26 Aug 2015	WA: Pierce: Gig Harbor
C. ustulatus	204301	U	27 Aug 2015	WA: Pierce: Tacoma
C. ustulatus	205164	M	10 Sep 2015	WA: Pierce: Tacoma
C. ustulatus	204295	U	13 Aug 2016	WA: Skagit: Anacortes
C. ustulatus	205165	F	28 Sep 2016	WA: Pierce: Tacoma
C. ustulatus	205167	M	2 May 2017	WA: King: Vashon
C. ustulatus	204520	M	23 May 2017	WA: King: Vashon
C. swainsoni	204304	F	20 May 2011	PA: Berks: Nolde Forest
C. swainsoni	204219	F	27 Sep 2016	PA: Montgomery: Gwynedd
C. swainsoni	204235	F	21 May 2017	PA: Luzerne: Drums
C. swainsoni	205953	M	Aug 2017	PA: Delaware: Wayne
C. swainsoni	207077	M	17 Jul 2019	PA: Warren: Allegheny National Forest
C. guttatus	204316	U	6 Nov 2003	WA: Skagit: Anacortes
C. guttatus	204314	F	7 Jan 2004	WA: King: Vashon
C. guttatus	204519	M	14 Apr 2015	WA: Skagit: Anacortes
C. guttatus	204318	F	22 Sep 2015	WA: Okanogan: Twisp
C. guttatus	204317	U	15 Oct 2015	WA: Pierce: Tacoma
C. guttatus	204518	F	6 Nov 2015	WA: King: Vashon
C. guttatus	204313	M	22 Nov 2015	WA: King: Vashon
C. guttatus	204315	M	11 Oct 2016	WA: Skagit: Anacortes
C. guttatus	204517	M	11 Jan 2017	WA: Whatcom: Bellingham
C. guttatus	205172	M	30 Apr 2017	WA: King: Seattle

bird collection, but, for logistical reasons, was unable to directly compare it to the ANSP specimens or Ridgway (1912).

The sample of recent specimens from western North America comprises, in most cases, the victims of cats and / or window collisions, salvaged by volunteers during the spring and autumn migratory periods (2003–17) and preserved (frozen) by G. Shugart and D. Paulson at the Univ. of Puget Sound. The migratory flyway west of the Cascades is utilised by 'pure' *C. ustulatus* individuals and hybrid *C. ustulatus* × *C. swainsoni* (Delmore & Irwin 2014). Breeding populations of pure *C. ustulatus* occur near Vancouver, Washington, where Townsend presumably collected Nuttall's syntypes, and extend north into the Seattle area. Vancouver is *c.*275 km south-west of the southern periphery of the hybrid zone and Seattle is *c.*70 km west. For this reason, without genotyping the birds, I cannot be certain that the sample of *C. ustulatus* study skins, from the spring and autumn migratory periods, does not contain any individuals of hybrid origin.

In the fresh *C. ustulatus* series, examined in 2018, the dorsal plumage and tails were more or less uniform Olive-Brown (Fig. 7). The dorsal plumage of ANSP 23644 was also more or less uniform Olive-Brown, though some parts of the specimen have faded in the direction of Saccardo's Umber, presumably during the years when it was mounted for

ISSN-2513-9894 (Online)

Figure 7. Plumage colour comparison of (A) ANSP 23644, collected and prepared by John K. Townsend near Vancouver, Washington, and claimed as the 'type of Nuttall' by Stone (1899: 19), and (B–D) three relatively fresh specimens of *Catharus ustulatus*, prepared by M. R. Halley: (B) ANSP 204297, a female that died in a window collision on 1 September 2014, on Vashon Island, King County, Washington (prep. = MRH88); (C) ANSP 205167, a male that died in a window collision on 2 May 2017, also on Vashon Island (prep. = MRH146); (D) ANSP 205165, a bird of uncertain sex that died in a window collision on 28 September 2016, in Tacoma, Pierce County, Washington (prep. = MRH141). These birds died during migration in a pathway used by 'pure' individuals of *C. ustulatus* and hybrid *C. ustulatus* × *C. swainsoni* (see Delmore & Irwin 2014) (Matthew R. Halley)

display. Like fresh specimens of *C. ustulatus*, there is no obvious contrast in colour between the back and tail of ANSP 23644, nor any suggestion that there ever was such a pattern. Neither is such a contrast evident in the fresh series of *C. swainsoni*, the backs and tails of which are more or less uniform Brownish Olive. The tails of some *C. ustulatus* specimens exhibit a subtle tendency toward Sepia, but this difference would not be well characterised by Nuttall's (1840) description of a 'tail *strongly* tinged with rufous' (my italics), which was identical to his description of Hermit Thrush *T. solitarius* Wilson (see Nuttall 1840: 394–395). In conclusion, it appears that Nuttall (1840) actually described one of Townsend's fresh *C. guttatus* specimens from western Washington, as evidenced by fresh specimens from that region with Brownish Olive back plumage (below the nape) and tails that transition (anterior to posterior) from Prout's Brown to Mummy Brown (Fig. 8). However, Nuttall's (1840) and Audubon's (1839) syntypes are apparently no longer extant. Neither of the two extant specimens of *C. guttatus* (or *C. ustulatus*) from the Townsend collection are a female

ISSN-2513-9894 (Online)

Figure 8. Plumage colour comparison of (A) a female *C. guttatus* (Pallas) collected and prepared by John K. Townsend in 'May' (1835 or 1836) on the 'Columbia River' (ANSP 16090), and (B–D) three specimens prepared by Matthew R. Halley: (B) ANSP 204316, an unsexed specimen that died in a window collision on 6 November 2003, on Salmon Beach Road, Skagit County, Washington (prep. = MRH87); (C) ANSP 204318, a female that died in a window collision on 22 September 2015, in Twisp, Okanogan County, Washington (prep. = MRH91); and (D) ANSP 204519, a male that died in a window collision on 14 April 2015, in Anacortes, Skagit County, Washington (prep. = MRH134) (Matthew R. Halley)

collected on the '10th of June' as described by Nuttall (1840), or a female collected on '19th June [1835]' as described by Audubon (1839: 203–204): MCZ 16298 is a male and ANSP 16091 was collected in 'May'.

Behavioural observations and nest description

The behavioural notes given by Nuttall (1840) in association with *T. ustulatus*, and his description of a nest purportedly made by that species, were not based on specimens but on Nuttall's vague recollections and (apparently) field notes from 1835. If anything, they cast more doubt on Nuttall's understanding of the species in question:

> 'At intervals, on the commencement of the breeding period, we heard their notes, bearing indeed, some resemblance to the quaint warble of the Veery or Wilson's Thrush [i.e. Wilson's composite *T. mustelinus*, see Halley 2018], though quite distinct, and easily recognizable from the notes of that Atlantic species. Its song was also more brief and interrupted, and the bird more shy and difficult of access. The warble of one of these birds which I heard at Chinhook, near the estuary of the Columbia [= Chinook,

ISSN-2513-9894 (Online)

> Washington], on the 4th of July [1835], resembled *wit wit t'villia*, and *wit wit t'villia t'villia*, cheering the dark solitudes of evergreens where all day he remains recluse like our Wood Thrush: his recognition call is *'wit 'wit* which he utters also when surprised, and as soon as seen flits rapidly through the thicket.'

These vocalisations, at least the calls (*'wit 'wit*), seem to be a good match to *C. ustulatus*, but some calls of *C. guttatus* have been similarly described ('*quit quit*', Dellinger *et al*. 2012). The transliteration of the song (*wit wit t'villia t'villia*) is also vague and could apply also to *C. guttatus*. Wood Thrush *Hylocichla mustelina* (J. F. Gmelin, 1789), an eastern species, does not typically range west of the Rocky Mountains.

Nuttall's (1840) narrative was written as if he and Townsend distinguished *T. ustulatus* from Wilson's composite *T. mustelinus* in the field: '...we heard their notes...easily recognizable from the notes of that Atlantic species.' However, neither man recognised that there was a new species until years later. Remember that, in 1836, Nuttall did not think that either of the two specimens of '*T. Wilsonii*?' were a new species when he and Audubon examined Townsend's collection in Philadelphia, and Townsend wrote (after Nuttall's departure) on 11 April 1836: 'The Wilson's Thrush (*Turdus wilsonii*)…breeds here [near Vancouver] & is consequently, for a part of the year in full song' (see Mearns & Mearns 2007: 359). Nuttall even sanctioned the sale of one of the specimens to Audubon after coming to the 'hasty conclusion that it was no other than the well known Wilson's Thrush' (Nuttall, 1840). Furthermore, the vocalisations that Nuttall apparently transcribed in his field journal (now lost) were not uttered by the same individuals that Townsend collected, nor is there evidence that they were heard by Nuttall on the same day Townsend collected the specimens. Thus, it seems that the extent of Nuttall's first-hand knowledge of the behaviour of these secretive birds was overstated by later authors who were not personally acquainted with him:

> '[Nuttall's] ear, so quick to appreciate the characteristics of the songs of birds, which showed a close resemblance between the notes of [*T. ustulatus*] and that of Wilson's Thrush (*T. fuscescens*), enabled him to detect very distinct and easily recognizable differences.' (Baird *et al*. 1874: 17)

The nest described by Nuttall (1840) seems unlikely to have been made by *C. guttatus* or *C. ustulatus*, or indeed any *Catharus* species. Mud has often been mentioned as a structural material in historical literature of *C. ustulatus*, but has not been observed in *C. ustulatus* nests by modern researchers (Mack & Yong 2000). Published references to mud are probably a consequence of Nuttall's (1840) original composite description of *T. ustulatus*: 'lined with dry leaves and some mud, externally of coarse grass.' Heckscher *et al*. (2014), by dissecting a sample of nests of *C. fuscescens*, recently debunked similar claims about the ostensible use of mud in nest construction; the natural desiccation process of wet leaves stabilises nest structures in lieu of mud. There is no evidence that Nuttall (1840) collected or dissected the nest he described.

Green moss typically replaces grass as a structural material in *C. ustulatus* nests (Mack & Yong 2000), but Nuttall (1840), an expert botanist, made no mention of moss in his description. Furthermore, the location of the nest on the 'prairies of Wahlamet' (= meadows in Willamette River valley, Oregon) is peculiar breeding habitat for *C. ustulatus*. Rathbun *in* Bent (1949) reported that in western Washington, '[*C. ustulatus*] nests from June 10 up to the middle of July…well within the forest, and a favorite location is among the low growth

ISSN-2513-9894 (Online)

along the forest's edge, particularly in the proximity of water.' In short, the nest described by Nuttall was probably not made by any *Catharus* species.

Nomenclatural consequences

The name *ustulatus* (Nuttall, 1840) has been in universal use in global ornithological literature for more than 150 years. However, the original description of *T. ustulatus* Nuttall, 1840, was likely based on a (syntype) specimen of Hermit Thrush *C. guttatus* (Pallas, 1811), a different species than that to which the name *ustulatus* has traditionally been applied. The identity of a second syntype, mentioned by Audubon (1839: 203–204) and cited by Nuttall (1840: 400) among the synonyms of *T. ustulatus*, is not identifiable (see above). The two extant specimens of *C. ustulatus* attributed to the Townsend collection (USNM 2040, ANSP 23644) have both been claimed as types, but this status can be ruled out on the basis of collection dates and sex data that conflict with the accounts of Nuttall (1840) and Audubon (1839). Furthermore, they do not match Nuttall's (1840) description of the colours of the dorsal plumage and tail.

Neotypification is reserved for circumstances in which 'an author considers that a name-bearing type is necessary to define the nominal taxon objectively' (Art. 75.1). However, this is not a straightforward case because the only syntype for which an adequate description exists (in Nuttall 1840) is a closer match to *C. guttatus* than *C. ustulatus*, and a neotype must be 'consistent with what is known of the former name-bearing type from the original description and from other sources' (Art. 75.3.5). Accordingly, traditional nomenclature can be preserved and stabilised via neotypification only if the ICZN uses its plenary power to set aside Art. 75.3.5. A petition of this kind will soon be submitted to the *Bulletin of Zoological Nomenclature* for consideration by the Commission.

The material basis of *T. swainsoni* Cabanis *in* Tschudi, 1845

As a replacement name, *T. swainsoni* Cabanis *in* Tschudi, 1845, is typified by the original material in Swainson & Richardson's (1831) circumscription of *Merula Wilsonii* (i.e., not including the type material of the synonyms, see ICZN 1999, Art. 72.7). Their original material included several 'northern specimens' of unspecified provenance, a male collected in May 1827 at Carlton House National Historic Site of Canada, Saskatchewan, and 'no less than five others, killed last year in New Jersey, and now in our museum' (Swainson & Richardson 1831: 183). Therefore, *T. swainsoni* Cabanis *in* Tschudi, 1845, was based on a series of syntypes (Art. 72.1.1) collected at geographically distant localities, and of unknown breeding origin because they were collected during the migratory period.

Swainson's collection was sold to the Univ. of Cambridge (UK) in 1840, but there is no trace of the specimens mentioned in his *M. Wilsonii* account (Swainson & Richardson 1831: 183, Parkinson 1988). Three specimens of *C. swainsoni* are extant in the collection, but none have collection dates (UMZC No 27/Tur/6/j/5–7) and two were collected by Ward in 'Pennsylvania.' Because no other extant material from Swainson's collection is known, the type material of *T. swainsoni* Cabanis *in* Tschudi, 1845, is presumed to be lost or destroyed. Therefore, the text description of the Carlton House specimen is the only available evidence for determination of the identity of *T. swainsoni*:

> 'Colour of the whole dorsal aspect a uniform deep hair-brown, inclining slightly to oil-green. The cheeks and the spaces between the eyes and nostrils are pale yellowish-brown, obscurely spotted with hair-brown. The *under plumage* is mostly white, tinged on the sides of the throat with yellowish-brown, and faintly clouded and blotched on

ISSN-2513-9894 (Online)

the flanks with hair-brown. The throat and breast are marked with broad, triangular, blackish-brown spots on the tips of the feathers. *Bill* dark umber-brown, pale at the base of the lower mandible. *Legs* pale yellowish-brown.' (Swainson & Richardson 1831: 183)

The above description is insufficient to distinguish between *C. swainsoni* (Cabanis *in* Tschudi, 1845) and *C. minimus aliciae* (Baird *et al*., 1858), which both occur during the spring migration in Saskatchewan. The latter species was not yet known when Swainson & Richardson (1831) made their description, nor when Cabanis (*in* Tschudi, 1845) published the replacement name *T. swainsoni*. Morphometric values given by Swainson & Richardson (1831) are insufficient to distinguish between these two closely related taxa. The coloration of the dorsal plumage of *C. swainsoni* and *C. m. aliciae* is practically identical and approximately one-quarter of *C. m. aliciae* males have 'medium buff' on the throat (Ouellet 1993) that may extend onto the cheeks and lores like *C. swainsoni* (e.g., ANSP 203886, 204425). The bird described by Swainson & Richardson (1831) had '*pale* yellowish brown' lores (my italics), which does not exclude *C. m. aliciae* from consideration. Coues (1878: 36), who distinguished *T. aliciae* from *T. swainsoni* on the basis of 'the *distinct* yellowish orbital ring and lores [my italics] of *swainsoni* not being seen', conceded that these characters are 'faintly indicated' in some specimens of *C. m. aliciae*. No mention of the eye-ring was made in Swainson and Richardson's (1831) description. Furthermore, Richardson's remark that the eggs of *M. Wilsonii* are 'without spots' matches *C. m. aliciae* but not *C. swainsoni*, adding further uncertainty (Bent 1949).

Neotypification of *T. swainsoni* Cabanis *in* Tschudi, 1845

The name *T. swainsoni* Cabanis *in* Tschudi, 1845, has been in universal use for the eastern (inland) taxon for more than 150 years. However, it is not unambiguously identifiable because none of its syntypes are extant and the attributes of the specimens described by Swainson & Richardson (1831), to which Cabanis (*in* Tschudi 1845) applied the replacement name *T. swainsoni*, are shared by more than one species.

To fix the taxonomic identity of *Merula Wilsonii* Swainson & Richardson, 1831 (excluding synonyms), and its replacement names including *T. swainsoni* Cabanis *in* Tschudi, 1845, an adult male (ANSP 207077) in the collection of the Academy of Natural Sciences of Drexel University, Philadelphia, PA, is hereby designated as its neotype (Fig. 9). This action stabilises traditional nomenclature and prevents destabilising confusion arising from alternative identifications. It fulfills the requirements for neotype designation in the *Code* (ICZN 1999) by clarifying the taxonomic application (status) of the name, as explained above (Art. 75.3.1), describing, illustrating and referencing the defining characters of *C. swainsoni* and its neotype (Art. 75.3.2), providing data sufficient to ensure recognition of the specimen designated (Art. 75.3.3), providing grounds for believing that all original type material has been lost and is untraceable (Art. 75.3.4), showing that traits of the neotype are included in the original description (Art. 75.3.5), choosing a neotype collected in the Mid-Atlantic region of North America, where some of Swainson & Richardson's (1831) syntypes originated (Art. 75.3.6), and recording that the neotype is preserved as the property of a recognised scientific institution (Art. 75.3.7). The choice of a specimen from its breeding grounds provides more stability than selecting a migrant individual with an unknown breeding locality.

ANSP 207077 is an adult male collected by M. R. Halley on 17 July 2019 on the west branch of Tionesta Creek, Allegheny National Forest, Warren County, Pennsylvania (41°69′03.79″N, 79°23′98.00″W, 550 m elevation). The bird was on its breeding territory near Heart's Content, an old-growth stand of eastern hemlock *Tsuga canadensis* and eastern

ISSN-2513-9894 (Online)

Figure 9. ANSP 207077, the neotype of *M. Wilsonii* Swainson & Richardson, 1831, and its replacement names including *T. swainsoni* Cabanis *in* Tschudi, 1845; see text for detail of the specimen's provenance (Matthew R. Halley)

white pine *Pinus strobus*. For more detail concerning the vegetative history of the area see Lutz (1930) and Rooney & Dress (1996). An audio recording was made of the singing bird with a Sennheiser ME66/K6 condenser microphone and Sony Zoom H1 recorder (.wav format, 24 bit, 96 kHz). Speaker playback of the recording was used to lure the bird into a mist-net. A compressed audio file (.mp3) was uploaded to xeno-canto.org (XC 489007) and an uncompressed file (.wav) was deposited in the Macaulay Library of Natural Sounds (Cornell University, Ithaca, NY) (ML 170463711, eBird checklist S58570739).

Approximately 50 µL of blood was drawn via brachial venipuncture into a microhematocrit capillary tube. Fresh blood was applied to a FTA card, and smeared onto a glass slide which was immediately fixed in pure methanol. The bird was euthanised in the field via cardiac compression, then transported on dry ice to ANSP, where it was prepared as a study skin and spread wing (Fig. 9, prep. = MRH214). The wingspan of the fresh (pliable) specimen measured 293 mm before removing the skin. An immature (unscleratised) feather louse with sternal asters (*Myrsidea* sp., identified by J. Gausas) was removed from ANSP 207077 and preserved in 95% EtOH. Samples of the heart, liver and muscle tissue of ANSP 207077 were frozen (-80° F) and archived (ANSP tissue = 35982). The syrinx was excised and initially preserved in 95% EtOH, then transferred to 10% neutral buffer formalin. Prior to preparation, the bird weighed 29.8 g with a stomach full of black insect parts and some seeds. It had enlarged, cream-coloured testes (10 × 6 and 9 × 6 mm) and enlarged seminal vesicles. No fat or moult was noted. There was no bursa and the skull was 100% pneumatised.

ISSN-2513-9894 (Online)

Diagnosis.—*C. swainsoni* is distinguished from other *Catharus* species by the combination of a buffy eye-ring, which is bold and spectacle-like, and uniform brownish-olive dorsal plumage and tail. In contrast to the similar *C. m. aliciae* (Baird *et al*., 1858), which also has Brownish Olive dorsal plumage and tail, the eye-ring of *C. swainsoni* is 'full and distinct,' the breast spots are 'larger and less distinct' and there is a 'lack of emargination on p6' (Pyle 1997: 397).

Through neotypification, the name *C. swainsoni* (Cabanis *in* Tschudi, 1845) is now restricted to the inland species to which the names *C. u. swainsoni* and *C. swainsoni* have been formerly applied (e.g., Ruegg 2007, del Hoyo & Collar 2016). For clarity of reference, the synonyms, nomenclatural combinations and principal citations of *C. swainsoni* (Cabanis *in* Tschudi, 1845), *C. u. ustulatus* (Nuttall, 1840), *C. u. oedicus* (Oberholser, 1899) and *C. guttatus* (Pallas, 1811) are provided in the Appendix.

English common names

Molecular phylogenetic studies have unanimously demonstrated that the resident (non-migratory) *Catharus* species, which have been traditionally called 'nightingale-thrushes,' do not form a monophyletic group (Outlaw *et al*. 2003, Klicka *et al*. 2005, Winker & Pruett 2006, Voelker *et al*. 2013, Everson *et al*. 2019). Therefore, the common name 'nightingale-thrush' is appropriately applied to all species in *Catharus* and continued use of 'thrush' for the migratory species alone perpetuates historical misconceptions about phylogenetic relationships.

Recently, the American Ornithological Society North American Classification Committee addressed a similar problem in hummingbirds by voting to 'standardize the English group name of all species of *Lampornis* to Mountain-gem and reduce the prevalence of the English group name 'hummingbird' across the family, thereby strengthening the association of these species with other species of *Lampornis* and emphasizing their distinctness relative to other species in the Trochilidae' (Chesser *et al*. 2019: 7). Following that example, I propose that the common names of the migratory species of *Catharus* be revised to 'strengthen

TABLE 2
Scientific and English common names of species in the genus *Catharus*, known collectively as nightingale-thrushes. Current names follow Clement (2000) with updates by Halley *et al*. (2017). The ordering of species according to phylogenetic clades (A–C) follows Voelker *et al*. (2013) and Everson *et al*. (2019). Novel proposed names are shown in bold.

Clade	Scientific name	Current name(s)	Proposed name
A	*C. aurantiirostris*	Orange-billed Nightingale-Thrush	Orange-billed Nightingale-Thrush
	C. mexicanus	Black-headed Nightingale-Thrush	Black-headed Nightingale-Thrush
	C. fuscater	Slaty-backed Nightingale-Thrush	Slaty-backed Nightingale-Thrush
	C. dryas	Gould's Nightingale-Thrush	Gould's Nightingale-Thrush
	C. maculatus	Sclater's Nightingale-Thrush	Sclater's Nightingale-Thrush
B	*C. minimus*	Grey-cheeked Thrush	**Grey-cheeked Nightingale-Thrush**
	C. bicknelli	Bicknell's Thrush	**Bicknell's Nightingale-Thrush**
	C. fuscescens	Veery / Wilson's or Tawny Thrush	**Veery Nightingale-Thrush**
	C. swainsoni	(Olive-backed) Swainson's Thrush	**Boreal Nightingale-Thrush**
	C. ustulatus	(Russet-backed) Swainson's Thrush	**Pacific Nightingale-Thrush**
C	*C. guttatus*	Hermit Thrush	**Hermit Nightingale-Thrush**
	C. occidentalis	Russet Nightingale-Thrush	Russet Nightingale-Thrush
	C. gracilirostris	Black-billed Nightingale-Thrush	Black-billed Nightingale-Thrush
	C. frantzii	Ruddy-capped Nightingale-Thrush	Ruddy-capped Nightingale-Thrush

ISSN-2513-9894 (Online)

the association' of these species with the other (non-migratory) species in the genus. This action will highlight the distinctness of *Catharus* relative to other genera in the Turdidae and 'reduce the prevalence' of the vague English group name 'thrush' across the family. Proposed names are listed in Table 2 and discussed below.

The common names Boreal Nightingale-Thrush (*C. swainsoni*) and Pacific Nightingale-Thrush (*C. ustulatus*) are ecologically and geographically appropriate and will reduce confusion with past uses of 'Swainson's Thrush', which was formerly applied to both species. Use of the adjective 'Russet-backed' for *C. ustulatus* is problematic because the similarly named Russet Nightingale-Thrush *C. occidentalis* occurs sympatrically with *C. ustulatus* in southern Mexico for most of the year. The fact that two other *Catharus* species have widespread breeding ranges that include boreal forest (*C. guttatus*, *C. minimus*) should not raise objection to the use of 'Boreal Nightingale-Thrush' for *C. swainsoni* alone; consider the similar case of Boreal Chickadee *Poecile hudsonicus* and Black-capped Chickadee *Poecile atricapillus*, which breed sympatrically in boreal habitats.

In phylogenetic analyses, *C. guttatus* has been reconstructed as the sister species of *C. occidentalis*, and this pair is more closely related to Ruddy-capped Nightingale-Thrush *C. frantzii* and Black-billed Nightingale-Thrush *C. gracilirostris* (also sister species) than to any of the long-distance migratory species (Voelker *et al*. 2013, Everson *et al*. 2019). The common name Hermit Nightingale-Thrush *C. guttatus* (Pallas) will strengthen the association of these closely related species (Table 2). For the same reasons, I propose the common names Veery Nightingale-Thrush *C. fuscescens* (Stephens), Grey-cheeked Nightingale-Thrush *C. minimus* (Lafresnaye) and Bicknell's Nightingale-Thrush *C. bicknelli* (Ridgway).

Acknowledgements

I am grateful to Nathan H. Rice, Jason D. Weckstein, Kenn Kaufman, Guy M. Kirwan, Edward C. Dickinson and Richard Schodde for commenting on early drafts of the manuscript. Gary Rosenberg, Nathaniel Shoobs, Paul Callomon and Daniel F. Lane provided advice on taxonomic matters. Gary Shugart and Dennis Paulson salvaged and shipped numerous frozen birds for this study. Dorothy Stoffa gave permission to collect specimens on private land. Joseph Sweeney assisted with field work. Jennifer Vess, Alexandria Capone, Evan Peugh and Kelsey Manahan provided assistance in the ANSP Library and Archives. Christopher M. Milensky and Carla J. Dove provided access to USNM 2040. Michael Brooke shared information about the Univ. of Cambridge collection. Therese M. Catanach, Emily Ostrow, David Peet, Charles W. Cruit, Spencer C. Galen, Dana Stott Cohen and Janice Dispoto provided invaluable assistance and camaraderie in the specimen preparation lab. This work was completed under US Fish and Wildlife Service (USFWS) Migratory Bird Permit MB019575-1, and US Dept. of Agriculture (USDA) APHIS permit 44877. Nomenclature in this paper was reviewed by the Working Group on Avian Nomenclature of the International Ornithologists' Union.

References:

Aldrich, J. W. 1968. Population characteristics and nomenclature of the Hermit Thrush. *Proc. US Natl. Mus*. 124(3637): 1–33.

Allen, J. A. 1864. Catalogue of the birds found at Springfield, Mass., with notes on their migrations, habits, &c.; together with a list of those birds found in the state not yet observed at Springfield. *Proc. Essex Institute* 4: 48–98.

AOU (American Ornithologists' Union). 1889. *Check-list of North American birds*. American Ornithologists' Union, Washington DC.

AOU (American Ornithologists' Union). 1895. *Check-list of North American birds*. Second edn. American Ornithologists' Union, New York, NY.

AOU (American Ornithologists' Union). 1902. Eleventh supplement to the American Ornithologists' Union *Check-list of North American birds*. *Auk* 19: 315–342.

AOU (American Ornithologists' Union). 1910. *Check-list of North American birds*. Third edn. American Ornithologists' Union, New York, NY.

AOU (American Ornithologists' Union). 1931. *Check-list of North American birds*. Fourth edn. American Ornithologists' Union, Lancaster, PA.

AOU (American Ornithologists' Union). 1944. Nineteenth supplement to the American Ornithologists' Union *Check-list of North American birds*. *Auk* 61: 441–464.

ISSN-2513-9894 (Online)

AOU (American Ornithologists' Union). 1957. *Check-list of North American birds*. Fifth edn. American Ornithologists' Union, Ithaca, NY.
AOU (American Ornithologists' Union). 1973. Thirty-second supplement to the American Ornithologists' Union *Check-list of North American birds*. *Auk* 90: 411–419.
AOU (American Ornithologists' Union). 1983. *Check-list of North American birds*. Sixth edn. American Ornithologists' Union, Lawrence, KS.
AOU (American Ornithologists' Union). 1998. *AOU Check-list of North American birds*. Seventh edn. American Ornithologists' Union. Washington, DC.
Audubon, J. J. 1839. *Ornithological biography*, vol. 5. Adam & Charles Black, Edinburgh.
Baird, S. F. 1864. Review of American birds in the museum of the Smithsonian Institution, pt. 1. *Smiths. Misc. Coll*. 181: 1–478.
Baird, S. F., Cassin, J. & Lawrence, G. 1858. *Explorations and surveys for a railroad route from the Mississippi River to the Pacific Ocean*, vol. 9. Beverly Tucker, Washington DC.
Baird, S. F., Cassin, J. & Lawrence, G. 1860. *The birds of North America; the descriptions of species based chiefly on the collections in the Museum of the Smithsonian Institution*. D. Appleton & Co., New York.
Baird, S. F., Brewer, T. M. & Ridgway, R. 1874. *A history of North American birds*, vol. 1. Little, Brown & Co., Boston, MA.
Bangs, O. 1902. On a second collection of birds made in Chiriquí, by W. W. Brown, Jr. *Proc. New England Zoöl. Cl*. 3: 15–70.
Bangs, O. 1930. Types of birds now in the Museum of Comparative Zoology. *Bull. Mus. Comp. Zool*. 70: 145–426.
Bangs, O. & Penard, T. E. 1921. The name of the eastern Hermit Thrush. *Auk* 38: 432–434.
Bay, R. A. & Ruegg, K. 2017. Genomic islands of divergence or opportunities for introgression? *Proc. Roy. Soc. B* 284: 20162414.
Beckham, C. W. 1887. Additional notes on the birds of Pueblo County, Colorado. *Auk* 4: 120–125.
Belding, L. 1889. Description of a new thrush from Calaveras County, California. *Proc. Calif. Acad. Sci*. (2)2: 18–19.
Bent, A. C. 1949. Life histories of North American thrushes, kinglets, and their allies. *Bull. US Natl. Mus*. 196: 1–454.
Bond, G. M. 1963. Geographic variation in the thrush *Hylocichla ustulata*. *Proc. US Natl. Mus*. 114: 373–87.
Brewer, T. M. 1844. Minutes of the July 17 meeting. *Proc. Boston Soc. Nat. Hist*. 1: 190–191.
Brewster, W. 1902. Birds of the Cape Region of Lower California. *Bull. Mus. Comp. Zool*. 41: 1–241.
Brewster, W. 1906. The birds of the Cambridge region of Massachusetts. *Mem. Nuttall Orn. Cl*. 4: 1–426.
Burleigh, T. D. & Peters, H. S. 1948. Geographic variation in Newfoundland birds. *Proc. Biol. Soc. Wash*. 61: 111–126.
Cabanis, J. 1847. Ornithologische notizen. *Archiv Naturgeschichte* 13: 186–256.
Chesser, R. T., Burns, K. J., Cicero, C., Dunn, J. L., Kratter, A. W., Lovette, I. J., Rasmussen, P. C., Remsen, J. V., Stotz, D. F., Winger, B. M. & Winker, K. 2018. Check-list of North American birds. American Ornithological Society. http://checklist.aou.org/taxa (accessed July 2019).
Chesser, R. T., Burns, K. J., Cicero, C., Dunn, J. L., Kratter, A. W., Lovette, I. J., Rasmussen, P. C., Remsen, J. V., Stotz, D. F. & Winker, K. 2019. Sixtieth supplement to the American Ornithological Society's *Check-list of North American birds*. *Auk* 136: https://doi.org/10.1093/auk/ukz042.
Clement, P. 2000. *Thrushes*. Princeton Univ. Press.
Cooper, J. G. 1870. *Ornithology*, vol. 1. Welch, Bigelow and Co., Cambridge, MA.
Corning, H. (ed.) 1969. *Letters of John James Audubon 1826–1840*. Kraus Reprint Co., New York.
Coues, E. 1872. *Key to North American birds*. Naturalists' Agency, Salem, MA.
Coues, E. 1878. Birds of the Colorado Valley. *US Geol. Survey, Misc. Publ*. 11: 1–807.
Cumming, R. A. 1933. Descriptions of a proposed new race of Song Sparrow and of a Hermit Thrush. *Murrelet* 14: 78–79.
Deignan, H. G. 1961. Type specimens of birds in the United States National Museum. *Bull. US Natl. Mus*. 221: 1–718.
Dellinger, R., Wood, P. B., Jones, P. W. & Donovan, T. M. 2012. Hermit Thrush (*Catharus guttatus*), v. 2.0. *In* Poole, A. F. (ed.) *The birds of North America*. Cornell Lab of Ornithology, Ithaca, NY. https://doi.org/10.2173/bna.261 (accessed July 2019).
Delmore, K. E. & Irwin, D. E. 2014. Hybrid songbirds employ intermediate routes in a migratory divide. *Ecol. Lett*. 17: 1211–1218.
de Queiroz, K. 2007. Species concepts and species delimitation. *Syst. Biol*. 56: 879–886.
Dickey, D. R. & van Rossem, A. J. 1938. The birds of El Salvador. *Publ. Field Mus. Nat. Hist., Zool. Ser*. 23: 1–609.
Everson, K. M., McLaughlin, J. F., Cato, I. A., Evans, M. M., Gastaldi, A. R., Mills, K. K., Shink, K. G., Wilbur, S. M. & Winker, K. 2019. Speciation, gene flow, and seasonal migration in *Catharus* thrushes (Aves: Turdidae). *Mol. Phyl. & Evol*. 139: https://doi.org/10.1016/j.ympev.2019.106564.

ISSN-2513-9894 (Online)

Fisher, A. K. 1893. Report on the ornithology of the Death Valley expedition of 1891, comprising notes on the birds observed in southern California, southern Nevada, and parts of Arizona and Utah. Pp. 7–158 *in North American Fauna*, vol. 7(2). Govt. Printing Office, Washington DC.
Fries, W. H. 2006. *The double elephant folio: the story of Audubon's Birds of America*. Zenaida Publishing, Amherst, MA.
Gill, F. & Donsker, D. (eds.) 2019. IOC world bird list (v. 9.1). doi: 10.14344/IOC.ML.9.1 (accessed July 2019).
Giraud, J. P. 1844. *The birds of Long Island*. Wiley & Putnam, New York.
Gmelin, J. F. 1789. *Systema naturae*, vol. 1(2). J. B. Delamollière, Lyon.
Godfrey, W. E. 1952 ['1951']. A new northwestern olive-backed thrush. *Canadian Field-natur.* 65: 172–174.
Graustein, J. E. 1967. *Thomas Nuttall naturalist, explorations in America 1808–1841*. Harvard Univ. Press, Cambridge, MA.
Grinnell, J. 1902. Check-list of California birds. *Pacific Coast Avifauna* 3: 1–98.
Grinnell, J. 1918. Seven new or noteworthy birds from east-central California. *Condor* 20: 86–90.
Halley, M. R. 2018. The ambiguous identity of *Turdus mustelinus* Wilson, and a neotype designation for the Veery *Catharus fuscescens* (Stephens). *Bull. Brit. Orn. Cl.* 138: 78–91.
Halley, M. R., Klicka, J., Sesink Clee, P. & Weckstein, J. D. 2017. Restoring the species status of *Catharus maculatus* (Aves: Turdidae), a secretive Andean thrush, with a critique of the yardstick approach to species delimitation. *Zootaxa* 4276: 387–404.
Heckscher, C. M., Taylor, S. M. & Sun, C. C. 2014. Veery (*Catharus fuscescens*) nest architecture and the use of alien plant parts. *Amer. Midland Natur.* 171: 157–164.
Hellmayr, C. E. 1934. Catalogue of birds of the Americas and the adjacent islands, pt. 7. *Publ. Field Mus. Nat. Hist., Zool. Ser.* 13(7): 1–531.
Henshaw, H. W. 1879. Remarks upon *Turdus pallasi* and its varieties. *Bull. Nuttall Orn. Cl.* 4: 134–139.
del Hoyo, J. & Collar, N. J. 2016. *HBW and BirdLife International illustrated checklist of the birds of the world*, vol. 2. Lynx Edicions, Barcelona.
Hunter, C. (ed.) 1983. *Life and letters of Alexander Wilson*. American Philosophical Society, Philadelphia, PA.
ICZN (International Commission on Zoological Nomenclature). 1999. *International code of zoological nomenclature*. Fourth edn. International Trust for Zoological Nomenclature, London.
Klicka, J., Voelker, G. & Spellman, G. M. 2005. A molecular phylogenetic analysis of the "true thrushes" (Aves: Turdinae). *Mol. Phyl. & Evol.* 34: 486–500.
Lafresnaye, M. F. 1848. Description de quelques oiseaux nouveaux de Caracas (province de Venezuela) et de Bogota. *Rev. Zool. Soc. Cuvierienne* 11: 2–12.
Linnaeus, C. 1766. *Systema naturae*, vol. 1. Laurentius Salvius, Holmiae.
Lutz, H. J. 1930. The vegetation of Heart's Content, a virgin forest in northwestern Pennsylvania. *Ecology* 11: 1–29.
Mack, D. E. & Yong, W. 2000. Swainson's Thrush (*Catharus ustulatus*), v. 2.0. *In* Poole, A. F. & Gill, F. B. (eds.) *The birds of North America*. Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bna.540 (accessed July 2019).
Maynard, C. J. 1881. *The birds of eastern North America; with original descriptions of all the species which occur east of the Mississippi River, between the Arctic Circle and the Gulf of Mexico, with full notes upon their habits, etc*. C. J. Maynard & Co., Newtonville, MA.
Mearns, B. & Mearns, R. 2007. *John Kirk Townsend, collector of Audubon's western birds and mammals*. Privately published, Dumfries.
Nuttall, T. 1832. *Manual of the ornithology of the United States and of Canada*, vol. 1. First edn. Hilliard & Brown, Cambridge, MA.
Nuttall, T. 1834. *Manual of the ornithology of the United States and of Canada*, vol. 2. First edn. Hilliard, Gray & Co., Boston, MA.
Nuttall, T. 1840. *Manual of the ornithology of the United States and of Canada*. Second edn. Hilliard, Gray & Co., Boston, MA.
Nuttall, T. 1841. Descriptions of new species and genera of plants in the natural order of the Compositae: collected in a tour across the continent to the Pacific, a residence in Oregon, and a visit to the Sandwich Islands and Upper California, during the years 1834 and 1835. *Trans. Amer. Philos. Soc.* 7: 283–485.
Oberholser, H. C. 1898. Description of a new North American thrush. *Auk* 15: 303–306.
Oberholser, H. C. 1899. Description of a new *Hylocichla*. *Auk* 16: 23–25.
Oberholser, H. C. 1956. A new hermit thrush from Canada. *Proc. Biol. Soc. Wash.* 69: 69–70.
Osgood, W. H. 1901. New subspecies of North American birds. *Auk* 18: 179–306.
Osgood, W. H. 1909. Biological investigations in Alaska and Yukon Territory. Pp. 7–96 *in North American Fauna*, vol. 30. US Dept. of Agriculture Bureau of Biological Survey. Govt. Printing Office, Washington DC.
Ouellet, H. 1993. Bicknell's Thrush: taxonomic status and distribution. *Wilson Bull.* 105: 545–572.
Pallas, P. S. 1811. *Zoographia Rosso-asiatica*. Petropoli, St. Petersburg.
Parkinson, P. 1988. William Swainson's ornithological collections. *Arch. Nat. Hist.* 15: 77–88.

ISSN-2513-9894 (Online)

Phillips, A. R. 1962 ['1961']. La acrecencia de errores acerca de la ornitologia de México, con notas sobre *Myiarchus*. *An. Inst. Biol*. 30: 349–368.
Phillips, A. R. 1991. *The known birds of North and Middle America*, pt. 2. Privately published.
Piacentini, V. Q., Aleixo, A., Agne, C. E., Maurício, G. N., Pacheco, J. F., Bravo, G. A., Brito, G. R. R., Naka, L. N., Olmos, F., Posso, S., Silveira, L. F., Betini, G. S., Carrano, E., Franz, I., Lees, A. C., Lima, L. M., Pioli, D., Schunck, F., do Amaral, F. R., Bencke, G. A., Cohn-Haft, M., Figueiredo, L. F. A., Straube, F. C. & Cesari, E. 2015. Annotated checklist of the birds of Brazil by the Brazilian Ornithological Records Committee / Lista comentada das aves do Brasil pelo Comitê Brasileiro de Registros Ornitológicos. *Rev. Bras. Orn*. 23: 91–298.
Pyle, P. 1997. *Identification guide to North American birds*, pt. 1. Slate Creek Press, Bolinas, CA.
Rand, A. L. & Traylor, M. A. 1954. *Manual de las aves de El Salvador*. Universidad de El Salvador.
Ridgway, R. 1869. Notes of certain obscurely known species of American birds (based on specimens in the museum of the Smithsonian Institution). *Proc. Acad. Nat. Sci. Phil*. 21: 125–135.
Ridgway, R. 1880. Revisions of nomenclature of certain North American birds. *Proc. US Natl. Mus*. 3: 1–162.
Ridgway, R. 1882. Descriptions of two new thrushes from the United States. *Proc. US Natl. Mus*. 4: 374–379.
Ridgway, R. 1907. The birds of North and Middle America, pt. 4. *Bull. US Natl. Mus*. 50: 1–973.
Ridgway, R. 1912. *Color standards and color nomenclature*. Privately published, Washington DC.
Ripley, S. D. 1964. Subfamily Turdinae, thrushes. Pp. 13–227 *in* Mayr, E. & Paynter, R. A. (eds.) *Check-list of birds of the world*, vol. 10. Mus. Comp. Zool., Cambridge, MA.
Rooney, T. & Dress, W. J. 1996. Species loss over sixty-six years in the ground-layer vegetation of Heart's Content, and old-growth forest in Pennsylvania, USA. *Natural Areas J*. 17: 297–305.
Ruegg, K. 2007. Divergence between subspecies groups of Swainson's Thrush (*Catharus ustulatus ustulatus* and *C. u. swainsoni*). *Orn. Monogr*. 63: 67–77.
Ruegg, K. & Smith, T. B. 2002. Not as the crow flies: a historical explanation for circuitous migration in Swainson's Thrush (*Catharus ustulatus*). *Proc. Roy. Soc. B* 269: 1375–81.
Salvin, O. & Godman, F. D. 1879. *Biologia Centrali-Americana*, Aves, vol. 1. R. H. Porter, London.
Sclater, P. L. 1859. A synopsis of the thrushes (Turdidae) of the New World. *Proc. Zool. Soc. Lond*. 1859: 321–347.
Seebohm, H. 1881. *Catalogue of the birds in the British Museum*, vol. 5. Trustees of the Brit. Mus., London.
Seebohm, H. 1902. *A monograph of the Turdidae, or family of thrushes*, vol. 1. Henry Sotheran & Co., London.
Stephens, J. F. 1817. *General zoology, or Systematic natural history*, vol. 10, part 1. T. Davison, London.
Stone, W. 1899. A study of the type specimens in the collection of the Academy of Natural Sciences of Philadelphia, with a brief history of the collection. *Proc. Acad. Nat. Sci. Phil*. 51: 5–62.
Stone, W. 1906. A bibliography and nomenclator of the ornithological works of John James Audubon. *Auk* 23: 298–312.
Swainson, W. & Richardson, J. 1831. *Fauna Boreali-Americana; or the zoology of the northern parts of British America*, pt. 2. John Murray, London.
Taczanowski, L. 1884. *Ornithologie du Pérou*. R. Friedländer & Sohn, Berlin.
Townsend, J. K. 1839. *Narrative of a journey across the Rocky Mountains, to the Columbia River, and a visit to the Sandwich Islands, Chili, &c.; with a scientific appendix*. H. Perkins, Boston, MA.
Tschudi, J. J. von. 1845. *Untersuchungen über die Fauna Peruana*. Scheitlin & Zollikofer, St. Gallen.
Voelker, G., Bowie, R. C. K. & Klicka, J. 2013. Gene trees, species trees and Earth history combine to shed light on the evolution of migration in a model avian system. *Mol. Ecol*. 22: 3333–3344.
Wetmore, A. 1943. The birds of southern Veracruz, Mexico. *Proc. US Natl. Mus*. 93: 215–340.
White, S. E. 1893. Birds observed on Mackinac Island, Michigan, during the summers of 1889, 1890, and 1891. *Auk* 10: 221–230.
Wilson, A. 1812. *American ornithology, or, The natural history of the birds of the United States*, vol. 5. Bradford & Inskeep, Philadelphia, PA.
Wilson, A., Bonaparte, C. L. & Jardine, W. 1832. *American ornithology, or, The natural history of the birds of the United States*. Whittaker, Treacher & Arnot, London & Stirling & Kenney, Edinburgh.

Address: Academy of Natural Sciences of Drexel University, Dept. of Biodiversity, Earth & Environmental Science, Drexel Univ., Philadelphia, Pennsylvania 19104, USA, e-mail: matthewhalley@gmail.com

Appendix

Synonyms and taxonomic combinations of *C. swainsoni* (Cabanis *in* Tschudi), *C. u. ustulatus* (Nuttall), *C. u. oedicus* (Oberholser) and *C. guttatus* (Pallas), and their principal citations. For clarity, references to composite taxa published prior to 1840 are excluded, including *T. minor* J. F. Gmelin, 1789, and Wilson's (1812) secondary composites (reviewed by Halley 2018). Accordingly, the following synonymy of *C. swainsoni* begins with Giraud (1844) and Brewer (1844). The name *T. aonalaschkae* J. F. Gmelin, 1789, is included in the synonymy of *C. guttatus* to clarify the resurgent use of that name in the late 19th century; it was deemed unidentifiable (AOU 1902: 215). Due to a lack of available material for comparison, subspecies within the *C.*

ISSN-2513-9894 (Online)

swainsoni and *C. guttatus* complexes are listed among the synonyms of those complexes. The subspecies *C. u. phillipsi* Ramos *in* Phillips, 1991, is omitted for the same reason.

Catharus swainsoni (Cabanis *in* Tschudi)[2]
Boreal Nightingale-Thrush

Turdus olivaceus Giraud 1844: 91 (junior homonym of *T. olivaceus* Linnaeus, 1766).
Merula olivacea Brewer 1844: 191 (idem).
Turdus swainsoni Cabanis *in* Tschudi 1845: 28; Sclater 1859: 326; Cooper 1870: 6; Coues 1872: 73; Baird *et al*. 1874: 14; Coues 1878: 34; Salvin & Godman 1879: 10; Seebohm 1881: 201; Taczanowski 1884: 487; Seebohm 1902: 179.
Turdus swainsonii Cabanis 1847: 205; Baird *et al*. 1858: 216; Baird 1864: 19; Allen 1864: 56; Ridgway 1869: 128; Maynard 1881: 6.
Turdus ustulatus swainsoni Beckham 1887: 125.
Turdus ustulatus swainsonii White 1893: 229; AOU 1889: 67; Fisher 1893: 145; AOU 1895: 318.
Hylocichla ustulata almae Oberholser 1898: 304; Dickey & van Rossem 1938: 457; Wetmore 1943: 305; AOU 1944: 457; Rand & Traylor 1954: 230; Bond 1963: 380.
Hylocichla ustulata swainsonii Bangs 1902: 49; Ridgway 1907: 55.
Hylocichla ustulata swainsoni AOU 1910: 361; Osgood, 1909: 43; AOU 1931: 259; Hellmayr 1934: 457; Dickey & van Rossem 1938: 456; Rand & Traylor 1954: 230; Bond 1963: 379.
Hylocichla ustulata clarescens Burleigh & Peters 1948: 118.
Hylocichla ustulata incana Godfrey '1951' [= 1952]: 173.
Catharus ustulatus Ripley 1964: 171; AOU 1983: 556 (in part), 1998: 505 (in part); Chesser *et al*. 2018 (in part).
Catharus ustulatus almae Ripley, 1964: 171; Clement, 2000: 313.
Catharus ustulatus swainsoni Ripley 1964: 172; Ramos *in* Phillips 1991: 89; Clement 2000: 314; Gill & Donsker 2019.
Catharus ustulatus appalachiensis Ramos *in* Phillips 1991: 90.
Catharus ustulatus incanus Ramos *in* Phillips 1991: 91.
Catharus swainsoni Piacentini *et al*. 2015; del Hoyo & Collar 2016.

Catharus ustulatus ustulatus (Nuttall)
(Northern) Pacific Nightingale-Thrush

Turdus ustulatus Nuttall, 1840: 400 (misidentified, neotypification pending); Baird *et al*. 1858: 215; Sclater 1859: 326; Baird 1864: 18; Ridgway 1869: 127; Cooper 1870: 5; Salvin & Godman 1879: 11 (in part); Seebohm 1881: 202 (in part); AOU 1889: 67 (in part), 1895: 318 (in part); Stone 1899: 19; Seebohm 1902: 175 (in part).
Turdus swainsoni* var. *ustulatus Coues 1872: 73 (in part); Baird *et al*. 1874: 16 (in part); Coues 1878: 35 (in part).
Hylocichla ustulata Brewster 1902: 210.
Hylocichla ustulata ustulata Grinnell 1902: 73 (in part); Ridgway 1907: 52 (in part); AOU 1910: 361 (in part), 1931: 259 (in part); Hellmayr 1934: 456 (in part); AOU 1957: 438 (in part); Deignan 1961: 431; Bond 1963: 378.
Catharus ustulatus ustulatus Ripley 1964: 172; Ramos *in* Phillips 1991: 91; Clement 2000: 313 (in part); Mack & Yong 2000.
Catharus ustulatus AOU 1983: 556 (in part), 1998: 505 (in part).

Catharus ustulatus oedicus (Oberholser)
(Southern) Pacific Nightingale-Thrush

Turdus ustulatus Salvin & Godman 1879: 11 (in part); Seebohm 1881: 202 (in part); AOU 1889: 67 (in part), 1895: 318 (in part); Seebohm 1902: 175 (in part).
Turdus swainsoni* var. *ustulatus Coues 1872: 73 (in part); Baird *et al*. 1874: 16 (in part); Coues 1878: 35 (in part).
Hylocichla ustulata ædica Oberholser 1899: 23; Brewster 1902: 211; Deignan 1961: 432; Bond 1963: 378.
Hylocichla ustulata ustulata Grinnell 1902: 73 (in part); Ridgway 1907: 52 (in part); AOU 1910: 361 (in part), 1931: 259 (in part); Hellmayr 1934: 456 (in part); AOU 1957: 438 (in part); Bond 1963: 378.
Catharus ustulatus oedicus Ripley 1964: 172; Ramos *in* Phillips 1991: 92; Clement 2000: 313 (in part); Mack & Yong 2000; Gill & Donsker 2019.
Catharus ustulatus AOU 1983: 556 (in part), 1998: 505 (in part).

[2] Jean Louis Cabanis (1816–1906) wrote the ornithological portions of Tschudi's (1845) *Untersuchungen über die Fauna Peruana*, including the following passage: '*T. Swainsoni* Cab. MSS. *Merula Wilsoni* Swains. (nec Bonap.) Faun. Bor. Amer. II. p. 182 excl. Synon.' Authorship of the name *T. swainsoni* has often been misattributed to Tschudi (e.g., AOU 1998: 505; see Cabanis 1847, and Sclater 1859: 326).

ISSN-2513-9894 (Online)

Catharus guttatus (Pallas)
Hermit Nightingale-Thrush

Turdus aonalaschkae J. F. Gmelin 1789: 808 (based on young bird, unidentifiable; see AOU 1902: 315); Ridgway 1880: 1; Seebohm 1881: 200; AOU 1889: 67; Fisher 1893: 145; AOU 1895: 318; Seebohm 1902: 193.
Muscicapa guttata Pallas '1826' [=1811]: 465.
Turdus nanus Audubon 1839: 201; Townsend 1839: 153; Nuttall 1840: 396; Baird *et al*. 1858: 213; Sclater 1859: 325; Baird 1864: 15; Ridgway 1869: 129; Cooper 1870: 4.
Turdus guttatus Cabanis *in* Tschudi 1845: 187.
Turdus pallasii Cabanis 1847: 205; Baird *et al*. 1858: 212; Sclater 1859: 325; Baird 1864: 14; Allen 1864: 56; Coues 1872: 72; Maynard 1881: 8.
Turdus silens Sclater 1859: 325.
Turdus audubonii Baird, 1864: 16; Salvin & Godman 1879: 14; Seebohm 1881: 198, 1898: 197.
Turdus pallasi Ridgway 1869: 128; Baird *et al*. 1874: 18; Coues 1878: 20; Henshaw 1879; Salvin & Godman 1879: 13; Seebohm 1881: 199, 1898: 185.
Turdus audubonii Ridgway 1869: 129.
Turdus pallasii audubonii Coues 1872: 72.
Turdus pallasii nanus Coues 1872: 72.
Turdus pallasi* var. *nanus Baird *et al*. 1874: 20.
Turdus pallasi* var. *audubonii Baird *et al*. 1874: 21.
Turdus aonalaschkae pallasi Ridgway 1880: 1.
Turdus aonalaschkae audubonii Ridgway 1880: 1; Beckham 1887: 124; AOU 1889: 67; Fisher 1893: 146; AOU 1895: 319.
Turdus aonalaschkae pallasii AOU 1889: 67, 1895: 319.
Turdus sequoiensis Belding 1889: 18.
Hylocichla guttata sequoiensis Ridgway 1907: 44; AOU 1910: 362, 1931: 258; Hellmayr 1934: 455.
Hylocichla aonalaschkae verecunda Osgood 1901: 183; Grinnell 1902: 73.
Hylocichla aonalaschkae aonalaschkae Grinnell 1902: 73.
Hylocichla aonalaschkae slevini Grinnell 1902: 73.
Hylocichla aonalaschkae sequoiensis Grinnell 1902: 73.
Hylocichla guttata Brewster 1902: 211; AOU 1957: 436.
Hylocichla guttata nana Brewster 1902: 212; Ridgway 1907: 42; Bangs 1930: 331; Hellmayr 1934: 454.
Hylocichla guttata audubonii Brewster 1902: 212; Ridgway 1907: 46; AOU 1910: 362, 1931: 258; Hellmayr 1934: 455.
Hylocichla guttata guttata Ridgway 1907: 39; AOU 1910: 361, 1931: 258; Hellmayr 1934: 453.
Hylocichla guttata slevini Ridgway 1907: 44; AOU 1910: 362, 1931: 258; Hellmayr 1934: 454.
Hylocichla guttata pallasii Ridgway 1907: 48.
Hylocichla guttata pallasi AOU 1910: 362.
Hylocichla guttata nanus AOU 1910: 362, 1931: 258.
Hylocichla guttata polionota Grinnell 1918: 89; AOU 1931: 258; Hellmayr 1934: 455.
Hylocichla guttata faxoni Bangs & Penard 1921: 433; Bangs 1930: 332; AOU 1931: 259; Hellmayr 1934: 456.
Hylocichla guttata vaccinia Cumming 1933: 79.
Hylocichla guttata crymophila Burleigh & Peters 1948: 117.
Hylocichla guttata euboria Oberholser 1956: 69.
Catharus guttatus Phillips '1961' [=1962]; Ripley 1964; AOU 1983: 556, 1998: 505; Chesser *et al*. 2018; Gill & Donsker 2019.
Catharus guttatus munroi Phillips '1961' [=1962]: 351, 1991: 80.
Catharus guttatus guttatus Phillips '1961' [=1962]: 353; Ripley 1964: 173; Aldrich 1968: 14; AOU 1973: 416; Phillips 1991: 81.
Catharus guttatus verecundus Phillips '1961' [=1962]: 354, 1991: 80.
Catharus guttatus slevini Phillips '1961' [=1962]: 355; Ripley 1964: 174; Aldrich 1968: 20; Phillips 1991: 84.
Catharus guttatus oromelus Phillips '1961' [=1962]: 356; Aldrich 1968: 23; Phillips 1991: 82.
Catharus guttatus jewetti Phillips '1961' [=1962]: 356, 1991: 83.
Catharus guttatus audubonii Phillips '1961' [=1962]: 359; Ripley 1964: 174; Aldrich 1968: 22; Phillips 1991: 86.
Catharus guttatus sequoiensis Phillips '1961' [=1962]: 360; Ripley 1964: 174; Aldrich 1968: 22; Phillips 1991: 84.
Catharus guttatus osgoodi Phillips 1991: 81.
Catharus guttatus vaccinius Aldrich 1968: 20; Phillips 1991: 82.
Catharus guttatus nanus Ripley 1964: 173; Aldrich, 1968: 18; Phillips 1991: 77.
Catharus guttatus polionotus Ripley 1964: 174; Phillips 1991: 85.
Catharus guttatus faxoni Ripley 1964: 175; Aldrich 1968: 26.
Catharus guttatus crymophilus Ripley 1964: 175; Aldrich 1968: 14.
Catharus guttatus euborius Aldrich 1968: 25; Phillips 1991: 77.

ISSN-2513-9894 (Online)

The earliest record of Raiatea or Leeward Society Islands Fruit Dove *Ptilinopus chrysogaster*

by Michael Lee & Alice Cibois

Received 25 April 2019; revised 7 July 2019; published 20 September 2019

http://zoobank.org/urn:lsid:zoobank.org:pub:8488F269-C48B-4F52-BBA2-2B8FB7208639

Summary.—We report the earliest record of Raiatea or Leeward Society Islands Fruit Dove *Ptilinopus chrysogaster* by R. P. Lesson during the *La Coquille* expedition in 1823 on the island of Bora Bora in the Society Islands. This antedates the previous earliest record of the species by 30 years.

Among the birds of Oceania, the fruit doves (*Ptilinopus* spp.) and their close allies *Drepanoptila*, *Alectroenas* and *Chrysoena* (Columbidae) represent one of the most widespread groups. Probably originating in the proto-New Guinea region where they remain especially diverse fruit doves are distributed both sides of Wallace's Line, and are Oceania's most taxonomically diverse family of landbirds (Cibois *et al*. 2014, 2015). With at least 45 extant species, *Ptilinopus* occur throughout New Guinea, Indonesia, the Philippines, Australia and Oceania, with the largest ('*P. purpuratus*') clade involving taxa in the Moluccas, New Guinea, Micronesia and Polynesia. A subgroup of this clade, variously considered to comprise eight extant species (del Hoyo & Collar 2014) or seven species (Thibault & Cibois 2017), inhabits the Cook, Society, Marquesas, Tuamotu and Austral archipelagos of eastern Polynesia, the limit of the fruit dove's eastern trans-oceanic dispersal.

Raiatea or Leeward Society Islands Fruit Dove *Ptilinopus chrysogaster* is monotypic and currently known from four of the Leeward Society Islands of French Polynesia: Huahine, Raiatea, Taha'a and Bora Bora. It was also reported

Figure 1. Lithograph of the holotype of Raiatea or Leeward Society Islands Fruit Dove *Ptilinopus chrysogaster*, by J. Wolf, in *Proc. Zool. Soc. Lond.* 1853: Pl. LIV (courtesy Biodiversity Heritage Library: https://www.biodiversitylibrary.org/item/96679#page/77/mode/1up)

ISSN-2513-9894 (Online)

Figure 2. Bora Bora where the *La Coquille* stayed from 25 May to 9 June 1823. 'Vue de l'île Borabora'. Engraving by Tardieu, after Lejeune and Chazal. Pl. 16 *in Voyage autour du monde, exécuté par ordre du Roi, sur la corvette La Coquille*, etc. *Atlas histoire du voyage*, 1828 (image courtesy Auckland War Memorial Museum)

on Maupiti but has not been recorded there since 1973 and is now considered locally extinct (Thibault & Cibois 2017). *P. chrysogaster* was named by Gray but he was unclear as to its provenance, suggesting incorrectly '*Hab.* – ? Probably from Otaheiti' (Gray 1853: 48; Fig. 1).

The Natural History Museum at Tring catalogue details relating to the type specimen of *P. chrysogaster* state that it was 'Presented by Verreaux, fide. Gray 1856' (https://www.nhm.ac.uk/research-curation/scientific-resources/collections/zoological-collections/bird-type-specimens/detail.dsml?vol=1&page=61&refer=browse&sort=ID&beginIndex=9&listPageURL=browse%2edsml%3fsort%3dID%26vol%3d1%26page%3d61). 'Verreaux' presumably refers to Maison Verreaux of Paris, the 19th-century firm of naturalists, collectors, taxidermists and traders of natural history specimens.

Gray's type locality was later corrected by Murphy (1924: 6) who chose Raiatea from among the known localities. Although he did not justify his choice ('The type of this species in the British Museum was erroneously labeled "Tahiti." Raiatea is here designated the type locality'), Murphy's revision is valid (ICZN 1999, Art. 76A.2). Meanwhile, the precise origin of Gray's type specimen is unknown (Holyoak & Thibault 1984, Thibault & Cibois 2017).

The earliest accepted record of Leeward Society Islands Fruit Dove at Bora Bora was by Wilson who visited the island in 1904 and noted the bird was a 'distinct local form' (Wilson 1907: 376). However, recent research relating to the work of the scientific expedition by the French navy corvette *La Coquille* of 1822–25, under the command of Louis Isidore Duperrey (1786–1865) (Duperrey 1826–30, Cretella 2010), reveals that the first record of the species on Bora Bora (Fig. 2) dates from May 1823—81 years earlier than Wilson's and 30 years prior to Gray's original description. This was by the medical officer and naturalist René Primevère Lesson (1794–1849; Fig. 3) (Lee & Holyoak 2017, Lee 2018).

Among the extensive mineralogical, botanical and zoological specimens brought back by the *La Coquille* expedition, at least 254 bird species were identified, 46 of them considered new to science (Cuvier 1825). Reviewing the nomenclature of the *La Coquille* bird records

ISSN-2513-9894 (Online)

Dickinson *et al*. (2015) identified 86 avian taxa; all but four of these, they adjudged, were named by Lesson, or by his naval surgeon colleague Prosper Garnot (1794–1838), or by the two as co-authors.

Lee & Bruce (2019) identified three further birds from the *La Coquille* expedition, all named by Lesson. Another bird named by Lesson from the expedition but overlooked by both Dickinson *et al*. (2015) and Lee & Bruce (2019) has also been identified (ML unpubl.).

During its Pacific voyage, *La Coquille* called at Tahiti on 2–22 May 1823, where Lesson recorded the Grey-green Fruit Dove, providing a full description and the name *Columba kurukuru* var. *täitensis* which he modified in his 1831 *Traité* to *Columba taïtensis* (Lesson 1831: 472). This was treated as a synonym of *Ptilopus* [*sic*] *purpuratus*, J. F. Gmelin 1789, by Salvadori (1893: 105) (Dickinson *et al*. 2015).

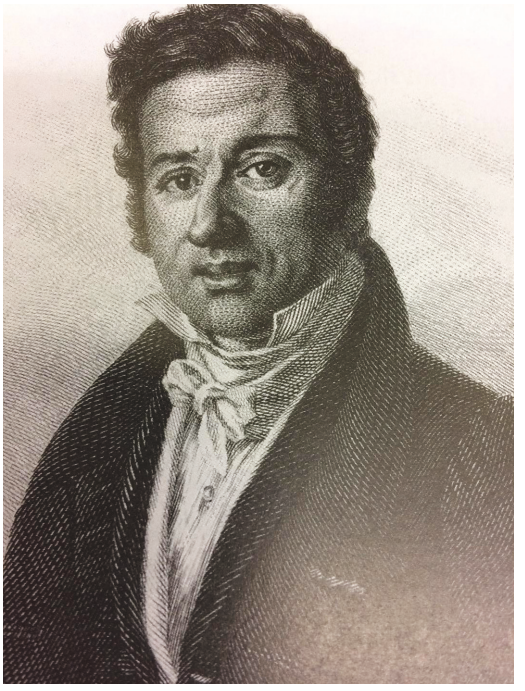


Figure 3. René Primevère Lesson (1794–1849), medical officer and naturalist of the *La Coquille* global expedition, which visited the Society Islands of Tahiti and Bora Bora in 1823. Lesson authored at least 86 new birds, mainly from Oceania, as the result of his work during the *La Coquille* expedition. Despite providing the earliest record, the fruit dove from Bora Bora was not among them (image courtesy Alexander Turnbull Library, National Library of New Zealand, Wellington)

Lesson reported that the fruit dove was by then restricted to the remote mountainous, 'le plus sauvage', regions of Tahiti due to it being hunted by the local people (R. P. Lesson *in* Duperrey 1826: 296–298). This accords with the zoo-archaeological data of Steadman who found that the Society Islands once supported six species of columbids, of which all but the two fruit doves are now extinct. He observed that 'being so palatable, hunting may have been a larger factor in the depletion of columbids than in that of most other landbirds' (Steadman 2006: 321, 329).

After departing Tahiti, *La Coquille* called at the island of Bora Bora, *c*.277 km to the north-west, on 26 May 1823. Bora Bora (727 m, 30.55 km^2) is a high island formed by an eroding extinct basaltic volcano. Geologically it is the second oldest of all the Society Islands, after nearby Maupiti (Neall & Trewick 2008, see also Dickinson *et al*. 2019).

On 27 May Lesson accompanied by two of the ship's navigating officers, Auguste Bérard (1796–1852) and Victor-Charles Lottin (1795–1858), set off to climb the island's central peak in what Lesson described as 'the best weather in the world'. After two hours they reached a circular plateau and after pausing to admire the views of the other islands in the Leeward group, Lesson recounted:

'Ce plateau élevé et solitaire, est l'asile d'une jolie tourterelle qui descend rarement dans la partie inférieure de l'île: depuis plusieurs instants ses roucoulements nous annonçaient sa présence; mais son plumage vert la faisait échapper à nos regards: nous parvînmes pourtant à en tuer plusieurs.'

'Cette tourterelle, que les naturels nomment Ouba est la Columba kurukuru des auteurs, que nous avions trouvée aussi a O-Taiti: son plumage offre quelquefois de légères différences. Au vert brillant des ailes et du dos, succèdent un vert jaunâtre pâles sur la cou,

ISSN-2513-9894 (Online)

Figure 4. Leeward Society Islands Fruit Dove *Ptilinopus chrysogaster* (© Fred Jacq, www.fred-jacq.org)

un jaune-serin sur la gorge, et un jaune vif sur le ventre et sur les couverture inférieures de la queue. Une calotte, d'un violet tendre que borde un auréole jaune, couvre la tête de la manière la plus gracieuse; les rémiges sont œillées de blanc à leur extrémité, le bec est jaunâtre, et les pieds sont oranges. L'ouba a huit pouces de longueur totale.'

In translation:

'This elevated and solitary plateau provides refuge for a pretty turtle dove that rarely descends to the lower part of the island; though its cooing announced its presence; for some time its green plumage allowed it to escape our attention; yet we managed to shoot several of them.'

'This turtle dove, which the natives call 'ouba' ['u'upa], is the *Kurukuru columba* of the authors which we also found at Tahiti: its plumage however offers slight differences. With brilliant green wings and mantle, a pale yellowish green on the neck, a yellow-serin on the throat, and a bright yellow on the belly and on the lower coverts of the tail. A cap, of a tender violet bordered by a yellow halo, covers the head in the most graceful manner; the flight feathers are hemmed in white at their extremity, the bill is yellowish, and the feet are orange. [It] is eight inches in length.' (R. P. Lesson *in* Duperrey 1828: 313–314).

In the first volume of his later book *Voyage autour de monde*, Lesson republished the extract but with some modified wording: 'Cette tourterelle, que les naturels nomme ouba était nouvelle … L'ouba est huit pouces de longueur et appartient à la race des kurukuru.' In translation: 'This turtle dove, that the natives call 'u'upa was new … [it] is eight inches in length and belongs to the race [group] of kurukuru' (Lesson 1838: 475–476).

Here Lesson goes somewhat further than just noting differences in plumage by suggesting that the Bora Bora bird was 'new'. However he stopped short of naming it as

ISSN-2513-9894 (Online)

such, although his conclusion that the bird 'belongs to the race of kurukuru' anticipates its status as a subspecies of the Tahiti bird, a status it held according to most authors until recent molecular analysis found it to be a distinct species, more closely related to the Cook Islands fruit doves (*P. rarotongensis* and *P. r. goodwini*) (Holyoak 1974), than Grey-green Fruit Dove (Cibois *et al*. 2014, del Hoyo & Collar 2014, Thibault & Cibois 2017).

However, despite Lesson recording that he collected specimens, there are no fruit doves from Bora Bora from the *La Coquille* expedition among the extensive present-day collection of fruit dove specimens in MNHN where the expedition collection was lodged (Voisin *et al*. 2004, 2005, 2008, Jansen 2015; P. Boussès pers. comm.). Raiatea or Leeward Society Islands Fruit Dove (Fig. 4) can be added to the list of birds (including three from New Zealand) that Lesson collected, described and provided indigenous names for (Lee & Bruce 2019) but probably due to the press of work did not allocate scientific names, leaving them for subsequent naturalists to name.

Acknowledgements

We thank J.-C. Thibault and Murray Bruce for reviewing the manuscript prior to submission and for their suggested improvements. We also thank Justin Jansen and an anonymous referee for their helpful comments. Thanks also to the Biodiversity Heritage Library (BHL) for access to historic publications, and to the BHL, Alexander Turnbull Library, Wellington, Auckland War Memorial Museum, Auckland, and M. Fred Jacq of Arue, Tahiti, for the provision of images.

References:

Cibois, A., Thibault, J.-C., Bonillo, C., Filardi, C. E., Watling, D. & Pasquet, E. 2014. Phylogeny and biogeography of the fruit doves (Aves: Columbidae). *Mol. Phyl. & Evol*. 70: 442–453.

Cibois, A., Thibault, J.-C., Meyer, J.-Y. & Pasquet, E. 2015. On the origin of sympatric fruit doves in a small and remote Pacific archipelago. *Pacific Sci*. 69: 299–312.

Cretella, M. 2010. The complete collation and dating of the section *Zoologie* of the *Coquille* voyage. *Boll. Malacologico* 46: 83–103.

Cuvier, G. 1825. Rapport sur la partie zoologique de l'Expédition Duperrey. *Ann. Sci. Natur*. 6: 5–20.

Dickinson, E. C., Bruce, M. D. & David, N. 2015. A review of the authorship and dates of publication of birds newly described from the "*Voyage de la Coquille*" (1822-1825) with comments on some spellings. *Zool. Bibliogr*. 3: 69–162.

Dickinson, E. C., Lee, M. Cibois., A., Boussès, P. & Fuchs, J. 2019. Clarifying the nomenclature of *Pomarea* species (Monarchidae) from the Society Islands. *Bull. Brit. Orn. Cl*. 139: 65–74.

Duperrey, L. I. (ed.) 1826–30. *Voyage autour du monde, exécuté par ordre du Roi, sur la corvette La Coquille pendant les années 1822, 1823, 1824 et 1825*. Arthus Bertrand, Paris.

Gray, G. R. 1853. Descriptions of two new species of *Ptilinopus*. *Proc. Zool. Soc. Lond*. 1853: 48.

Holyoak, D. T. 1974. Undescribed land birds from the Cook Islands, Pacific Ocean. *Bull. Brit. Orn. Cl*. 94: 145–150.

Holyoak, D. T. & Thibault. J.-C. 1984. Contribution à l'étude des oiseaux de Polynésie orientale. *Mém. Mus. Natl. Hist. Nat. (Paris), A. Zool*. 127: 1–209.

del Hoyo, J. & Collar, N. J. 2014. *HBW and BirdLife International illustrated checklist of the birds of the world*, vol. 1. Lynx Edicions, Barcelona.

ICZN (International Commission for Zoological Nomenclature). 1999. *International code of zoological nomenclature*. Fourth edn. International Trust for Zoological Nomenclature, London.

Jansen, J. F. J. J. 2015. The bird collection of the Muséum national d'Histoire naturelle, Paris, France: the first years (1793-1825). *J. Natl. Mus. (Prague), Nat. Hist. Ser*. 184: 81–111.

Lee, M. 2018. *Navigators & naturalists – French exploration of New Zealand and the South Seas 1769–1824*. Bateman Books, Auckland.

Lee, M. & Bruce, M. D. 2019. Three additional birds from the "*Voyage de La Coquille*" (1822-1825). *Zool. Bibliogr*. 6(7): 103–112.

Lee, M. & Holyoak, D. T. 2017. The chequered history of Chattering Kingfisher *Todiramphus tutus* on Tahiti: a response. *Bull. Brit. Orn. Cl*. 137: 211–217.

Lesson, R. P. 1831. *Traité d'ornithologie*. F. G. Levrault, Bruxelles.

Lesson, R. P. 1838. *Voyage autour du monde sur la corvette La Coquille*, vol. 1. Alburgh.

Murphy, R. C. 1924. Birds collected during the Whitney South Sea Expedition. I. *Amer. Mus. Novit*. 115: 1–111.

Neall, V. E. & Trewick, S. A. 2008. The age and origins of the Pacific islands – a geologic overview. *Philos. Trans. Roy. Soc. Lond. B. Biol. Sci*. 363: 3293–3308.

Salvadori, T. 1893. *Catalogue of the birds in the British Museum*, vol. 21. Trustees of the British Museum, London.

ISSN-2513-9894 (Online)

Steadman, D. W. 2006. *Extinction & biogeography of tropical Pacific birds*. Univ. of Chicago Press.
Thibault, J.-C. & Cibois, A. 2017. *Birds of eastern Polynesia. A biogeographical atlas*. Lynx Edicions, Barcelona.
Voisin, C., Voisin, J.-F., Jouanin, C. & Bour, R. 2004. Liste des types d'oiseaux des collections du Muséum national d'Histoire naturelle de Paris. 13. Gangas et Pigeons (Pteroclididae et Columbidae, première partie. *Zoosystema* 26: 107–128.
Voisin, C., Voisin, J.-F., Jouanin, C. & Bour, R. 2005. Liste des types d'oiseaux des collections du Muséum national d'Histoire naturelle de Paris. 14: Pigeons (Columbidae), deuxième partie. *Zoosystema* 27: 839–866.
Voisin, C., Voisin, J.-F., Jouanin, C. & Bour, R. 2008. Liste de types d'oiseaux des collections du Muséum national d'Histoire naturelle de Paris. 17: Pigeons (Columbidae), complement. *Zoosystema* 30: 773–779.
Wilson, S. B. 1907. Notes on birds of Tahiti and the Society Group. *Ibis* 49: 373–379.

Addresses: Michael Lee, 336 Seaview Road, Waiheke Island, Auckland, 1081, New Zealand, e-mail: mikeleeauckland@gmail.com. Alice Cibois, Muséum d'Histoire naturelle, CP 6434, CH 1211 Geneva 6, Switzerland, e-mail: Alice.Cibois@ville-ge.ch

ISSN-2513-9894 (Online)

Avifauna of the Lake Kutubu Wildlife Management Area, Papua New Guinea

by Iain A. Woxvold, Jared M. Diamond, K. David Bishop & Leo Legra

Received 28 April 2019; revised 21 July 2019; published 20 September 2019

http://zoobank.org/urn:lsid:zoobank.org:pub:6CFCBF65-33D5-451A-8B4D-F2B7F6157298

Summary.—The Lake Kutubu Wildlife Management Area (WMA) covers approximately 23,500 ha of freshwater lake and surrounding forest environments on the southern slopes of New Guinea's central cordillera in mainland Papua New Guinea (PNG). Ornithological work within the WMA spans more than 50 years, although most of the data are available only in the grey literature and are difficult to obtain. In light of a proposed review of PNG's protected area network, we collate bird records from the WMA and draw upon data from the nearby Agogo Range to consider the potential for additional species to occur within the gazetted area. The WMA inventory stands at 216 species, nearly one-third of all species resident or regularly occurring in the New Guinea region. The high species richness is attributable to the presence of a variety of forest and wetland habitats spanning nearly 600 m elevation, supporting bird species characteristic of lowland, hill and lower montane environments. Resident avifauna include five IUCN threatened or Near Threatened species (New Guinea Harpy Eagle *Harpyopsis novaeguineae*, Gurney's Eagle *Aquila gurneyi*, New Guinea Vulturine Parrot *Psittrichas fulgidus*, Striated Lorikeet *Charmosyna multistriata* and Banded Yellow Robin *Gennaeodryas placens*) and the restricted-range Greater Melampitta *Megalampitta gigantea*. Geographic and elevational range extensions are reported for numerous taxa, and recent data are presented to better document the distributional relationships of species pairs in the genera *Talegalla*, *Megapodius*, *Micropsitta* and *Lonchura*, and of races of Brown Cuckoo-Dove *Macropygia amboinensis* and Double-eyed Fig Parrot *Cyclopsitta diophthalma*.

Papua New Guinea's (PNG's) protected area system covers *c*.4% of its land surface (Adams *et al*. 2017, Leverington *et al*. 2017). Most of the gazetted land is contained within Wildlife Management Areas (WMAs), a legal instrument tailored to function in the context of customary land tenure which accounts for approximately 97% of land in PNG (Allen 2009). Under the WMA system, customary landowners, often in partnership with the government or NGOs, define the boundaries of the area to be protected, establish rules governing the use of its natural resources, and elect local representatives to a Wildlife Management Committee responsible for its regulation and management.

The management of PNG's protected areas has been problematic (Melick *et al*. 2012). Forest loss and degradation continue apace (Bryan *et al*. 2015), WMAs have no legal protection against exploitation (Leverington *et al*. 2017) and, in recent decades, the average rate of loss in most WMAs has been similar to that in unprotected areas (Shearman & Bryan 2011).

In 2014, the PNG government launched its Policy on Protected Areas outlining guidelines for improving the governance and management of protected areas and the biodiversity values they contain (Independent State of Papua New Guinea 2014). The scheme will review the values of existing protected areas and the wishes of customary

ISSN-2513-9894 (Online)

landowners, and decide how each area should be defined under the future Protected Area Network. Following review, each area's protected status may be confirmed, reclassified or degazetted.

Within this context, our knowledge of the avifauna present within PNG's protected areas is highly variable. Detailed information is available for sites that are regularly visited by ornithologists (e.g. Varirata National Park: Eastwood 1997) or that have hosted detailed scientific research programmes (e.g. Crater Mountain WMA and YUS Conservation Area: Mack & Wright 1996, Sinclair 2002, Freeman *et al*. 2013, Mack 2014). At the other extreme, some sites remain biologically unexplored, while others have been the subject of one or more surveys but the data are reported only in the grey literature and the summary information is difficult to obtain.

Lake Kutubu WMA is located in Southern Highlands Province, on the southern slopes of New Guinea's central cordillera *c*.530 km north-west of the national capital Port Moresby (Fig. 1). It was established in 1992 'to conserve the outstanding and internationally significant scenic, geophysical and biodiversity values of the Lake Kutubu WMA, and safeguard the interests and maintain the cultural integrity of its traditional owners' (quoted in D'Cruz 2008: 8–9). Multiple bird surveys have been conducted in the area, with the most recent efforts continuing to further our knowledge of the region's avifauna. Most of the relevant data appear in unpublished NGO reports (*cf*. Schodde & Hitchcock 1968). Here, we review the body of ornithological work conducted within Lake Kutubu WMA, and draw upon the results of surveys conducted on the nearby Agogo Range to consider the potential for additional species to occur in the WMA. This paper is based on a report previously published online (Woxvold & Legra 2018) and incorporates data from additional surveys not available at the time that report was written.

Study area

Lake Kutubu is mainland PNG's largest perched lake. Lying at *c*.820 m above sea level, and covering more than 4,900 ha, it is flanked by high-relief terrain with forested slopes rising more than 400 m above lake level within 1 km of its shore. Lake Kutubu WMA covers some 23,497 ha of the lake and the environs (Leverington *et al*. 2017) to above 1,380 m at Mount Kemenagi near the southern shore (Fig. 1).

Located in the 'Kikori-Lake Kutubu Karst Area' of the Southern Fold Mountains, the geology is characterised by Tertiary limestones and Pleistocene volcanic deposits forming a north-west-trending series of ridges, plateaux and valleys (Löffler 1977, Bryan & Shearman 2008). Polygonal karst dominates major topographic features south and west of the lake, including the Kutubu anticline and, immediately outside the WMA boundary, the Agogo Range (here considered to include the Iagifu and Hedinia anticlines; Fig. 1). Recent alluvial deposits are located at each end of the nearly 19 km-long lake. Rainfall is 'continuously heavy' (little seasonality) and totals more than 4,000 mm annually (McAlpine *et al*. 1983, Bryan & Shearman 2008). The lake is drained from the north-west via the Soro River which forms part of the Kikori River drainage.

Three major natural vegetation groupings are mapped under the PNG Forest Inventory Mapping System (FIMS) (Hammermaster & Saunders 1995): (1) wooded freshwater swamps—dominated by complexes of Sago *Metroxylon sagu* / *Pandanus* swamp woodland and mixed swamp forest on flood-prone alluvium at each end of the lake, with reedbeds (including *Phragmites*) present at the lake margins; (2) hill forest—medium-crowned forest on slopes below 1,000 m, with *Nothofagus* present on most upper slopes and ridges more than a few hundred metres from the lakeshore; and (3) lower montane forest—on terrain

ISSN-2513-9894 (Online)

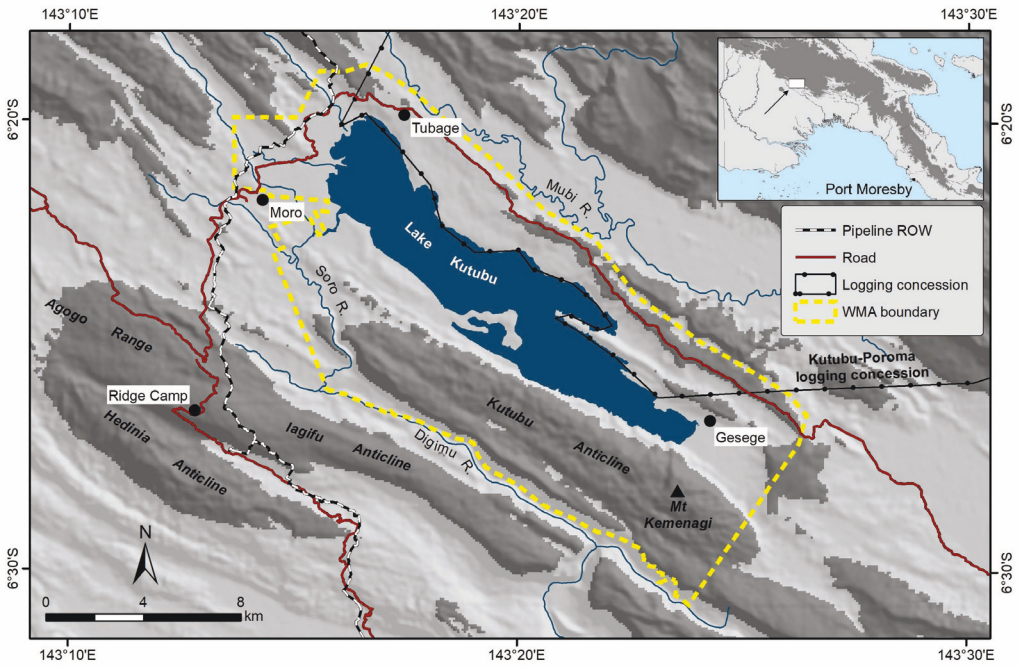


Figure 1. The Lake Kutubu Wildlife Management Area and places mentioned in the text. Land above 1,000 m is shaded darker grey.

above 1,000 m, alone or in complex form as structural variants (small- / very small-crowned) with or without *Nothofagus* prominent in the canopy.

The Lake Kutubu and adjacent Mubi River valleys are the traditional lands of the Foi people (Regis 2000). First contact with Europeans did not occur until the 1930s (Champion 1940). Half a century later, in the late 1980s commercial reserves of oil and gas were discovered in the uplands of the Kikori basin. Petroleum production is ongoing, and the Lake Kutubu area hosts a variety of support facilities and infrastructure.

Vegetation is predominantly intact except in areas cleared for oil and gas infrastructure and around local settlements. Local resident settlements are presently concentrated along the margins of the lake and at a few sites beside roads. Secondary forest in regenerating garden sites and natural forest degraded by local resource extraction is present around settlements and along some roads.

Existing data

The first ornithologist to visit Lake Kutubu was R. Schodde of the Commonwealth Scientific and Industrial Research Organization (CSIRO). In September–October 1961 he spent four weeks surveying birds at the north-west end of the lake between the Soro River outlet and the Mubi River valley (Schodde & Hitchcock 1968). In addition to general field observations, Schodde collected 132 specimens of 79 species (held at the Australian National Wildlife Collection, Canberra; ANWC). The records are well annotated, with most encounters traceable to within the WMA. Exceptions include those species shot by local Papua New Guinean assistants whose movements were not documented but are presumed to have been restricted to the local vicinity.

In partnership with industry leaders, in 1994 the World Wildlife Fund (WWF) initiated the Kikori Integrated Conservation and Development Project (KICDP), currently termed

ISSN-2513-9894 (Online)

the Kikori Basin Conservation Program, aimed at preserving biodiversity within the Kikori drainage (Leary *et al*. 1996, McCall & Flemming 2000).

As part of the first KICDP survey programme, in 1994 and 1995 I. Burrows surveyed birds (1) within and immediately adjacent to Lake Kutubu WMA around Moro and the lake area, and (2) more than 4 km south and west of the WMA in the Agogo Range (at *c*.900–1,100 m; Hartshorn *et al*. 1994, Burrows 1995). No trapping was undertaken, and during a total of ≤10 observation days most of the forest survey effort was expended in the Agogo Range. Only the 1994 reconnaissance report (Hartshorn *et al*. 1994) distinguishes records from the Agogo Range and the Moro–Kutubu areas. Thus, in terms of locating records within the WMA boundary, the provenance of many species observed by Burrows only in 1995 cannot be determined. Nevertheless, all surveys were conducted at elevations within those covered by the WMA, and most species of uncertain provenance have been recorded locally by other workers.

During 1997–99, R. Jaensch (Wetlands International) and various co-workers surveyed birds on four occasions on and around Lake Kutubu (Jaensch undated a,b, Jaensch & Kulmoi undated). No trapping was undertaken. Jaensch made additional brief visits to the Agogo Range outside the WMA and annotated his results sufficiently to distinguish records from each site.

On behalf of WWF, JMD & KDB conducted repeat-visit surveys of the Moro–Lake Kutubu–Agogo Range area in 1998, 1999, 2001, 2003, 2006 and 2007. Their observation-based surveys (no trapping) were conducted at 790–1,440 m while based (1) at Moro near Lake Kutubu, and (2) at the 'Ridge Camp', a permanent industrial base located outside the WMA in the Agogo Range. Originally reported as a combined Agogo Range / Moro–Kutubu dataset (Diamond & Bishop 2003, 2007), the list of species recorded within the WMA is here presented separately.

Most recently, birds were surveyed by IAW & LL within the WMA in May 2017 (Woxvold & Legra 2018), and the Agogo Range in 2015 (Woxvold & Legra 2017), 2017 and 2018 (IAW & LL unpubl.). Survey methods included active searches, camera-trapping, mist-netting and screening of automated bioacoustic recorder data. Survey coverage and effort are described in detail in Woxvold & Legra (2018).

Insofar as locality information can be determined with certainty, the results of the above surveys are combined to provide a comprehensive list of birds recorded to date in the Lake Kutubu WMA. While the WMA was delineated to exclude converted habitats of the Moro camp and airstrip, birds recorded at these sites are here included among the WMA records as this area of exclusion is immediately surrounded by the WMA.

Conventions used

Taxonomy follows Beehler & Pratt (2016). Species appearing in square brackets (in text, tables and appendices) were only provisionally identified to species level; although not definitively identified, encounters are considered most likely to have involved the species named and these records are included in the overall species tally. Records denoted by '?' in Appendices 1 and 3 are considered less certain and are not included in site totals.

Species of conservation concern include those listed in the IUCN Red List of Threatened Species (IUCN 2019) as threatened (Vulnerable—VU; no Endangered or Critically Endangered bird species have been recorded in the Lake Kutubu WMA), Near Threatened (NT) or Data Deficient (DD) and those listed as Protected (P) under the PNG Fauna (Protection & Control) Act 1966. The list of nationally protected species was obtained from Kula & George (1996). Restricted-range (RR) species are those having a total global breeding range smaller than 50,000 km^2 (Stattersfield *et al*. 1998).

ISSN-2513-9894 (Online)

Results

At least 216 bird species from 63 families have been recorded in the Lake Kutubu WMA and / or immediately adjacent to the WMA in the Moro facilities area. The taxa recorded by various workers are listed in Appendix 1 along with their conservation status, trapping frequencies and residency / migratory status.

Nine species were recorded within the WMA for the first time during the most recent surveys in 2017–18. Three of these were confirmed present by camera-trapping alone—Wattled Brushturkey *Aepypodius arfakianus*, Cinnamon Ground Dove *Gallicolumba rufigula* and Thick-billed Ground Pigeon *Trugon terrestris*. Mottled Meliphaga *Meliphaga mimikae* was identified from mist-net captures, while other novel records were seen and / or heard during active searches and / or recorded by SM3 recorders—Buff-banded Rail *Hypotaenidia philippensis*, Sooty Owl *Tyto tenebricosa*, Nankeen Kestrel *Falco cenchroides*, Greater Melampitta *Megalampitta gigantea* and Eurasian Tree Sparrow *Passer montanus*.

During a review of prior studies, adjustments were made to the status / identity of seven previously recorded taxa. Reasons for these adjustments are outlined in detail in Appendix 2. The changes are as follows.

Removal from the WMA list of four unconfirmed species whose presence requires a range extension and / or is better assigned to a locally occurring species—Southern Cassowary *Casuarius casuarius*, Yellow-legged Brushturkey *Talegalla fuscirostris*, crowned pigeon *Goura* sp. and Fan-tailed Cuckoo *Cacomantis flabelliformis*.

In the absence of confirmed records, where two closely related species may occur locally and are difficult to distinguish in the field, the expansion of single taxon listings to dual-possibility records—White-throated *Eurostopodus mystacalis* / Papuan Nightjar *E. papuensis*, Uniform *Aerodramus vanikorensis* / Mountain Swiftlet *A. hirundinaceus* and Yellow-billed *Syma torotoro* / Mountain Kingfisher *S. megarhyncha*.

Including data from all surveys, the Lake Kutubu WMA avifauna includes some 192 breeding resident species and 23 species that occur in the Kikori basin only or predominantly as non-breeding migrants (Appendix 1). The residency status of the *Eurostopodus* nightjar recorded by Schodde (Schodde & Hitchcock 1968) is uncertain—it may have been a resident species (*E. papuensis*) or an Australian breeding migrant (*E. mystacalis*) (see Appendix 2). At least five breeding resident species have local regional populations seasonally augmented by non-breeding visitors from Australia—Green Pygmy Goose *Nettapus pulchellus*, Pacific Black Duck *Anas superciliosa*, Australasian Grebe *Tachybaptus novaehollandiae*, Eastern Koel *Eudynamys orientalis* and Oriental Dollarbird *Eurystomus orientalis*. Most migratory birds recorded in the WMA breed outside New Guinea in Australia (17 / 23; 73.9%). Six migratory species breed in the Northern Hemisphere and visit New Guinea during the austral summer—Oriental Cuckoo *Cuculus optatus*, Grey-tailed Tattler *Tringa brevipes*, Common Sandpiper *Actitis hypoleucos*, Red-necked Stint *Calidris ruficollis*, Sharp-tailed Sandpiper *C. acuminata* and Gray's Grasshopper Warbler *Locustella fasciolata*.

Eighteen species of conservation concern have been recorded in the WMA. They include seven birds listed by IUCN as Vulnerable or Near Threatened, 13 that are Protected under PNG law and three restricted-range species. IUCN listed and restricted-range species are discussed individually below (Species accounts).

One non-native bird species was recorded, the commensal *Passer montanus* having recently established itself across much of the Moro facilities area. *P. montanus* was first recorded in mainland PNG at Port Moresby in April 2009 (Gregory 2009). An accomplished colonist, its recent arrival has been followed by a rapid expansion into settled areas with the first record from nearby Gulf Province at Kerema in 2011 (Woxvold *et al*. 2015). This is

ISSN-2513-9894 (Online)

the first reported occurrence in Southern Highlands Province, although it is likely already to be more widespread there.

Species accounts

Species accounts follow (in taxonomic order) for conservation listed taxa, restricted-range species, rarely recorded species, and wherever records (post-Schodde & Hitchcock 1968) extend a species' known geographic or elevational range. Unless otherwise stated, summary information on status and distribution is taken from Beehler & Pratt (2016).

RED-LEGGED BRUSHTURKEY *Talegalla jobiensis*

Occupies northern New Guinea from Yapen Island and the Mamberamo basin east to Milne Bay. Until recently, confirmed records from the southern watershed were restricted to a few sites in the Owen Stanley Range (Aroa River area) and the upper Purari River basin (Jones *et al*. 1995, Mack & Wright 1996; J. Ross Sinclair *in litt*. 2015). The shy behaviour of megapodes, and the difficulty in distinguishing closely related species based on vocalisations alone, has meant that some prior southern upland records were reported only at genus level, or followed earlier published authorities in assuming the species to be the southern lowland resident *T. fuscirostris*. However, emerging evidence suggests that *T. jobiensis* replaces *T. fuscirostris* at upland sites across much of southern mainland PNG with confirmed records in most major catchments from the upper Fly River east to the Moroka area (Beehler & Pratt 2016; IAW unpubl.). Camera-trapping in 2017 showed *T. jobiensis* to be fairly common (nine events on seven cameras; Fig. 2a) in hill forest and at the edge of wooded swamps north of the lake. Outside the WMA, it has been camera-trapped at 925–1,400 m in the nearby Agogo Range (Woxvold & Legra 2017). These are the first confirmed records from the Kikori basin.

[NEW GUINEA SCRUBFOWL *Megapodius decollatus***]**

Until recently, *M. decollatus* was thought to predominantly occur in northern New Guinea, with Orange-footed Scrubfowl *M. reinwardt* replacing it across most of the southern watershed (Jones *et al*. 1995, Pratt & Beehler 2015). However, there is growing evidence that *M. decollatus* is widespread on the southern slopes of the central cordillera where it replaces *M. reinwardt* in upland environments (Woxvold *et al*. 2015, Beehler & Pratt 2016, Woxvold & Legra 2017). Unfortunately, many prior records of *Megapodius* from southern New Guinea, including from the Moro–Lake Kutubu–Agogo Range area, refer to Common (Dusky) Scrubfowl *M. freycinet*, within which both *M. decollatus* and *M. reinwardt* (*inter alia*) were formerly subsumed (Mayr 1938). Difficulties with observing these species in the field, and with collecting detailed and reliable information from local informants, mean that such records cannot be safely assigned to either taxon. *M. decollatus* has been camera-trapped at 920–1,400 m in forest on limestone in the Agogo Range, *c*.3–5 km outside the WMA (Woxvold & Legra 2017), and to the south-east at 540 m in the Gobe operations area (IAW unpubl.). These are the first confirmed records from the Kikori basin. Within the WMA, *Megapodius* calls were recorded at three SM3 stations in 2017. *M. reinwardt* certainly occupies lowland habitats further downstream in the Kikori basin (Woxvold 2018a,b). However, based on recent evidence regarding the distribution and habitat requirements of these species in New Guinea's southern watershed, and on confirmed records from comparable habitats nearby, the Lake Kutubu WMA records are here provisionally assigned to *M. decollatus*.

GREEN PYGMY GOOSE *Nettapus pulchellus*

Twenty-nine individuals seen on the lake by Jaensch (undated a) represent a high-elevation record for this species (Coates 1985).

ISSN-2513-9894 (Online)

Figure 2(a) Red-legged Brushturkey *Talegalla jobiensis*; (b) Thick-billed Ground Pigeon *Trugon terrestris*; (c) New Guinea Vulturine Parrot *Psittrichas fulgidus*; (d) Greater Melampitta *Megalampitta gigantea*, all camera-trapped in the Agogo Range.

BROWN CUCKOO-DOVE *Macropygia amboinensis*

Beehler & Pratt (2016) subsumed all New Guinean subspecies east of the Bird's Neck within *M. a. cinereiceps*. Simultaneously, Ng *et al*. (2016) rearranged the *M. amboinensis* species complex along bioacoustic lines, proposing that populations with monosyllabic calls in eastern New Guinea be treated as a separate species—Amboyna Cuckoo-Dove *M. amboinensis*—from those with disyllabic call motifs in the west—Sultan's Cuckoo-Dove *M. doreya*. Ng *et al*. (2016) noted that the contact zone of *M. amboinensis* and *M. doreya* is poorly understood, but mapped the distribution of *M. amboinensis* in southern New Guinea west to near the PNG / Indonesian border, aligning with other accounts of the range of *M. a. goldiei* (Baptista *et al*. 1997) which they include within *M. amboinensis*. However, birds in the Kikori River basin, including within the Lake Kutubu WMA, have disyllabic calls characteristic of *M. doreya*.

THICK-BILLED GROUND PIGEON *Trugon terrestris*

A large terrestrial pigeon endemic to lowland and foothill forests of New Guinea and Salawati Island. An individual camera-trapped in hill forest at 865 m on 7 May 2017 (Fig. 2b) is the highest confirmed record for the species (previously up to 640 m).

RUFESCENT IMPERIAL PIGEON *Ducula chalconota*

Two observed by Burrows 'along the swing bridge road Lake Kutubu' on 22 March 1994, and subsequently reported by Jaensch. While the exact location is unknown, the reference

ISSN-2513-9894 (Online)

to Lake Kutubu suggests that this is the lowest reported elevation for this species by nearly 200 m (previously as low as 1,000 m).

GREY-TAILED TATTLER *Tringa brevipes* (NT) / **RED-NECKED STINT** *Calidris ruficollis* (NT)
Regionally present at highest density in tidal environments, in 1961 Schodde observed small numbers at the edge of Lake Kutubu—one *C. ruficollis* and 'occasional groups of two to five birds' of *T. brevipes* (Schodde & Hitchcock 1968: 23). In 2007 JMD & KDB recorded a single *C. ruficollis* at Moro airstrip.

BAT HAWK *Macheiramphus alcinus*
Rare in New Guinea from the lowlands to above 1,100 m. On 18 October 2007, KDB observed one in flight over a ridge above Kaimari Creek.

NEW GUINEA HARPY EAGLE *Harpyopsis novaeguineae* (VU, P)
Occupies forested habitats from sea level to above 3,000 m. Visually inconspicuous (does not soar), it is most readily detected by its distinctive and far-carrying call. It was observed by JMD & KDB within and / or near the WMA in most survey years (1998, 2001, 2002, 2006, 2007), and the species has been regularly recorded by other observers in the Agogo Range (Hartshorn *et al*. 1994, Burrows 1995; IAW unpubl.).

GURNEY'S EAGLE *Aquila gurneyi* (NT)
Widespread but very sparse in forested habitats throughout New Guinea, mostly below 1,000 m. Occasionally observed high over forest in the WMA—in 2001 a duo near the Soro River (JMD & KDB), and in 2017 singles at the north end of the lake and near Moro (IAW & LL).

WHITE-BELLIED SEA EAGLE *Haliaeetus leucogaster*
Observed over Lake Kutubu in 1998 and 2007 (Diamond & Bishop 2007) and in 2017. This is the highest reported location in New Guinea (previously up to 540 m; reported at 1,700 m on Sulawesi: Thiollay 1994).

NEW GUINEA VULTURINE PARROT *Psittrichas fulgidus* (VU, P)
Endemic to New Guinea where it inhabits hill and lower montane forest normally below 1,600 m. A nomadic and specialist frugivore, it feeds almost exclusively on a select variety of figs (*Ficus* spp.; Fig. 2c) (Mack & Wright 1998). *P. fulgidus* is regularly encountered in small numbers in the WMA where it has been recorded by all surveyors (Appendix 1). It is a mobile and easily detected species and multiple records at the same site may involve repeat encounters with the same individuals. Outside the WMA, in 2015 ten were observed at a single fruiting fig in the Agogo Range (Woxvold & Legra 2017).

STRIATED LORIKEET *Charmosyna multistriata* (NT, RR)
A rare blossom nomad, endemic to the southern slopes of the central cordillera from the Snow Mountains in Indonesia east into PNG as far as Crater Mountain (Mack & Wright 1996). On 5 May 1998, JMD & KDB observed a flock of six birds at 825 m near the Soro River.

DOUBLE-EYED FIG PARROT *Cyclopsitta diophthalma*
A widespread and geographically variable species with seven subspecies currently recognised from New Guinea, its satellite islands and north-east Australia (Gill & Donsker

ISSN-2513-9894 (Online)

2019). In southern New Guinea there are no published lowland records east of the Fly River (Coates 1985, Beehler & Pratt 2016). However, recent surveys reveal that *C. diophthalma* is widespread in the Kikori-Purari region. Observed in the Lake Kutubu WMA by JMD & KDB (April 2003 and May 2006), elsewhere it has been seen in the nearby Agogo Range (IAW unpubl.), in the Kikori basin lowlands (below 500 m) at Gobe, Kantobo, Pinini Creek and at Kopi (Diamond & Bishop 2003, 2007) and in the Purari basin lowlands (IAW unpubl.). It is often stated that *C. diophthalma* and Orange-breasted Fig Parrot *C. gulielmitertii* replace each other locally (Coates 1985, Beehler & Pratt 2016). However, both species have been recorded in Lake Kutubu WMA and at all of the above-listed lowland sites, and in the Purari lowlands they have been observed together in the same fruiting tree. It is uncertain which subspecies is present in the WMA. A lone male observed by IAW in the Agogo Range showed a blue spot in front of the eye and a red forecrown with a yellow posterior margin, recalling the nominate northern mainland form *C. d. diophthalma*. In contrast, a pair observed by IAW in the Purari basin lowlands (below 200 m) was most similar to *C. d. aruensis*, the male showing no obvious blue eye spot or yellow margin to the red forecrown, and the female lacked red facial markings but had grey cheeks and a blue forecrown. As provisionally observed below for two *Micropsitta* species, it is possible that these two *Cyclopsitta* subspecies overlap and separate altitudinally within the Kikori–Purari region.

YELLOW-CAPPED PYGMY PARROT *Micropsitta keiensis* **/ BUFF-FACED PYGMY PARROT** *M. pusio*

The distributional limits of *Micropsitta* in southern New Guinea are poorly known. Of two similar-looking lowland species, *M. keiensis* occurs in the west and *M. pusio* in the east, with a potential zone of contact / overlap somewhere in the Gulf of Papua hinterland. Recent field guides and regional checklists report both species in the Kikori basin (Pratt & Beehler 2015, Beehler & Pratt 2016, Gregory 2017), although it is unclear on what records these assessments are based (Beehler & Pratt 2016 cite Schodde & Hitchcock 1968 as the source for a Lake Kutubu record of *M. pusio*, but no such record appears in that report). Both species apparently occur in the Lake Kutubu WMA, where Burrows observed a pair of *M. pusio* 'along the swamp road, Lake Kutubu' (1995: 36) and KDB saw *M. keiensis* in 2007 (in addition to sightings of unidentified *Micropsitta* in other years). Burrows' record is the westernmost sighting of *M. pusio* from the southern watershed, while *M. keiensis* occurs east at least as far as the lower Purari River basin (IAW unpubl.). Other Kutubu area reports refer to *M. pusio / keiensis* (Jaensch undated a) or to *M. pusio* without describing the encounter (Jaensch undated b). The Kikori–Purari region may represent a zone of overlap within which these two species separate altitudinally. Elsewhere in the Kikori basin, all confirmed records involve *M. keiensis* at elevations below 200 m—at Iviri and Keboi Kerowa (Leary undated), in the Wau Creek proposed WMA and at Uro Creek (Woxvold 2018a,b). In the Purari basin, *M. pusio* was reported from uplands in Crater Mountain WMA (above 850 m; Mack & Wright 1996), whereas *M. keiensis* is the only species confirmed present at lower elevations (all records below 250 m; IAW unpubl.). Further observations are required to confirm this pattern.

TROPICAL SCRUBWREN *Sericornis beccarii* × **LARGE SCRUBWREN** *S. nouhuysi* (**PERPLEXING SCRUBWREN** *S. virgatus*)

There is much confusion over the taxonomy of some *Sericornis* populations occupying the upper hill–lower montane zone of central and western New Guinea. Morphologically highly variable, they are considered by some to be hybrid populations involving *S. nouhuysi* and *S. beccarii* (e.g. Coates 1990, Beehler & Pratt 2016). Others treat them as a

ISSN-2513-9894 (Online)

valid species—Perplexing Scrubwren *S. virgatus* (e.g. Diamond 1985, Gregory 2007, Gill & Donsker 2019)—although there is disagreement as to which populations this taxon should include. Scrubwrens of this troublesome group are present in the Kikori basin. Within the Lake Kutubu WMA, an adult male collected by Schodde at 820 m at the north-west end of the lake is most similar to *S. beccarii*, with a black-and-white pattern on the forehead and an incomplete white eye-ring (Schodde & Hitchcock 1968, Coates 1990). Outside the WMA, duller forms more similar to *S. nouhuysi* have been observed in the lower montane limestone forests of the Agogo Range and at Gobe 50 km south-east of Lake Kutubu (Diamond & Bishop 2003, 2007; IAW unpubl.). These birds show an obscure / thin buffy eye-ring and obscure pale tips to the wing-coverts. Their song—a tinkling *Gerygone*-like song of a couple of repeated short phrases—is the same as that of other populations encountered by JMD on the outlying mountain ranges on New Guinea's north and north-west coast.

BLACK THICKET FANTAIL *Rhipidura maculipectus*
Endemic to the lowland wet-floor forests of south and west New Guinea and satellite islands. Confirmed present in swamp forest north-west of the lake in 2006 and 2007 (Diamond & Bishop 2007), songs provisionally attributed to this species were fairly common there in 2017 and 2018. This is the highest reported elevation for the species.

TWELVE-WIRED BIRD-OF-PARADISE *Seleucidis melanoleuca* (P)
Endemic to lowland forests of New Guinea and Salawati Island, especially swamp forest with *Metroxylon sagu* and *Pandanus* spp. (Coates 1990, Frith & Beehler 1998). Recorded locally by JMD & KDB in 2001 and 2007, the Lake Kutubu swamps are the highest recorded locality for this species (elsewhere up to 180 m).

GREATER MELAMPITTA *Megalampitta gigantea* (RR)
One of New Guinea's most enigmatic birds, *M. gigantea* is a near-specialist inhabitant of forested karst where it is believed to roost and nest underground (Diamond 1983, Gregory 1995). It is a restricted-range species known from a few localities across New Guinea at 500–1,400 m. On 7 May 2017 one was heard from the road in an area of limestone forest north-west of Lake Kutubu near the KP 89–90 section of the pipeline right-of-way (ROW). Elsewhere in the Kikori basin it is fairly common in the Agogo Range and at Gobe (Diamond & Bishop 2003, 2007, Woxvold & Legra 2017; Fig. 2d).

[RUFOUS MONARCH *Symposiachrus rubiensis***]**
An uncommon bird endemic to lowland forests of western and central New Guinea. There are few reports from PNG's southern watershed, including two from the Strickland basin—in the Nomad River area (Bell 1970) and near the Rentoul River (IAW unpubl.). In 1994, Burrows observed a 'male seen at close range…in forest by the Moro camp' (Burrows 1995: 37). Given the large extension in both altitudinal (not previously reported above 175 m) and geographic range, and the lack of records from subsequent surveys, this record is here treated as provisional.

BANDED YELLOW ROBIN *Gennaeodryas placens* (NT, RR)
Endemic to New Guinea and Batanta Island (Indonesia), with isolated populations scattered in hill and lower montane forest at 100–1,450 m. First reported from the WMA by Schodde who collected one from forest near Moro (Schodde & Hitchcock 1968), it was later recorded by JMD & KDB (in 2001, 2003, 2006, 2007) and on 9 May 2017 two were heard in forest on limestone at *c.* 950 m along the KP 89–90 section of the pipeline ROW.

ISSN-2513-9894 (Online)

GRAY'S GRASSHOPPER WARBLER *Locustella fasciolata*
There are few records of this Northern Hemisphere migrant from eastern New Guinea. Within the WMA, on 18 October 2007 JMD & KDB observed one in dense secondary scrub (<1 m tall) at the north-east corner of the WMA. Elsewhere locally, this species was observed in the Agogo Range in 2001.

STREAK-HEADED MANNIKIN *Lonchura tristissima* / **WHITE-SPOTTED MANNIKIN** *L. leucosticta*
The distributional limits of these uncommon and closely related species are poorly known. *L. leucosticta* occupies southern lowlands from the Lorentz River in Indonesia east at least to the Hegigio–Kikori basin in PNG (Coates 1990). *L. tristissima* occurs in northern New Guinea and the far east and west of the southern watershed; in southern PNG it has been recorded on the south-east peninsula as far west as the Lohiki River between the Purari and Lakekamu basins. Within Lake Kutubu WMA, KDB observed both species along the Swamp Road at the north-west end of the lake—*L. tristissima* in 2003 and *L. leucosticta* in 2006.

Discussion

The Lake Kutubu WMA supports a rich and varied avifaunal community. Surveys conducted to date have recorded nearly one-third of all bird species resident or regularly occurring in the New Guinea region (including satellite islands and excluding seabirds and vagrants: 216 / 696, 31.0%). The high species richness is attributable both to the diverse set of environments present and to the high accumulated survey effort spanning more than 50 years. The diversity, conservation value and potential for additional species within the WMA are discussed below.

Forest environments.—These habitats support the majority of bird species present within the WMA—of 216 bird species recorded, 170 (78.7%) occur in forest environments, most of which are forest-dependent (cannot persist in converted habitats alone). All resident (non-migratory) conservation listed and restricted-range bird species confirmed present in the WMA are dependent on forest habitats.

The WMA supports a wide range of forest environments. Approximately 160 km^2 of upper hill and lower montane forests span nearly 600 m elevation across a variety of substrates, including limestone karst, non-calcareous sediments and volcanic slopes. In addition, some 19.6 km^2 of swamp forest / woodland provide an unusually high example of a typically lowland forest ecosystem. Elevation exerts a marked influence on the structure of New Guinean bird communities (Diamond 1972, Beehler 1982), and while some forest birds are capable of utilising all of these environments, several species strongly prefer, or are specialist inhabitants of, just one or a few of these vegetation types. Resident forest birds typical of the upper hill–lower montane transition zone (around 1,000 m) on which the WMA is centred include (but are not limited to) Spotted Honeyeater *Xanthotis polygrammus*, Goldenface *Pachycare flavogriseum*, Papuan Cicadabird *Edolisoma incertum*, Drongo Fantail *Chaetorhynchus papuensis*, Crinkle-collared Manucode *Manucodia chalybatus*, *Megalampitta gigantea*, Black-winged Monarch *Monarcha frater*, White-eyed Robin *Pachycephalopsis poliosoma* and White-rumped Robin *Peneothello bimaculata*. A number of montane birds normally found above 1,000 m are also confirmed present, including *Aepypodius arfakiensis*, Pygmy Lorikeet *Charmosyna wilhelminae*, Goldie's Lorikeet *Psitteuteles goldiei*, Red-breasted Pygmy Parrot *Micropsitta bruijnii*, Mottled Berryhunter *Rhagologus leucostigma* and Black Fantail *Rhipidura atra*. Finally, lowland forest species reported at record or unusually high elevations within the WMA include *Trugon terrestris*, Little Bronze Cuckoo *Chalcites minutillus*, Yellow-streaked Lory *Chalcopsitta scintillata*, Streak-headed Honeyeater *Pycnopygius stictocephalus*, Large-billed

ISSN-2513-9894 (Online)

Gerygone *Gerygone magnirostris*, Lowland Peltops *Peltops blainvillii*, *Seleucidis melanoleucus*, King Bird of Paradise *Cicinnurus regius*, [*Symposiachrus rubiensis*] and Black-sided Robin *Poecilodryas hypoleuca*. The well-integrated complex of multiple forest ecosystems present in the WMA thus supports a rich forest bird community that differs in composition among sites within a small geographic area.

The WMA forests are well connected with extensive areas of both similar and additional ecosystem types, including montane forest above 2,000 m and lowland forest below 500 m, both of which occur within 10 km of the WMA boundary. The WMA is thus positioned to support a variety of wide-ranging landscape-level nomadic bird species, including various large frugivores and birds of prey that may not permanently reside there.

The WMA's forests face a variety of pressures. Localised conversions to settlements and gardens were formerly largely confined to the lake's margins and islands (Schodde & Hitchcock 1968). Subsequent infrastructure development and local population growth has seen these losses expand to areas along the road networks within the north-west and north-east margins of the WMA (Fig. 1). As well as local losses, small-scale resource harvesting has degraded some areas of forest near settlements and along the road network. Other recent losses are industry based; while the Moro facilities area was excluded from the WMA limits, recent pipeline construction has converted a narrow, *c*.8 km-long ROW of hill, lower montane and swamp forest environments within the north-west margin of the WMA (Fig. 1).

Logging presents an additional threat (D'Cruz 2008). More than 49 km^2 of the proposed Kutubu–Poroma logging concession (under the PNG Forest Authority draft National Forest Plan) overlaps the Lake Kutubu WMA at its north-east edge (Fig. 1). As of mid 2019 no commercial logging had taken place within the concession (PNG Forest Observatory, http://forest.pngsdf.com/; IAW pers. obs.).

Despite these threats, extensive areas of undisturbed forest remain in the Lake Kutubu WMA. These include much of the wooded swamps and *c*.80 km^2 of hill and lower montane forest on the broad limestone ridge of the Kutubu anticline south of the lake. Swamplands and forest on karst are generally unsuitable for gardening and settlement, and are prohibited from logging under PNG law (PNGFA 1996). These areas are expected to remain largely intact into the foreseeable future, and are sufficient to support viable populations of most resident forest bird species.

Lake Kutubu and its environs are the most frequently surveyed area within the Kikori basin. Despite this effort, each new survey reveals the presence of additional birds, with the latest surveys in 2017–18 adding six forest species to the Lake Kutubu WMA list, all of them resident breeders. It follows that additional species probably remain undetected within the WMA. Notably, the Kutubu anticline includes the highest point within the WMA, reaching over 1,380 m at Mount Kemenagi in the south-east, and its limestone forests are unsurveyed.

The Agogo Range lies immediately south of and parallel to the Kutubu anticline, and its forests have been visited by most ornithologists who have worked the Kutubu area (with the exception of Schodde). Given their proximity and the similarity in habitat and elevation, it is reasonable to expect that birds recorded on the Agogo Range also occur on the Kutubu anticline ridge within the southern sector of the Lake Kutubu WMA. Appendix 3 lists 29 bird species not recorded within the WMA, plus four species only provisionally recorded in the WMA, that have been observed in the Agogo Range by the present authors and / or Burrows (1995). Nearly all of these (31 / 33; 93.9%) are forest bird species, including three nationally Protected birds of paradise—Carola's Parotia *Parotia carolae*, Superb Bird of Paradise *Lophorina superba* and Black-billed Sicklebill *Drepanornis albertisi*.

ISSN-2513-9894 (Online)

Wetland environments.—Twenty-four wetland species have been recorded on the lake, rivers and adjacent low vegetated swamps. They are listed in Table 1, along with their residency / migratory status and numbers reported by Schodde (Schodde & Hitchcock 1968) and Jaensch (undated a). Ten recorded wetland species breed locally in southern New Guinea. Breeding has not been reported within the WMA, though this may be an artefact of under-sampling. For species such as *Nettapus pulchellus*, *Anas superciliosa*, *Tachybaptus novaehollandiae*, White-browed Crake *Amaurornis cinerea*, Dusky Moorhen *Gallinula tenebrosa* and Australian Reed Warbler *Acrocephalus australis*, all of which prefer to breed along the vegetated margins of lakes and slow-moving freshwater systems, Lake Kutubu may represent an important breeding site within the region (for example at the province scale). Others such as Little Ringed Plover *Charadrius dubius*, Azure Kingfisher *Ceyx azureus* and

TABLE 1

Birds of rivers and wetlands, their residency / migratory status (Res / Mig), and notes on abundance by Schodde (Schodde & Hitchcock 1968; 'RS') and Jaensch (undated a; 'RJ'). Res / Mig status indicates: BR—breeding resident species; M—species that occur in New Guinea only as non-breeding migrants; BR/M—breeding residents with populations seasonally augmented by non-breeding visitors, and a widespread local breeding range potentially overlapping the study area; M(BR)—breeding residents augmented by non-breeding visitors but known breeding sites are localised and lie outside the Kikori basin.

Scientific name	**English name**	**Res / Mig**	**RS**	**RJ**
Nettapus pulchellus	Green Pygmy Goose	BR/M		29
Anas superciliosa	Pacific Black Duck	BR/M	Occasional pairs	10
Tachybaptus novaehollandiae	Australasian Grebe	BR/M		[3]
Nycticorax caledonicus	Nankeen Night Heron	M(BR)	Common, singles and groups of up to ten, adults and immatures	
Ardea ibis	Cattle Egret	M		1
Ardea alba	Great Egret	M(BR)	Regular singles and duos	26
Ardea intermedia	Intermediate Egret	M(BR)	Regular singles and duos	22
Egretta picata	Pied Heron	M		3
Egretta novaehollandiae	White-faced Heron	M		
Egretta garzetta	Little Egret	M		7
Microcarbo melanoleucos	Little Pied Cormorant	M(BR)	Several groups of 20–30	65
Phalacrocorax sulcirostris	Little Black Cormorant	M(BR)	Regular singles and groups of 4–5	
Anhinga novaehollandiae	Australasian Darter	M(BR)	1+	
Amaurornis cinerea	White-browed Crake	BR		[2+]
Gallinula tenebrosa	Dusky Moorhen	BR		3
Charadrius dubius	Little Ringed Plover	BR		
Tringa brevipes	Grey-tailed Tattler	M	Occasional groups of 2–5	
Actitis hypoleucos	Common Sandpiper	M	Regular singles	
Calidris ruficollis	Red-necked Stint	M	1	
Calidris acuminata	Sharp-tailed Sandpiper	M	1	
Haliaeetus leucogaster	White-bellied Sea Eagle	BR		
Ceyx azureus	Azure Kingfisher	BR	Frequent singles	2
Monachella muelleriana	Torrent Flycatcher	BR		
Acrocephalus australis	Australian Reed Warbler	BR		c

ISSN-2513-9894 (Online)

Torrent Flycatcher *Monachella muelleriana* are better adapted to smaller waterways and / or fast-flowing rivers that are well represented across the local region. *Haliaeetus leucogaster* is predominantly a bird of coastal and estuarine environments; Lake Kutubu may support one or more breeding pairs, or they may occur locally as non-breeding visitors. Understanding the importance of the WMA to breeding waterbirds would require additional surveys of vegetated wetlands at the margins of the lake and larger watercourses, and discussions with local residents.

Fourteen migratory wetland species have been recorded in the WMA (Table 1). Ten of these breed in Australia or are known to breed in New Guinea only outside of the Kikori–Purari area. Four are migratory shorebirds that breed in the Northern Hemisphere—*Tringa brevipes*, Common Sandpiper *Actitis hypoleucos*, *Calidris ruficollis* and Sharp-tailed Sandpiper *C. acuminata*. Lake Kutubu does not contain extensive areas of tidal mudflats that are typically required to support large numbers of Palearctic shorebirds, though it may regularly host larger congregations of migrants that breed in Australia or elsewhere in New Guinea. For example, numbers of Little Pied Cormorant *Microcarbo melanoleucos* recorded by Schodde and Jaensch (Table 1) may represent locally significant congregations—while they are much smaller than flock sizes recorded in the middle and lower Fly River wetlands of Western Province (Bishop 2005; up to *c*.9,000 birds: Gregory *et al*. 1996), they represent the highest concentrations reported to date for the Kikori–Purari systems (Beehler & Pratt 2016; IAW unpubl.).

Numerous additional wetland species have been observed in the expansive system of riverine and estuarine wetlands in the lower Kikori basin (summarised in Woxvold 2018b), many of which may regularly visit Lake Kutubu.

Conclusions

Lake Kutubu WMA is set in one of the world's most biologically diverse and endemically rich terrestrial regions (Olson & Dinerstein 1998, Brooks *et al*. 2006). More than one-third of all New Guinean bird species have been recorded within the WMA and / or the adjacent Agogo Range. The high species richness is attributable to the presence of multiple habitats, including a variety of dryland forest, open-water wetland and swamp vegetation types, spanning an elevational range of nearly 600 m within a small geographic area.

Resident avifauna include five IUCN threatened or Near Threatened species—*Harpyopsis novaeguineae*, *Aquila gurneyi*, *Psittrichas fulgidus*, *Charmosyna multistriata* and *Gennaeodryas placens*—and a suite of nationally Protected and New Guinean endemic taxa, including three restricted-range bird species—*Charmosyna multistriata*, *Megalampitta gigantea* and *Gennaeodryas placens*. Lake Kutubu WMA is the only PNG protected area in which *Megalampitta gigantea* is known to occur.

The area is potentially of great interest to international birdwatchers. 'Adventuring into eco-tourism' is one of four reasons for establishment of the Lake Kutubu WMA listed in its Protected Area Register. In addition to the spectacular scenery afforded by the lake and surrounding landscape, the region's avifauna may play a key role in supporting a sustainable local ecotourism industry.

Acknowledgements

IAW & LL are grateful to ExxonMobil PNG Limited for their funding and logistical support. They are especially indebted to Dr Jane Mogina and Stephen Richards for their vision and efforts in facilitating the multi-disciplinary 2017 biodiversity surveys. Thanks also to Kyle Armstrong and Stephen Richards for deploying SM3 automated sound recorders, and to Pita Amik, Kyle Armstrong and Enock Kale for deploying mist-nets. Anita Mosby, Chris Muller and Pagi Toko provided additional support and company in the field. Bird surveys were conducted in accordance with the permitting procedures of the PNG Conservation and

ISSN-2513-9894 (Online)

Environment Protection Authority (CEPA). JMD and KDB thank the World Wildlife Fund, the National Geographic Society, Chevron, and Oil Search (PNG) Ltd. for their support. Thane Pratt and Mary LeCroy provided valuable comments on the submitted draft.

References:

Adams, V. M., Tulloch, V. J. & Possingham, H. P. 2017. *Land–sea conservation assessment for Papua New Guinea.* Univ. of Queensland, Brisbane.

Allen, B. 2009. Agricultural development, policy and governance. Pp. 426–488 *in* Bourke, R. M. & Harwood, T. (eds.) *Food and agriculture in Papua New Guinea*. Australian National Univ. E Press, Canberra.

Baptista, L. F., Traill, P. W. & Horblit, H. M. 1997. Family Columbidae (pigeons and doves). Pp. 60–245 *in* del Hoyo, J., Elliott, A. & Sargatal, J. (eds.) *Handbook of the birds of the world*, vol. 4. Lynx Edicions, Barcelona.

Beehler, B. M. 1982. Ecological structuring of forest bird communities in New Guinea. Pp. 837–860 *in* Gressitt, J. L. (ed.) *Biogeography and ecology of New Guinea*. Monogr. Biol., vol. 42. Dr W. Junk Publishers, The Hague.

Beehler, B. M. & Pratt, T. K. 2016. *Birds of New Guinea: distribution, taxonomy, and systematics*. Princeton Univ. Press.

Bell, H. L. 1970. Field notes on birds of the Nomad River Sub-district, Papua. *Emu* 70: 97–104.

Bishop, K. D. 2005. A review of the avifauna of the TransFly eco-region: the status, distribution, habitats and conservation of the region's birds. WWF Project: TransFly Ecoregion Action Program. Project no. 9S0739.02.

Brooks, T. M., Mittermeier, R. A., da Fonseca, G. A. B., Gerlach, J., Hoffmann, M., Lamoreux, J. F., Mittermeier, C. G., Pilgrim, J. D. & Rodrigues, A. S. L. 2006. Global biodiversity conservation priorities. *Science* 313: 58–61.

Bryan, J. E. & Shearman, P. L. (eds.) 2008. *Papua New Guinea resource information system handbook*. Third edn. Univ. of Papua New Guinea, Port Moresby.

Bryan, J. E., Shearman, P. L., Aoro, G., Wavine, F. & Zerry, J. 2015. The current state of PNG's forests and changes between 2002 & 2014. Pp. 7–42 *in* Bryan, J. E. & Shearman, P. L. (eds.) *The state of the forests of Papua New Guinea 2014: measuring change over the period 2002–2014*. Univ. of Papua New Guinea, Port Moresby.

Burrows, I. 1995. A field survey of the avifauna of the Kikori River Basin. 'Tab D' *in* Hartshorn, G. S., Lery, T., Seri, L., Burrows, I., Allen, G. R., Polhemus, D. A., Balun, L., Orsak, L., Bigilale, E., Kinbag, F., Kinibel, A., Dal, C., Gebia, O., Wasel, H., Ellis, G. & Forney, M. (eds.) *Field survey of biodiversity in the Kikori River Basin Papua New Guinea*. WWF KICDP area report.

Champion, I. 1940. The Bamu–Purari patrol, 1936. *Geogr. J.* 96: 190–206.

Coates, B. J. 1985. *The birds of Papua New Guinea, including the Bismarck archipelago and Bougainville*, vol. 1. Dove Publications, Alderley.

Coates, B. J. 1990. *The birds of Papua New Guinea, including the Bismarck archipelago and Bougainville*, vol. 2. Dove Publications, Alderley.

D'Cruz, R. 2008. *Lake Kutubu catchment management plan*. Report prepared by Aonyx Environmental, Malaysia, for the WWF Kikori River Programme.

Diamond, J. M. 1972. *Avifauna of the eastern highlands of New Guinea*. Nuttall Orn. Cl., Cambridge, MA.

Diamond, J. M. 1983. *Melampitta gigantea*: possible relation between feather structure and underground roosting habits. *Condor* 85: 89–91.

Diamond, J. M. 1985. New distributional records and taxa from the outlying mountain ranges of New Guinea. *Emu* 85: 65–91.

Diamond, J. & Bishop, K. D. 2003. Seasonality in birds in the Kikori River Catchment: year-2003 studies. WWF KICDP area report.

Diamond, J. & Bishop, K. D. 2007. Status of birds of the Kikori River catchment: year-2007 studies. WWF KICDP area report.

Eastwood, C. 1997. Site report [Birds seen in Varirata (October 1996 - February 1998)]. *PNG Bird Soc. Newsl.* 291: 8 (also supplement 'Varirata table.xls').

Freeman, B. G., Class, A., Mandeville, J., Tomassi, S. & Beehler, B. M. 2013. Ornithological survey of the mountains of the Huon Peninsula, Papua New Guinea. *Bull. Brit. Orn. Cl.* 133: 4–18.

Frith, C. B. & Beehler, B. M. 1998. *The birds of paradise: Paradisaeidae*. Oxford Univ. Press.

Gill, F. & Donsker, D. (eds.) 2019. IOC World Bird List (v 9.1). http://www.worldbirdnames.org/.

Gregory, P. 1995. *Birds of the Ok Tedi area*. Ok Tedi Mining Ltd., Port Moresby.

Gregory, P. 2007. Acanthizidae (Australian warblers). Pp. 544–611 *in* del Hoyo, J., Elliott, A. & Christie, D. A. (eds.) *Handbook of the birds of the world*, vol. 12. Lynx Edicions, Barcelona.

Gregory, P. 2009. Eurasian Tree Sparrows (*Passer montanus*) in PNG. *Muruk* 9: 96–97.

Gregory, P. 2017. *Birds of New Guinea. Including Bismarck archipelago and Bougainville*. Lynx Edicions, Barcelona.

Gregory, P., Halse, S. A., Jaensch, R. P., Kay, W. R., Kulmoi, P., Pearson, G. B. & Storey, A. W. 1996. The middle Fly waterbird survey 1994–95. *Muruk* 8: 1–7.

ISSN-2513-9894 (Online)

Hammermaster, E. T. & Saunders, J. C. 1995. *Forest resources and vegetation mapping of Papua New Guinea*. PNGRIS Publ. 4. Commonwealth Scientific and Industrial Research Organisation & Australian Agency for International Development, Canberra.
Hartshorn, G. S., Burrows, I., Forney, M., Kosi, T., Mala, T. & Wiakabu, J. 1994. Preliminary biological reconnaissance of the Kikori River Basin, Papua New Guinea. WWF KICDP area report.
Independent State of Papua New Guinea. 2014. *Papua New Guinea policy on protected areas*. Conservation and Environment Protection Authority, Waigani.
IUCN. 2019. IUCN Red List of threatened species. V. 2019.2. www.iucnredlist.org.
Jaensch, R. undated a. Birds recorded at Lake Kutubu, Moro and Agogo Range, Papua New Guinea, 30 July to 2 August 1997. Wetlands International Report.
Jaensch, R. undated b. Birds of the Lake Kutubu Swamp Forest Papua New Guinea (summary report). Wetlands International Report.
Jaensch R. & Kulmoi P. undated. Birds recorded at Tubo Lodge, Lake Kutubu, August 1997 and February 1998. Wetlands International Report.
Jones, D. N., Dekker, R. W. R. J. & Roselaar, C. S. 1995. *The megapodes: Megapodiidae*. Oxford Univ. Press.
Kula, G. R. & George, I. 1996. *Protected fauna of Papua New Guinea*. Dept. of Environment and Conservation, National Capital District, Papua New Guinea.
Leary, T. undated. Brief report on Iviri and Keboi Kerowa mammal monitoring - December 2003. WWF KICDP area report.
Leary, T., Naug, R. & Price, J. 1996. Kikori Integrated Conservation and Development Project. Pp. 805–814 *in* Buchanan, P. G. (ed.) *Petroleum exploration, development and production in Papua New Guinea*. Proc. Third PNG Petroleum Convention, Port Moresby, 9–11 September 1996.
Leverington, F., Peterson, A. & Peterson, G. 2017. *Assessment of management effectiveness for Papua New Guinea's protected areas 2017*. Final report. Secretariat of the Pacific Regional Environment Council, Apia, Samoa.
Löffler, E. 1977. *Geomorphology of Papua New Guinea*. Commonwealth Scientific and Industrial Research Organisation & Australian National Univ. Press, Canberra.
Mack, A. L. 2014. *Searching for pekpek: cassowaries and conservation in the New Guinea rainforest*. Cassowary Conservation and Publishing, LLC, PA.
Mack, A. L. & Wright, D. D. 1996. Notes on occurrence and feeding of birds at Crater Mountain Biological Research Station, Papua New Guinea. *Emu* 96: 89–101.
Mack, A. L. & Wright, D. D. 1998. The Vulturine Parrot, *Psittrichas fulgidus*, a threatened New Guinea endemic: notes on its biology and conservation. *Bird Conserv. Intern*. 8: 185–194.
Mayr, E. 1938. Birds collected during the Whitney South Sea Expedition. 39. Notes on New Guinea birds. 4. *Amer. Mus. Novit*. 1006: 1–16.
McAlpine, J., Keig, G. & Falls, R. 1983. *Climate of Papua New Guinea*. Australian National Univ., Canberra.
McCall, D. & Flemming, D. 2000. *Chevron and WWF: lessons learned from six years of collaboration in biodiversity protection*. WWF / Chevron Niugini Report.
Melick, D. R., Kinch, J. P. & Govan, H. 2012. How global biodiversity targets risk becoming counterproductive: the case of Papua New Guinea. *Conserv. Soc*. 10: 344–353.
Ng, E. Y. X., Eaton, J. A., Verbelen, P., Hutchinson, R. O. & Rheindt, F. E. 2016. Using bioacoustic data to test species limits in an Indo-Pacific island radiation of *Macropygia* cuckoo doves. *Biol. J. Linn. Soc*. 118: 786–812.
Olson, D. M. & Dinerstein, E. 1998. The Global 200: a representation approach to conserving the Earth's most biologically valuable ecoregions. *Conserv. Biol.* 12: 502–515.
PNGFA. 1996. *Papua New Guinea logging code of practice*. Papua New Guinea Forest Authority and Dept. of Environment and Conservation, Port Moresby.
Pratt, T. K. & Beehler, B. M. 2015. *Birds of New Guinea*. Second edn. Princeton Univ. Press.
Regis, J. 2000. WWF's partnership with the Foi of Lake Kutubu, Papua New Guinea. Pp. 91–111 *in* Weber, R., Butler, J. & Patty, L. (eds.) *Indigenous peoples and conservation organizations: experiences in collaboration*. WWF, Washington DC.
Richards, A. & Rowland, R. 1995. List of birds recorded in Papua New Guinea during the period 16 October, 1992 to 29 November, 1992. *Muruk* 7: 75–95.
Schodde, R. & Hitchcock, W. B. 1968. *Contributions to Papuasian ornithology. I. Report on the Birds of the Lake Kutubu Area, Territory of Papua and New Guinea*. Division of Wildlife Research Tech. Paper no. 13. Commonwealth Scientific and Industrial Research Organisation, Melbourne.
Shearman, P. L. & Bryan, J. E. 2011. A bioregional analysis of the distribution of rainforest cover, deforestation and degradation in Papua New Guinea. *Austral Ecol*. 36: 9–24.
Sinclair, J. R. 2002. Selection of incubation mound sites by three sympatric megapodes in Papua New Guinea. *Condor* 104: 395–406.
Stattersfield, A. J., Crosby, M. J., Long, A. J. & Wege, D. C. 1998. *Endemic Bird Areas of the world: priorities for biodiversity conservation*. BirdLife International, Cambridge, UK.
Thiollay, J. M. 1994. Family Accipitridae (hawks and eagles). Pp. 52–205 *in* del Hoyo, J., Elliott, A. & Sargatal, J. (eds.) *Handbook of the birds of the world*, vol. 2. Lynx Edicions, Barcelona.

ISSN-2513-9894 (Online)

Woxvold, I. A. 2018a. Avifauna of the Wau Creek proposed Wildlife Management Area, Gulf Province, Papua New Guinea. Pp. 97–124 *in* Richards, S. J. (ed.) *Rapid biological assessments of Wau Creek, Uro Creek and Lake Kutubu: documenting biodiversity values to promote forest conservation in the Kikori River basin, Papua New Guinea*. ExxonMobil PNG Ltd., Port Moresby. https://pnglng.com/media/PNG-LNG-Media/Files/Environment/Rapid-biological-assessments-of-Wau-Creek,-Uro-Creek-and-Lake-Kutubu_FINAL.pdf

Woxvold, I. A. 2018b. Avifauna of the Uro Creek catchment, Gulf Province, Papua New Guinea. Avifauna of the Wau Creek proposed Wildlife Management Area, Gulf Province, Papua New Guinea. Pp. 213–244 *in* Richards, S. J. (ed.) *Rapid biological assessments of Wau Creek, Uro Creek and Lake Kutubu: documenting biodiversity values to promote forest conservation in the Kikori River basin, Papua New Guinea*. ExxonMobil PNG Ltd., Port Moresby. https://pnglng.com/media/PNG-LNG-Media/Files/Environment/Rapid-biological-assessments-of-Wau-Creek,-Uro-Creek-and-Lake-Kutubu_FINAL.pdf

Woxvold, I. A. & Legra, L. 2017. Birds. Pp. 91–120 *in* Richards, S. J. (ed.) *Biodiversity Assessment of the PNG LNG Upstream Project Area, Southern Highlands and Hela Provinces, Papua New Guinea*. ExxonMobil PNG Ltd., Port Moresby. https://pnglng.com/media/PNG-LNG-Media/Files/Environment/Ecology%20Reports/smaller-PMA3-biodiversity-report-PDF-version-Jan-2018.pdf

Woxvold, I. A. & Legra, L. 2018. Avifauna of the Lake Kutubu Wildlife Management Area, Southern Highlands Province, Papua New Guinea. Pp. 317–353 *in* Richards, S. J. (ed.) *Rapid biological assessments of Wau Creek, Uro Creek and Lake Kutubu: documenting biodiversity values to promote forest conservation in the Kikori River basin, Papua New Guinea*. ExxonMobil PNG Ltd., Port Moresby. https://pnglng.com/media/PNG-LNG-Media/Files/Environment/Rapid-biological-assessments-of-Wau-Creek,-Uro-Creek-and-Lake-Kutubu_FINAL.pdf

Woxvold, I. A., Ken, B. & Aplin, K. P. 2015. Birds. Pp. 103–130 *in* Richards, S. & Whitmore, N. (eds.) *A rapid biodiversity assessment of Papua New Guinea's Hindenburg Wall region*. Wildlife Conservation Society Papua New Guinea Program, Goroka.

Addresses: Iain A. Woxvold, 44 Aroona Road, Goldie, VIC 3435, Australia, e-mail: iainwoxvold@gmail.com. Jared M. Diamond, Geography Dept., 1255 Bunche Hall, UCLA, Los Angeles, CA 90095-1524, USA, e-mail: jdiamond@geog.ucla.edu. K. David Bishop, P.O. Box 1234, Armidale, NSW 2350, Australia, e-mail: kdbishop@ozemail.com.au. Leo Legra, Community Relations Department, Newcrest Mining Ltd. – Lihir Island Operations, Lihir, New Ireland, Papua New Guinea, e-mail: llegra09@gmail.com

Appendix 1

Birds recorded in the Lake Kutubu WMA and immediate environs. Conservation status is shown in brackets after the English name for species listed by the IUCN as Vulnerable (VU) and Near Threatened (NT), species Protected (P) under Papua New Guinean law and restricted-range species (RR). Observers—Schodde (RS), Burrows (IB), Jaensch (RJ), JMD & KDB (D-B), IAW & LL (W-L). Square brackets indicate provisional records (uncertain but probable; see Conventions used). Capture rates for the 2017 survey (2017 capt.) are shown as the camera-trapping rate (Relative Abundance Index, proportion <1) and the number of birds mist-netted (integers with the suffix 'n'). Residency / migratory (Res / Mig) status indicates: BR—breeding resident species; M—species that occur in New Guinea only as non-breeding migrants; BR/M—breeding residents with populations seasonally augmented by non-breeding visitors, and widespread local breeding range potentially overlapping the study area; M(BR)—breeding residents augmented by non-breeding visitors, but known breeding sites are localised and outside of the Kikori basin; t—birds of terrestrial environments, including forest, converted lands and aerial foraging species; w—birds of wetlands, including lakes, rivers and streams; wt—species of both wetland and open terrestrial environments; data from Coates (1985, 1990) and Beehler & Pratt (2016).

Scientific name	English name (conservation status)	Observers	2017 capt.	Res / Mig
CASUARIIDAE				
Casuarius bennetti	Dwarf Cassowary	[RS, RJ]		BRt
MEGAPODIIDAE				
Aepypodius arfakianus	Wattled Brushturkey	W-L	0.019	BRt
Talegalla jobiensis	Red-legged Brushturkey	[IB, D-B], W-L	0.173	BRt
Megapodius decollatus	New Guinea Scrubfowl	[D-B, W-L]		BRt
ANATIDAE				
Nettapus pulchellus	Green Pygmy Goose	RJ		BR/Mw
Anas superciliosa	Pacific Black Duck	RS, RJ, D-B		BR/Mw

ISSN-2513-9894 (Online)

Scientific name	English name (conservation status)	Observers	2017 capt.	Res / Mig
PODICIPEDIDAE				
Tachybaptus novaehollandiae	Australasian Grebe	[RJ]		BR/Mw
COLUMBIDAE				
Reinwardtoena reinwardtii	Great Cuckoo-Dove	RJ, D-B, W-L		BRt
Macropygia amboinensis	Brown Cuckoo-Dove	IB, RJ, D-B, W-L		BRt
Macropygia nigrirostris	Black-billed Cuckoo-Dove	RS, D-B, W-L		BRt
Gallicolumba rufigula	Cinnamon Ground Dove	W-L	0.077	BRt
Alopecoenas jobiensis	White-breasted Ground Dove	RS		BRt
Trugon terrestris	Thick-billed Ground Pigeon	W-L	0.019	BRt
Otidiphaps nobilis	Pheasant Pigeon	D-B, W-L	0.462	BRt
Chalcophaps stephani	Stephan's Emerald Dove	RS, D-B		BRt
Megaloprepia magnifica	Wompoo Fruit Dove	RS, RJ, D-B, W-L		BRt
Ptilinopus nainus	Dwarf Fruit Dove	IB, D-B		BRt
Ptilinopus superbus	Superb Fruit Dove	RS, IB, RJ, D-B, W-L		BRt
Ptilinopus perlatus	Pink-spotted Fruit Dove	RS, IB, D-B, W-L		BRt
Ptilinopus ornatus	Ornate Fruit Dove	RJ, D-B, W-L		BRt
Ptilinopus iozonus	Orange-bellied Fruit Dove	D-B		BRt
Ptilinopus pulchellus	Beautiful Fruit Dove	RS, RJ, D-B, W-L		BRt
Ducula rufigaster	Purple-tailed Imperial Pigeon	RJ, D-B, W-L		BRt
Ducula chalconota	Rufescent Imperial Pigeon	IB, RJ		BRt
Ducula pinon	Pinon's Imperial Pigeon	D-B		BRt
Ducula zoeae	Zoe's Imperial Pigeon	RS, IB, RJ, D-B, W-L		BRt
Gymnophaps albertisii	Papuan Mountain Pigeon	IB, RJ, D-B, W-L		BRt
ARDEIDAE				
Nycticorax caledonicus	Nankeen Night Heron	RS		M(BR)w
Ardea ibis	Cattle Egret	RJ		Mt
Ardea alba	Great Egret (P)	RS, RJ, D-B		M(BR)w
Ardea intermedia	Intermediate Egret (P)	RS, RJ		M(BR)w
Egretta picata	Pied Heron	RJ		Mw
Egretta novaehollandiae	White-faced Heron	D-B		Mw
Egretta garzetta	Little Egret (P)	RJ		Mw
PHALACROCORACIDAE				
Microcarbo melanoleucos	Little Pied Cormorant	RS, RJ		M(BR)w
Phalacrocorax sulcirostris	Little Black Cormorant	RS		M(BR)w
ANHINGIDAE				
Anhinga novaehollandiae	Australasian Darter	RS, D-B		M(BR)w
RALLIDAE				
Rallina tricolor	Red-necked Crake	D-B, W-L	0.115	BRt
Hypotaenidia philippensis	Buff-banded Rail	W-L		BRwt

ISSN-2513-9894 (Online)

Scientific name	English name (conservation status)	Observers	2017 capt.	Res / Mig
Amaurornis cinerea	White-browed Crake	RJ, D-B		BRw
Amaurornis moluccana	Rufous-tailed Bush-hen	RS, D-B		BRt
Gallinula tenebrosa	Dusky Moorhen	RJ		BRw
CENTROPODIDAE				
Centropus menbeki	Greater Black Coucal	IB, [RJ], D-B, W-L		BRt
CUCULIDAE				
Microdynamis parva	Dwarf Koel	D-B, W-L		BRt
Eudynamys orientalis	Eastern Koel	[RJ], D-B, W-L		BR/Mt
Chalcites meyerii	White-eared Bronze Cuckoo	RS, RJ, D-B		BRt
Chalcites minutillus	Little Bronze Cuckoo	D-B, W-L		BRt
Caliechthrus leucolophus	White-crowned Cuckoo	D-B, W-L		BRt
Cacomantis castaneiventris	Chestnut-breasted Cuckoo	IB, [RJ], D-B, W-L		BRt
Cacomantis variolosus	Brush Cuckoo	RJ, D-B, W-L		BRt
Cuculus optatus	Oriental Cuckoo	D-B		Mt
PODARGIDAE				
Podargus ocellatus	Marbled Frogmouth	D-B, W-L		BRt
Podargus papuensis	Papuan Frogmouth	D-B, W-L		BRt
CAPRIMULGIDAE				
Eurostopodus mysticalis / papuensis	White-throated / Papuan Nightjar	RS		BR/Mt
Caprimulgus macrurus	Large-tailed Nightjar	D-B		BRt
AEGOTHELIDAE				
Aegotheles sp.	Owlet-nightjar sp.	D-B		BRt
HEMIPROCNIDAE				
Hemiprocne mystacea	Moustached Treeswift	RS, RJ, D-B, W-L		BRt
APODIDAE				
Collocalia esculenta	Glossy Swiftlet	RS, IB, RJ, D-B, W-L		BRt
Aerodramus vanikorensis / hirundinaceus	Uniform / Mountain Swiftlet	RS, IB, RJ, D-B, W-L		BRt
CHARADRIIDAE				
Charadrius dubius	Little Ringed Plover	D-B, W-L		BRwt
SCOLOPACIDAE				
Tringa brevipes	Grey-tailed Tattler (NT)	RS		Mw
Actitis hypoleucos	Common Sandpiper	RS		Mw
Calidris ruficollis	Red-necked Stint (NT)	RS, D-B		Mw
Calidris acuminata	Sharp-tailed Sandpiper	RS, D-B		Mw
GLAREOLIDAE				
Stiltia isabella	Australian Pratincole	RS		Mt
ACCIPTRIDAE				
Aviceda subcristata	Pacific Baza	RS, RJ, D-B, W-L		BRt
Henicopernis longicauda	Long-tailed Buzzard	IB, RJ, D-B, W-L		BRt

ISSN-2513-9894 (Online)

Scientific name	English name (conservation status)	Observers	2017 capt.	Res / Mig
Macheiramphus alcinus	Bat Hawk	D-B		BRt
Harpyopsis novaeguineae	New Guinea Harpy Eagle (VU, P)	D-B		BRt
Hieraaetus weiskei	Pygmy Eagle	IB, W-L		BRt
Aquila gurneyi	Gurney's Eagle (NT)	D-B, W-L		BRt
Haliastur indus	Brahminy Kite	RS, IB, RJ, D-B, W-L		BRt
Haliaeetus leucogaster	White-bellied Sea Eagle	D-B, W-L		BRw
Circus approximans spilothorax	Swamp (Papuan) Harrier	IB		BRt
Circus approximans ?subsp.	Swamp Harrier	D-B		BR/Mwt
Accipiter hiogaster	Variable Goshawk	RJ, D-B		BRt
Accipiter poliocephalus	Grey-headed Goshawk	IB, D-B		BRt
Accipiter cirrocephalus	Collared Sparrowhawk	[RJ]		BRt
TYTONIDAE				
Tyto tenebricosa	Sooty Owl	W-L		BRt
STRIGIDAE				
Ninox theomacha	Papuan Boobook	RS, D-B, W-L		BRt
BUCEROTIDAE				
Rhyticeros plicatus	Blyth's Hornbill (P)	RS, IB, RJ, D-B, W-L		BRt
MEROPIDAE				
Merops ornatus	Rainbow Bee-eater	RS, IB, RJ, D-B, W-L		Mt
CORACIIDAE				
Eurystomus orientalis	Oriental Dollarbird	RS, IB, RJ, D-B, W-L		BR/Mt
HALCYONIDAE				
Melidora macrorrhina	Hook-billed Kingfisher	RS, IB, D-B, W-L		BRt
Dacelo gaudichaud	Rufous-bellied Kookaburra	RS, IB, RJ, D-B, W-L		BRt
Todiramphus macleayii	Forest Kingfisher	RS		Mt
Todiramphus sanctus	Sacred Kingfisher	RS, RJ, D-B		Mt
Syma torotoro	Yellow-billed Kingfisher	D-B		BRt
Syma torotoro / megarhyncha	Yellow-billed / Mountain Kingfisher	RJ		BRt
ALCEDINIDAE				
Ceyx solitarius	Papuan Dwarf Kingfisher	D-B, W-L		BRt
Ceyx azureus	Azure Kingfisher	RS, IB, RJ, D-B, W-L	1n	BRw
FALCONIDAE				
Falco cenchroides	Nankeen Kestrel	W-L		Mt
Falco severus	Oriental Hobby	[RS], D-B		BRt
Falco peregrinus	Peregrine Falcon	RJ, D-B		BRt
CACATUIDAE				
Probosciger aterrimus	Palm Cockatoo (P)	RS, IB, RJ, D-B, W-L		BRt
Cacatua galerita	Sulphur-crested Cockatoo	RS, IB, RJ, D-B, W-L		BRt

ISSN-2513-9894 (Online)

Scientific name	English name (conservation status)	Observers	2017 capt.	Res / Mig
PSITTRICHASIDAE				
Psittrichas fulgidus	New Guinea Vulturine Parrot (VU, P)	RS, IB, RJ, D-B, W-L		BRt
PSITTACULIDAE				
Charmosyna placentis	Red-flanked Lorikeet	D-B, [W-L]		BRt
Charmosyna wilhelminae	Pygmy Lorikeet	D-B, [W-L]		BRt
Charmosyna multistriata	Striated Lorikeet (NT, RR)	D-B		BRt
Charmosyna pulchella	Fairy Lorikeet	D-B		BRt
Lorius lory	Black-capped Lory	RS, IB, RJ, D-B, W-L		BRt
Psitteuteles goldiei	Goldie's Lorikeet	D-B		BRt
Trichoglossus haematodus	Rainbow Lorikeet	RS, RJ, D-B, W-L		BRt
Pseudeos fuscata	Dusky Lory	RS, RJ, D-B, W-L		BRt
Chalcopsitta scintillata	Yellow-streaked Lory	RJ, D-B, W-L		BRt
Psittaculirostris desmarestii	Large Fig Parrot	RJ, D-B		BRt
Cyclopsitta gulielmitertii	Orange-breasted Fig Parrot	IB, RJ, D-B, W-L		BRt
Cyclopsitta diophthalma	Double-eyed Fig Parrot	D-B		BRt
Loriculus aurantiifrons	Orange-fronted Hanging Parrot	RS, RJ, D-B		BRt
Alisterus chloropterus	Papuan King Parrot	D-B, W-L		BRt
Eclectus roratus	Eclectus Parrot	RS, IB, RJ, D-B, W-L		BRt
Geoffroyus geoffroyi	Red-cheeked Parrot	RS, RJ, D-B, W-L		BRt
Geoffroyus simplex	Blue-collared Parrot	IB, D-B, W-L		BRt
Micropsitta keiensis	Yellow-capped Pygmy Parrot	D-B		BRt
Micropsitta pusio	Buff-faced Pygmy Parrot	IB, [RJ], ?D-B		BRt
Micropsitta bruijnii	Red-breasted Pygmy Parrot	RJ		BRt
PITTIDAE				
Erythropitta erythrogaster	Red-bellied Pitta	D-B, W-L	0.192	BRt
Pitta sordida	Hooded Pitta	D-B		BRt
PTILONORHYNCHIDAE				
Ailuroedus buccoides	White-eared Catbird	RS, D-B, W-L	1n	BRt
MALURIDAE				
Sipodotus wallacii	Wallace's Fairywren	RJ		BRt
Malurus cyanocephalus	Emperor Fairywren	RS, IB, RJ, D-B, W-L		BRt
Malurus alboscapulatus	White-shouldered Fairywren	RS, IB, RJ, D-B, W-L		BRt
MELIPHAGIDAE				
Myzomela eques	Ruby-throated Myzomela	D-B		BRt
Xanthotis flaviventer	Tawny-breasted Honeyeater	RS, IB, RJ, D-B, W-L		BRt
Xanthotis polygrammus	Spotted Honeyeater	RS, D-B		BRt
Philemon meyeri	Meyer's Friarbird	[RJ], D-B		BRt
Philemon buceroides	Helmeted Friarbird	RS, IB, RJ, D-B, W-L		BRt
Glycichaera fallax	Green-backed Honeyeater	D-B		BRt

ISSN-2513-9894 (Online)

Scientific name	English name (conservation status)	Observers	2017 capt.	Res / Mig
Pycnopygius ixoides	Plain Honeyeater	D-B		BRt
Pycnopygius stictocephalus	Streak-headed Honeyeater	D-B, W-L		BRt
Melilestes megarhynchus	Long-billed Honeyeater	RS, IB, RJ, D-B, W-L	2n	BRt
Meliphaga aruensis	Puff-backed Meliphaga	D-B, W-L	2n	BRt
Meliphaga albonotata	Scrub Meliphaga	RS, IB, RJ, D-B, W-L		BRt
Meliphaga analoga	Mimic Meliphaga	RS, D-B		BRt
Meliphaga mimikae	Mottled Meliphaga	W-L	1n	BRt
Meliphaga sp.		RJ		BRt
Caligavis obscura	Obscure Honeyeater	RS, D-B, W-L		BRt
ACANTHIZIDAE				
Pachycare flavogriseum	Goldenface	D-B, W-L		BRt
Crateroscelis murina	Rusty Mouse Warbler	RS, IB, RJ, D-B, W-L		BRt
Sericornis beccarii	Tropical Scrubwren	RS		BRt
Gerygone chrysogaster	Yellow-bellied Gerygone	RJ, D-B, W-L		BRt
Gerygone chloronota	Green-backed Gerygone	IB, RJ, D-B, W-L		BRt
Gerygone palpebrosa	Fairy Gerygone	RJ, D-B, W-L		BRt
Gerygone magnirostris	Large-billed Gerygone	D-B		BRt
MELANOCHARITIDAE				
Melanocharis nigra	Black Berrypecker	RS, D-B, W-L	1n	BRt
Oedistoma iliolophus	Spectacled Longbill	RS, D-B, W-L		BRt
Oedistoma pygmaeum	Pygmy Longbill	RS, D-B, W-L		BRt
Toxorhamphus poliopterus	Slaty-headed Longbill	RJ		BRt
CINCLOSOMATIDAE				
Ptilorrhoa castanonota	Chestnut-backed Jewel-babbler	RJ, D-B, W-L	0.019	BRt
MACHAERIRHYNCHIDAE				
Machaerirhynchus flaviventer	Yellow-breasted Boatbill	RS, D-B		BRt
CRACTICIDAE				
Peltops blainvillii	Lowland Peltops	RS, IB, D-B		BRt
Peltops montanus	Mountain Peltops	RJ, D-B, W-L		BRt
Cracticus quoyi	Black Butcherbird	RS, D-B, W-L		BRt
Cracticus cassicus	Hooded Butcherbird	RS, IB, RJ, D-B, W-L		BRt
ARTAMIDAE				
Artamus maximus	Great Woodswallow	RS, IB, RJ, D-B, W-L		BRt
RHAGOLOGIDAE				
Rhagologus leucostigma	Mottled Berryhunter	RS		BRt
CAMPEPHAGIDAE				
Coracina caeruleogrisea	Stout-billed Cuckooshrike	IB, RJ		BRt
Coracina boyeri	Boyer's Cuckooshrike	RS, IB, RJ, D-B, W-L		BRt
Coracina papuensis	White-bellied Cuckooshrike	RS		BRt

ISSN-2513-9894 (Online)

Scientific name	English name (conservation status)	Observers	2017 capt.	Res / Mig
Campochaera sloetii	Golden Cuckooshrike	RJ, D-B, W-L		BRt
Lalage leucomela	Varied Triller	IB, RJ, D-B, W-L		BRt
Edolisoma incertum	Papuan Cicadabird	IB, D-B, W-L		BRt
Edolisoma tenuirostre	Common Cicadabird	IB		Mt
Edolisoma schisticeps	Grey-headed Cicadabird	IB, RJ, D-B, W-L		BRt
Edolisoma melas	Black Cicadabird	RS, RJ, D-B, W-L		BRt
OREOICIDAE				
Ornorectes cristatus	Piping Bellbird	RS, IB, D-B, W-L	0.058	BRt
PACHYCEPHALIDAE				
Colluricincla megarhyncha	Little Shrikethrush	RS, IB, RJ, D-B, W-L		BRt
Pseudorectes ferrugineus	Rusty Shrikethrush	RS, IB, D-B, W-L	4n	BRt
Pachycephala hyperythra	Rusty Whistler	RS		BRt
Pachycephala simplex	Grey Whistler	RS, D-B, W-L		BRt
ORIOLIDAE				
Pitohui uropygialis	Southern Variable Pitohui	RS, IB, RJ, D-B, W-L	1n	BRt
Pitohui dichrous	Hooded Pitohui	RS, IB, RJ		BRt
Oriolus szalayi	Brown Oriole	RS, IB, [RJ], D-B, W-L		BRt
RHIPIDURIDAE				
Chaetorhynchus papuensis	Drongo Fantail	RS, W-L		BRt
Rhipidura leucophrys	Willie Wagtail	RS, IB, RJ, D-B, W-L		BRt
Rhipidura maculipectus	Black Thicket Fantail	D-B, [W-L]		BRt
Rhipidura leucothorax	White-bellied Thicket Fantail	RS, RJ, D-B, W-L		BRt
Rhipidura threnothorax	Sooty Thicket Fantail	D-B, W-L		BRt
Rhipidura rufidorsa	Rufous-backed Fantail	[RJ], D-B		BRt
Rhipidura atra	Black Fantail	RS		BRt
Rhipidura hyperythra	Chestnut-bellied Fantail	RS, D-B		BRt
Rhipidura rufiventris	Northern Fantail	RS, IB, RJ, D-B, W-L		BRt
DICRURIDAE				
Dicrurus bracteatus carbonarius	(Papuan) Spangled Drongo	RS, IB, RJ, D-B, W-L		BRt
PARADISAEIDAE				
Manucodia chalybatus	Crinkle-collared Manucode (P)	RS, RJ, D-B		BRt
Seleucidis melanoleucus	Twelve-wired Bird of Paradise (P)	D-B		BRt
Ptiloris magnificus	Magnificent Riflebird (P)	RS, IB, RJ, D-B, W-L		BRt
Cicinnurus regius	King Bird of Paradise (P)	RS, IB, RJ, D-B, W-L		BRt
Cicinnurus magnificus	Magnificent Bird of Paradise (P)	RS, IB, RJ, D-B, W-L		BRt
Paradisaea raggiana	Raggiana Bird of Paradise (P)	RS, IB, RJ, D-B, W-L		BRt
MELAMPITTIDAE				
Megalampitta gigantea	Greater Melampitta (RR)	W-L		BRt

ISSN-2513-9894 (Online)

Scientific name	English name (conservation status)	Observers	2017 capt.	Res / Mig
MONARCHIDAE				
Arses telescopthalmus	Frilled Monarch	IB, RJ, D-B, W-L		BRt
Myiagra alecto	Shining Flycatcher	RS, D-B, W-L		BRt
Symposiachrus rubiensis	Rufous Monarch	[IB]		BRt
Symposiachrus guttula	Spot-winged Monarch	RS, RJ, D-B		BRt
Carterornis chrysomela	Golden Monarch	RS, RJ, D-B, W-L		BRt
Monarcha frater	Black-winged Monarch	RS, D-B		BRt
CORVIDAE				
Corvus tristis	Grey Crow	RS, IB, RJ, D-B, W-L		BRt
PETROICIDAE				
Pachycephalopsis poliosoma	White-eyed Robin	D-B		BRt
Kempiella flavovirescens	Olive Flyrobin	IB, [RJ], W-L		BRt
Monachella muelleriana	Torrent Flycatcher	D-B		BRw
Drymodes beccarii	Papuan Scrub Robin	D-B, W-L	0.038	BRt
Poecilodryas hypoleuca	Black-sided Robin	RS, IB, D-B, W-L		BRt
Peneothello bimaculata	White-rumped Robin	RS, D-B, W-L		BRt
Gennaeodryas placens	Banded Yellow Robin (NT, RR)	RS, D-B, W-L		BRt
HIRUNDINIDAE				
Hirundo tahitica	Pacific Swallow	RS, IB, RJ, D-B, W-L		BRt
ZOSTEROPIDAE				
Zosterops atrifrons	Black-fronted White-eye	RJ, D-B, W-L		BRt
ACROCEPHALIDAE				
Acrocephalus australis	Australian Reed Warbler	RJ, D-B		BRw
LOCUSTELLIDAE				
Locustella fasciolata	Gray's Grasshopper Warbler	D-B		Mt
Megalurus macrurus	Papuan Grassbird	RS		BRt
STURNIDAE				
Aplonis metallica	Metallic Starling	D-B		BRt
Mino dumontii	Yellow-faced Myna	RS, IB, RJ, D-B, W-L		BRt
MUSCICAPIDAE				
Saxicola caprata	Pied Bushchat	IB, RJ, D-B, W-L		BRt
DICAEIDAE				
Dicaeum geelvinkianum	Red-capped Flowerpecker	RJ, D-B, W-L		BRt
NECTARINIIDAE				
Leptocoma aspasia	Black Sunbird	RS, IB, RJ, D-B, W-L		BRt
PASSERIDAE				
Passer montanus	Eurasian Tree Sparrow	W-L		BRt
ESTRILDIDAE				
Erythrura trichroa	Blue-faced Parrotfinch	D-B		BRt

ISSN-2513-9894 (Online)

Scientific name	English name (conservation status)	Observers	2017 capt.	Res / Mig
Lonchura tristissima	Streak-headed Mannikin	D-B		BRt
Lonchura leucosticta	White-spotted Mannikin	D-B		BRt

Appendix 2

The following accounts outline reasoning for adjustment to the status / identity of prior recorded species. They exclude recent taxonomic adjustments where there is no confusion over the identity of the recorded species.

SOUTHERN CASSOWARY *Casuarius casuarius*
A lowland species (most records below 300 m) replaced in upland environments, and on steep terrain in some lowland areas, by *C. bennetti*. The identity of cassowaries within Lake Kutubu WMA is yet to be confirmed. Schodde & Hitchcock (1968) presumed both species present based on reports from local residents and European officers. This is higher than all confirmed localities for *C. casuarius* in New Guinea and, given the unreliability of many second-hand accounts, requires confirmation from direct field sightings (Beehler & Pratt 2016). Until there is evidence to prove otherwise, all WMA records are provisionally referred to *C. bennetti*, which is known to occur locally outside the WMA in the Agogo Range (Woxvold & Legra 2017) and downstream in the Gobe area.

YELLOW-LEGGED BRUSHTURKEY *Talegalla fuscirostris*
A lowland species with one confirmed record above 400 m, on the Sogeri Plateau in Varirata National Park near Port Moresby where the species is known to breed (Richards & Rowland 1995). Emerging evidence suggests that *T. jobiensis* replaces *T. fuscirostris* in upland sites across much of southern mainland Papua New Guinea (see Species accounts), with the latter potentially occupying isolated hill-zone sites of relatively gentle terrain (such as at Varirata). Schodde & Hitchcock (1968) reported flushing a bird with 'pale yellowish feet' (R. Schodde *in litt*. 2015), implying *T. fuscirostris*, in the Mubi River valley. The Mubi River valley includes the largest area of flat alluvial terrain locally present, though this lies mostly outside of the WMA boundary. On similar terrain within the WMA (see Species accounts), camera-trapping revealed *T. jobiensis* to be fairly common with no images taken of *T. fuscirostris*. Given the fleeting nature and uncertain location (with respect to the WMA boundary) of Schodde's sighting, his record of *T. fuscirostris* is here excluded from the WMA tally. Burrows (Hartshorn *et al*. 1994) and Diamond & Bishop (2003, 2007) also reported *T. fuscirostris* from the Moro / Kutubu and Agogo Range areas. However, *T. jobiensis* is the only *Talegalla* confirmed present in the Agogo Range (Woxvold & Legra 2017) and Lake Kutubu WMA, and it is likely that, as many have done before them, these surveyors were interpreting fleeting glimpses and / or aural encounters based on incomplete distribution data available at the time. Until there is evidence to prove otherwise, these records are provisionally ascribed to *T. jobiensis*.

SOUTHERN CROWNED PIGEON *Goura scheepmakeri*
Crowned pigeons are terrestrial-foraging species endemic to the New Guinea lowlands where they prefer forest on gentle terrain. Schodde & Hitchcock (1968: 29) stated that '*Goura* pigeons … were reported by the CSIRO Resources Survey forest botanist … from the primary rainforest between Kutubu station and the Mubi River'. There are no other reports of crowned pigeons from above 500 m, and this record is excluded from subsequent regional handbooks or checklists (Coates 1985, Beehler & Pratt 2016). Without good views, inexperienced observers may confuse other large terrestrial birds such as *Otidiphaps nobilis*, *Trugon terrestris* or even megapodes for crowned pigeons. The Kutubu *Goura* record is here excluded from the WMA list.

FAN-TAILED CUCKOO *Cacomantis flabelliformis*
A 'tentative identification' by Jaensch (undated a) for the Moro / Lake Kutubu area, potentially within range of the rarely recorded migratory Australian subspecies *C. f. flabelliformis* (distribution poorly known) but below that of resident montane *C. f. excitus* (Beehler & Pratt 2016). The locality is within the elevational range of the similar looking, and almost identical sounding, common resident Chestnut-breasted Cuckoo *C. castaneiventris*, a bird confirmed present by other observers. Jaensch's record is here provisionally reassigned to the latter species.

WHITE-THROATED NIGHTJAR *Eurostopodus mystacalis* **/ PAPUAN NIGHTJAR** *E. papuensis*
Schodde reported *Eurostopodus* nightjars from forest clearings near Moro, 'tentatively' identifying them as *E. papuensis*, a poorly known species endemic to the lowlands of New Guinea and Salawati Island, 'on account of the absence of large white marks in the wings and tail and the general locality and habitat, which should exclude [Archbold's Nightjar] *E. archboldi*' (Schodde & Hitchcock 1968: 34). Another possible species is *E. mystacalis*, a non-breeding migrant from Australia that may remain in the area as late as September–October (Beehler & Pratt 2016). The highest reported elevation for *E. papuensis* is 400 m; that for *E. mystacalis* is

ISSN-2513-9894 (Online)

above 1,500 m (Coates 1985, Beehler & Pratt 2016). Until their identity is confirmed, rather than invoking an elevational record for *E. papuensis*, the Moro nightjars are here recorded as *Eurostopodus mystacalis* / *E. papuensis*.

UNIFORM SWIFTLET *Aerodramus vanikorensis* / **MOUNTAIN SWIFTLET** *A. hirundinaceus*
Lake Kutubu WMA is located in an elevational zone of overlap for *A. vanikorensis* and *A. hirundinaceus*, two common and widespread species that are indistinguishable in flight. *Aerodramus* are common in the WMA and have been reported variously as *A. vanikorensis*? (Schodde & Hitchcock 1968), *A. hirundinaceus* (Hartshorn *et al*. 1994, Burrows 1995, Jaensch & Kulmoi undated), *A. hirundinaceus*? (Jaensch undated a), *Aerodramus* sp. (Jaensch undated b) and *A. hirundinaceus* and / or *A. vanikorensis* (Diamond & Bishop 2003, 2007). Until identifications are confirmed (requiring birds in the hand), all *Aerodramus* records are here presented as *A. vanikorensis* / *hirundinaceus* (Appendix 1). It is acknowledged that the rare Bare-legged Swiftlet *A. nuditarsus* and / or Three-toed Swiftlet *A. papuensis* may also occur locally; we consider that these larger species are (at least by some observers) distinguishable in the field and, if present, would occur at lower density than the common smaller species, so that *A. vanikorensis* / *hirundinaceus* would account for some, if not all, *Aerodramus* swiftlets observed by various workers.

Appendix 3

Possible additional species recorded in comparable habitats in the nearby Agogo Range by (observers) Burrows (IB), JMD & KDB (D-B), and IAW & LL (W-L) (some birds recorded by Burrows may have been recorded within the WMA but this cannot be ascertained from his report; see text). The symbol '[WMA]' appears after the English name for species confirmed present in the Agogo Range and provisionally recorded within the WMA. Conservation status is shown in brackets after the English name for species Protected (P) under Papua New Guinean law. Residency / migratory (Res / Mig) status indicates: BR—breeding resident species; M—species that occur in New Guinea only as non-breeding migrants; BR/M—breeding residents with populations seasonally augmented by non-breeding visitors, and widespread local breeding range potentially overlapping the study area; M(BR)—breeding residents augmented by non-breeding visitors, but known breeding sites are localised and outside of the Kikori basin; t—birds of terrestrial environments, including forest, open areas and aerial foraging species; w—birds of wetlands, including lakes, rivers and streams; data from Coates (1985, 1990) and Beehler & Pratt (2016).

Scientific name	English name (status)	Observers	Res / Mig
Casuarius bennetti	Dwarf Cassowary [WMA]	D-B, W-L	BRt
Megapodius decollatus	New Guinea Scrubfowl [WMA]	W-L	BRt
Henicophaps albifrons	New Guinea Bronzewing	IB, D-B, W-L	BRt
Alopecoenas beccarii	Bronze Ground Dove	W-L	BRt
Ptilinopus bellus	Mountain Fruit Dove	D-B, W-L	BRt
Gymnocrex plumbeiventris	Bare-eyed Rail	W-L	BRt
Aegotheles insignis	Feline Owlet-nightjar	D-B	BRt
Aegotheles albertisi	Mountain Owlet-nightjar	W-L	BRt
Megatriorchis doriae	Doria's Hawk	D-B	BRt
Accipiter cirrocephalus	Collared Sparrowhawk [WMA]	IB, D-B	BRt
Accipiter meyerianus	Meyer's Goshawk	IB	BRt
Tanysiptera sylvia	Buff-breasted Paradise Kingfisher	D-B	Mt
Syma megarhyncha	Mountain Kingfisher [WMA]	W-L	BRt
Falco berigora	Brown Falcon	IB, D-B	BRt
Charmosyna josefinae	Josephine's Lorikeet	D-B	BRt
Ailuroedus melanotis	Black-eared Catbird	IB, D-B, W-L	BRt
Myzomela cruentata	Red Myzomela	IB, D-B	BRt
Myzomela nigrita	Papuan Black Myzomela	IB, D-B, W-L	BRt
Myzomela adolphinae	Elfin Myzomela	IB, D-B	BRt

ISSN-2513-9894 (Online)

Scientific name	English name (status)	Observers	Res / Mig
Meliphaga orientalis	Mountain Meliphaga	D-B	BRt
Sericornis spilodera	Pale-billed Scrubwren	D-B, [W-L]	BRt
Sericornis arfakianus	Grey-green Scrubwren	W-L	BRt
Melanocharis arfakiana	Obscure Berrypecker	D-B	BRt
Melanocharis longicauda	Mid-mountain Berrypecker	?IB	BRt
Edolisoma montanum	Black-bellied Cicadabird	IB, D-B, W-L	BRt
Parotia carolae	Carola's Parotia (P)	D-B, W-L	BRt
Lophorina superba	Superb Bird of Paradise (P)	D-B	BRt
Drepanornis albertisi	Black-billed Sicklebill (P)	D-B	BRt
Symposiachrus axillaris	Fan-tailed Monarch	D-B, W-L	BRt
Kempiella griseoceps	Yellow-legged Flyrobin	D-B, [W-L]	BRt
Tregellasia leucops	White-faced Robin	D-B, W-L	BRt
Petrochelidon nigricans	Tree Martin	D-B	Mt
Seicercus poliocephalus	Island Leaf Warbler	D-B, W-L	BRt
Zoothera heinei	Russet-tailed Thrush	W-L	BRt

ISSN-2513-9894 (Online)

Nesting behaviour of Natewa Silktail *Lamprolia klinesmithi*

by Joseph England

Received 21 May 2019; revised 12 August 2019; published 20 September 2019

http://zoobank.org/urn:lsid:zoobank.org:pub:C337F855-B862-46C0-ADE1-58CFC59E8BF5

Summary.—I report observations on the nesting behaviour of Natewa Silktail *Lamprolia klinesmithi* on the Natewa Peninsula, Vanua Levu, Fiji. Field work in June–August 2018 located four nests of which two were closely monitored. Nest attentiveness was very low (42.58% and 42.05% of total observation time spent at the nest), as was provisioning rate (35.29% of nest visits with food) in part due to uniparental care but possibly also in response to nest predation and fecundity-survival trade-off by the parent. Nest site and habitat were significantly different from historical records pertaining to the closely related (previously conspecific) Taveuni Silktail *L. victoriae*. The close proximity of nests and presence of six individuals in the nesting area poses questions concerning the species' breeding strategy. The paucity of data surrounding the ecology of *Lamprolia* and the lack of formal protective legislation on the Natewa Peninsula highlight the need for research into this endemic and globally threatened species.

The genus *Lamprolia* (silktails), endemic to the islands of Vanua Levu and Taveuni, Fiji, has been the cause of significant taxonomic confusion since its description by Otto Finsch in 1874, having been described as 'one of the most puzzling birds of the world' (Mayr 1945). Initially, its systematic affinities were adjudged largely based on plumage and behaviour, rather than any comprehensive morphological or genetic studies. *Lamprolia* was once thought to be affiliated to Paradisaeidae due to various similarities with the genera *Manucodia* and *Ptiloris* (Cottrell 1966, Heather 1977). This hypothesis was dismissed by Olson (1980) and Coates *et al*. (2006), with more detailed morphological analysis indicating that the genus was best placed in Monarchidae. The most recent assertion based on DNA is that *Lamprolia* is most closely related to the equally distinct Papuan *Chaetorhynchus*, together within Rhipiduridae (Irestedt *et al*. 2008). Additional molecular evidence (Anderson *et al*. 2015, 2017) has helped confirm that the previously monospecific *Lamprolia* comprises two species-level taxa: Taveuni Silktail *L. victoriae* (considered Near Threatened, and restricted to the island of Taveuni) and Natewa Silktail *L. klinesmithi* (Vulnerable, and confined to 260 km² of the Natewa Peninsula on Vanua Levu) (BirdLife International 2017, del Hoyo *et al*. 2018).

This study focuses on *L. klinesmithi*, the smaller and more vibrantly spangled species, which also displays supposed ecological differences in foraging behaviour (Watling 2001). Despite the recent taxonomic split, the incentive to study both populations has not yet been a priority. As a result, far more is known concerning the more easily observed and abundant *L. victoriae* on Taveuni, where there is greater coverage of undisturbed forest and three reserves provide legal protection for the species (Masibalavu & Dutson 2006). Ornithological field work on the Natewa Peninsula has been very limited (BirdLife International 2018) meaning that research into the ecology of *L. klinesmithi* has been minimal. Despite the majority of the Natewa Peninsula being recognised as an Important Bird Area (IBA) and the existence of community agreements (BirdLife International 2018),

ISSN-2513-9894 (Online)

the area is not subject to formal protection from logging and agriculture, which has led to extensive areas of mature forest being cleared and degraded (Masibalavu & Dutson 2006). Larger scale logging has slowed substantially since the start of the 21st century, with a mere 0.19% canopy cover lost between 2000 and 2012 across the IBA (Tracewski *et al*. 2016). However, the spatial scale used by Tracewski *et al*. (2016) may not elucidate finer changes in forest type and the key threat to much of the biodiversity on Natewa; degradation of mature forest via small-scale agricultural clearance. The nest, eggs and behaviour at the nest have been described for *Lamprolia* generally, but these are based on 14 nests from Taveuni and just one on Vanua Levu (Heather 1977). My study presents observational data at four additional nests on the Natewa Peninsula, two of which were monitored, elucidating novel information on the nesting behaviour of *L. klinesmithi* and questioning previous hypotheses concerning the species' social structure.

Methods

Study site.—Field work was undertaken on the Natewa Peninsula between 11 June and 5 August 2018, at a forestry station between the villages of Natewa and Vunimokasoi (16°38′7.3104″S, 179°45′16.1784″E; *c*.230 m), from which trails were established and used to search for nests. The area represents a mosaic of undisturbed and regenerating forest from past logging, as well as patches of farmland supporting small-scale crop production, including 'dalo' *Colocasia esculenta* and 'kava' *Piper methysticum*, and hardwood plantations of mahogany *Swietenia macrophylla* and pine *Pinus caribaea*. The discovery of four nests within 0.023 km² during the last ten days of the study provided an insight into the species' reproductive behaviour.

Monitoring.—Nests were found on 26 July (hereafter, nest 1), 30 July (nests 2 and 3) and 3 August (nest 4). The location, tree species, height and stage of nesting was determined at all four nests, but monitoring was only undertaken at nests 1 and 3 due to their relative visibility. Four nest watches of varying lengths were undertaken at each nest, two in the morning and two in the afternoon, between their discovery and the end of the study. Nests were observed from *c*.15 m using a telescope and binoculars to minimise disturbance, with the observer noting and timing all behaviours by the adults using a watch to the nearest second at nest 1 and to the nearest minute at nest 2 (due to the second observer possessing a less accurate watch). A total of 654 minutes 20 seconds was spent observing nest 1 and 371 minutes at nest 3. Periods of attentiveness (time spent at nest), brooding (time spent brooding the chick), incubation, and absence (time away from nest), as well as the number of visits, calls and food provisions made by the adult were measured at nests 1 and 3.

Recordings of vocalisations were made using a Tascam DR-05 handheld recorder and a BOYA BY-PVM1000L shotgun microphone. The contents of all nests were checked upon their discovery and subsequently for the monitored nests at the start of each nest watch using a mirror mounted on a pole, with photographs taken when possible. Nest 2 was too high to determine the nest contents using this method, but sound-recordings made of a begging young in the nest enabled me to establish the nesting stage. Nest height was determined by measuring the pole using a tape measure. Tree species was determined by a knowledgable local guide. Sex of the adults could not be determined as the species is sexually monomorphic.

In addition to nest watches, mist-netting was also conducted over the course of two field trips (12–21 July 2017 and 24 July–4 August 2018) in the vicinity of nests 1 and 3, where all species trapped were ringed and processed. This permitted me to determine the number of birds present in the area, as well as the breeding condition, gender and age of those individuals with cloacal protuberence or a brood patch.

ISSN-2513-9894 (Online)

Results

Nesting stage and location.—All nests were cup-shaped, typically Monarchidae-like in structure, largely comprised of dead leaves, vine tendrils and moss, bound together with spider web and lined with pale grey feathers, probably of Barking Imperial Pigeon *Ducula latrans*. Nest 3 differed slightly in that there was much moss hanging loosely around the outside (Fig. 1). Nests were sited 5.0–10.5 m above ground in the horizontal fork of small branches of 'makita' *Atuna racemosa* trees, the rim of the nest being level with the branches of the fork. Each nest was shaded by either the leaves of the tree or a vine, and was sited within 2 m of the main or a principal secondary trunk of the nest tree. The depth of the cup relative to the size of the bird meant only the head and tail protruded from the nest, as well described and illustrated by Heather (1977).

Nests 1–3 were all located within 5 m of a stream, and all nests were in relatively mature wet forest but very close to small-scale 'dalo' *Colocasia esculenta* and 'kava' *Piper methysticum* cultivation. Nests 1 and 3 were just 18 m apart, with nest 2 being 250 m away, above a steep stream bank. Nest 1 held a single hatchling estimated to be just a few days old given very sparse feathering, closed eyes and no audible begging. Nest 2 had a single nestling in the later stages of development based on the fairly loud begging calls recorded when the adult arrived. Nest 3 initally had one egg that hatched on 1 or 2 August 2018; its base colour was pinkish white with extensive reddish-brown speckling (Fig. 1). Nest 4 held a very similar egg. Table 1 presents the details of nest placement and nesting stage at each nest.

Nesting behaviour.—Nest attentiveness (percentage of overall observation time spent at nests by adults) was 42.58% and 42.05% for nests 1 and 3, respectively. Provisioning rate (percentage of nest visits with food) was 35.29% at both nests. Results and timings for behaviours observed at nests 1 and 3 are presented in Tables 2a and 2b, respectively. At nest 1, it appeared that just one bird attended, brooded and provisioned the chick, as two adults were never seen together at the nest. At nest 3 almost certainly a ringed female with a brood patch was the only adult seen regularly in attendance. Once, two unringed birds arrived at the nest simultaneously, silently hopped around the rim while wing flapping for *c*.30 seconds, and then flew off. I assume the unringed bird attending nest 1 was also an adult female, because neither of the males I ringed showed any evidence of a brood patch.

TABLE 1
Summary of key details recorded at four nests of Natewa Silktail *Lamprolia klinesmithi* found on the Natewa Peninsula, Vanua Levu, Fiji.

	Nest 1	**Nest 2**	**Nest 3**	**Nest 4**
GPS location	16°37′36.5406″S, 179°44′54.7188″E	16°37′45.0588″S, 179°44′57.7212″E	16°37′37.1382″S, 179°44′54.8982″E	16°37′48.5400″S, 179°44′53.0406″E
Date found	26 July 2018	30 July 2018	30 July 2018	3 August 2018
Height (m)	6.45	10.0	5.2	5.0
Tree species	Makita	Makita	Makita	Makita
Nesting stage	Feeding, chick predated?	Feeding	Incubating + feeding	Incubating
Number of eggs	NA	NA	1	1
Number of nestlings	1	1	1	NA
Number of nest-watches	4	0	4	0

ISSN-2513-9894 (Online)

Figure 1. Two nests of Natewa Silktail *Lamprolia klinesmithi*, Natewa Peninsula, Vanua Levu, Fiji: (a) nest 1 with the adult perched on the rim, (b) nest 3 and (c) the egg in nest 3 shown in the reflection of the mirror (Joseph England)

When brooding the adult regularly sat upright and tended the chick or nest briefly before either leaving the nest or re-assuming the usual low-slung position in the nest. The bird would leave silently, dropping straight down from the nest very rapidly and always in the same direction. There was an observed preference for facing away from the apex of the fork and trunk of the tree. At least six *L. klinesmithi* were regularly seen in the immediate vicinity of the nests. At times up to four individuals would pursue each other swiftly through the

ISSN-2513-9894 (Online)

TABLE 2a
Summary data from four nest watches conducted at nest 1 of a sample of four nests of Natewa Silktail *Lamprolia klinesmithi* on the Natewa Peninsula, Vanua Levu, Fiji.

	Watch 1	Watch 2	Watch 3	Watch 4	Total
Date	26 July 2018	28 July 2018	28 July 2018	30 July 2018	NA
Start time	15:30:00	09:09:00	14:25:11	06:53:00	NA
Duration	02:05:42	02:50:41	02:55:37	03:02:20	10:54:20
Nest visits	11	8	8	7	34
Attentiveness total	00:49:34	01:16:50	01:22:18	01:09:53	04:38:35
Attentiveness %	39.43	45.02	46.86	38.33	42.58
Attentiveness mean	00:04:30	00:09:36	00:10:17	00:09:59	00:08:12
Attentiveness range	00:00:15–00:10:10	00:00:11–00:18:15	00:00:30–00:22:39	00:07:50–00:13:56	00:00:11–00:22:39
Brooding	00:38:16	01:04:21	01:11:05	01:01:57	03:55:39
Brooding %	77.20	83.75	86.37	88.65	84.59
Provisioning chick	2	2	5	3	12
Provisioning chick %	18.18	25.00	62.50	42.86	35.29
Provisioning self	0	1	1	3	5
Mean calls prior to arrival	2	2.14	1.88	3.29	2.27
Off nest total	01:16:08	01:33:51	01:33:19	01:52:27	06:15:45
Off nest %	60.57	54.98	53.14	61.67	57.42
Off nest mean	00:06:55	00:13:24	00:11:40	00:14:03	00:11:03
Off nest range	00:00:41–00:22:36	00:02:23–00:44:15	00:00:09–00:23:56	00:03:45–00:33:58	00:00:09–00:44:15

TABLE 2b
Summary data from four nest watches conducted at nest 3 of a sample of four nests of Natewa Silktail *Lamprolia klinesmithi* on the Natewa Peninsula, Vanua Levu, Fiji.

	Watch 1	Watch 2	Watch 3	Watch 4	Total
Date	30 July 2018	31 July 2018	31 July 2018	4 August 2018	NA
Start time	15:45:00	07:45:00	14:40:00	07:37:00	NA
Duration	00:38:00	03:07:00	01:22:00	01:04:00	06:11:00
Nest visits	2	9	5	4	20
Attentiveness total	00:15:00	01:12:00	00:40:00	00:29:00	02:36:00
Attentiveness %	39.47	38.50	48.78	45.31	42.05
Attentiveness mean	00:07:30	00:08:00	00:08:00	00:07:15	00:07:48
Attentiveness range	00:07:00–00:08:00	00:04:00–00:14:00	00:05:00–00:12:00	00:03:00–00:11:00	00:03:00–00:14:00
Provisioning chick	NA	NA	NA	3	3
Provisioning chick %	NA	NA	NA	75.00	NA
Provisioning self	NA	NA	NA	0	NA
Mean calls prior to arrival	1	2	0.25	1.25	1.125
Off nest total	00:23:00	01:55:00	00:42:00	00:35:00	03:35:00
Off nest %	60.53	61.50	51.22	54.69	57.95
Off nest mean	00:11:30	00:14:22	00:10:30	00:08:45	00:11:57
Off nest range	00:05:00–00:18:00	00:07:00–00:26:00	00:07:00–00:13:00	00:05:00–00:11:00	00:05:00–00:26:00

ISSN-2513-9894 (Online)

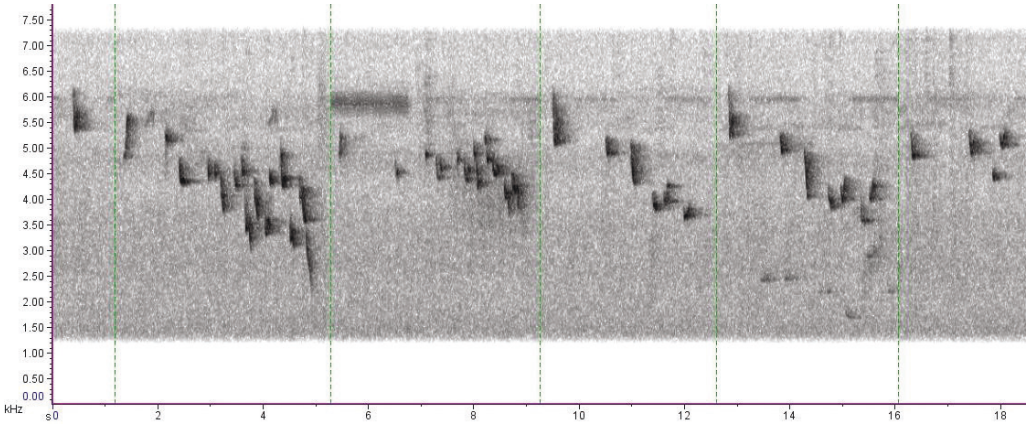


Figure 2. Sonogram showing the variation in calls given by the adult Natewa Silktail *Lamprolia klinesmithi* at nest 1, each calling event separated by green dotted lines; recording archived at https://www.hbw.com/ibc/sound/natewa-silktail-lamprolia-klinesmithi/silktail-song.

understorey, often passing directly overhead when a high-pitched rasping call was heard. Singles would occasionally pause to perch and then rejoin the chase. Despite this, there appeared to be complete tolerance of other silktails foraging and vocalising near nests. Just once was there an observed response from the nesting individual to a second bird; at nest 1 the brooding bird flew directly upwards to challenge a calling silktail causing a chase and interaction, before probably the same bird returned with a small cricket.

Vocalisations.—Prior to arrival at the nest, several calls were given as the bird got closer, ranging from a single sharp note to the full song, a series of rising and falling whistles, see https://www.hbw.com/ibc/sound/natewa-silktail-lamprolia-klinesmithi/silktail-song (Fig. 2). The number of calls given prior to arrival increased with the duration of the off-bout. Calls from the nest were rare and consisted of just one or two single notes, with no obvious purpose, or reaction from nearby individuals. A scold was also given in response to disturbance by the adult at nest 2 while constantly twitching its wings and tail, and furtively moving through the midstorey.

Provisioning.—The only identifiable food items brought to nest 1 were small crickets, although some prey was perhaps not seen due to its small size. The adult brought food to the nest five times but consumed the prey itself. Faecal sacs were apparently consumed by the adult and were not observed to be removed from the nest. There was less provisioning at nest 3 as the adult was incubating for the majority of the time spent watching.

Predation.—On 31 July nest 1 was checked and found to be empty, with the chick presumably having been predated. The adult was not seen at the nest again. Less vocalising was witnessed and there were more silent arrivals at nest 3. Nesting birds were alert to both Barking Imperial Pigeon and Fiji Shrikebill *Clytorhynchus vitiensis* that flew overhead but did not call or leave the nest. At nest 3 the nearby call of a Collared Kingfisher *Todiramphus chloris* caused the bird to depart the nest. Two silktails were observed mobbing a kingfisher in the area three weeks before the discovery of the nests. It is presumed from this behaviour that a kingfisher or possibly a shrikebill was responsible for the predation of nest 1.

Discussion

Breeding season.—There is no specific breeding season for many birds in Fiji, as appears to be also true elsewhere in the Pacific (Pyle *et al*. 2016) and perhaps across much of the tropics (Hau *et al.* 2008). Some species are known to breed in every month, presumably

ISSN-2513-9894 (Online)

in response to sporadic peaks in resource abundance (Watling 2001). Most avian breeding activity in Fiji occurs between June and August, which also appears true of *Lamprolia*, for which there are no nesting records in January–April (Heather 1977, Frith & Watling 1989, Watling 2001). The only previous nesting record of *Lamprolia* on Vanua Levu was in early September (Heather 1977). Records on Taveuni imply synchronised breeding, given the presence of multiple fledglings and vacated nests (Frith & Watling 1989), which matches the findings of the present study. Whether this reflects some form of intraspecific stimulation or environmental factors is unknown.

Nest, nest site and clutch.—The appearance of the four nests all match one of the two types described by Heather (1977). All were decorated externally with mosses and lichens, rather than with no decoration or just dry leaves and fibres. The fact two nests possessed a lining of Barking Imperial Pigeon feathers is consistent with the moss-decorated type described by Heather (1977). There was no apparent correlation between nest type and the different populations of *Lamprolia* on Taveuni and Vanua Levu, nor with season, altitude or material availability (Heather 1977). The use of feathers for nest lining is rare among birds in Fiji, having been reported only in Pacific Swallow *Hirundo tahitica*, with a single observation for Azure-crested Flycatcher *Myiagra azureocapilla* (Heather 1977). Such a lining is not required for insulation due to the warm climate in Fiji, and given that a lining of feathers is thought to increase nest predation (Møller 1984) there must be some as yet unknown net benefit. Each nest held one egg; those eggs seen, but not measured, match previous descriptions. Clutch size is usually an evolutionary trait associated with a 'slower pace of life' in the tropics (Jetz *et al*. 2008), but it is also directly linked to limited food availability and as a method of minimising predation risk (Martin *et al.* 2000), both of which could be factors at play with *Lamprolia*.

Nest height above the ground contrasted with previous observations on Taveuni. All historical nests were placed 1–3 m up (Heather 1977, Watling 2001) whereas all four in this study were 5.0–10.5 m high. As most previous recorded nests were on Taveuni, it is possible this reflects a behavioural difference between Natewa and Taveuni Silktails. Observations of the foraging behaviour of Taveuni Silktail suggest that that species is more likely to feed among the leaf litter (Heather 1977). It has been speculated that these behavioural differences are due to the absence of Taveuni's Azure-crested Flycatcher (or its congener on Vanua Levu, Chestnut-throated Flycatcher *Myiagra castaneigularis*) from the Natewa Peninsula. The *Myiagra* species are subcanopy feeders that utilise a similar niche to *Lamprolia*, which would lead to the latter's competitive exclusion on Taveuni but niche-broadening on Natewa. Alternatively, the presence of the introduced Small Indian Mongoose *Herpestes javanicus* on Vanua Levu could be the cause (Morley 2004). Although direct predation has been not observed, the mongoose can climb trees and its foraging behaviour is relatively undescribed across much of the species' introduced range (Nellis & Everard 1983).

The consistency of nesting habitat, including proximity to water and tree species used, indicate that Natewa Silktail is reliant on a fairly specialist forest type. *Atuna racemosa* grows only along creek lines in lowland valleys, which explains the preference for streamside gullies. It is used by indigenous comunities to construct corner posts and rafters for their houses due to its durable and flexible properties in strong winds, whilst smaller branches and leaves are used for waterproof roof thatching and to bind the walls as a form on insulation (V. Cegumalua pers. comm.). These properties are perhaps also utilised and beneficial to *Lamprolia*. The nest tree species was not noted on Taveuni, but it was reported that nests there were often sited on or near ridgetops, whereas the only previous Natewa nest record was in a broad level-ground gully near a sharp drop to a stream (Heather 1977). Nesting habitat is perhaps another key difference between the two species.

ISSN-2513-9894 (Online)

Nesting behaviour.—Nest attentiveness was extremely low, indeed lower than that of any passerine species subject to comparable studies (Tieleman *et al*. 2004, Chalfoun & Martin 2007). This could be a result of food limitation (Chalfoun & Martin 2007), lower latitude (Martin 2002) or to minimise the risk to the adult and nest of predation (Martin *et al*. 2000, Ghalambor & Martin 2001). Low nest attentiveness during incubation could at least partially explain the need for insulation, which a feather lining would offer (Tieleman *et al*. 2004). The low rate of chick provisioning, long off-bouts and frequency of self-feeding at the nest suggests a life history trade-off, with the adults placing their own survival above that of their offspring due to low clutch size (Ghalambor & Martin 2001). Heather (1977) concluded that one bird nestbuilds and incubates, and my study shows also that apparently one adult alone provisions the chick. Single-parent care is another factor reducing attentiveness (Matysioková & Remeš 2014).

Predation appeared to be a key factor determining much of the silktail's nesting behaviour. The evasive and defensive behaviour against Fiji Shrikebill and particularly Collared Kingfisher implies these two species are nest predators. The shading over the nest, low concealed posture of the sitting birds, and quick dropping flight when departing the nest, are common to all nests found (Frith & Watling 1989) and likely to be designed to minimise predation. The external decoration of moss and greenery would also help to conceal the nest.

The reason for the prolific vocalising prior to arrival is unknown. Although apparently paradoxical, these calls may reduce predation risk by negating untimely begging and increasing feeding efficiency (Magrath *et al*. 2010). Although a reduction in vocalisations was noted while incubating, calls were still given before arrival at the nest. This suggests they could have an alternative function, perhaps to signal their presence to other adults nesting nearby. The relationship between off-bout length and number of calls prior to arrival at the nest is interesting and, with further work, could help uncover the reason for the vocalising.

The close proximity of all nests, especially 1 and 3, is unusual. The tolerance of two or more nesting birds so close to each other is remarkable and rare in non-colonial birds. Heather (1977) described a group of three nests at various stages on Taveuni, showing that this is not a one-off. Although pursuit flights between four birds occurred in the nesting area, this behaviour appeared display-like or ritualistic rather than confrontational, as in the same area individuals were seen foraging in loose groups of up to six. This could suggest that the group comprises related individuals or that a harem-type mating system exists. Of course, it is possible that, because *Lamprolia* requires such apparently specialised habitat for nesting, habitat constraints have led to such nest proximity.

Nest attentiveness and provisioning, although low, is probably explained by small clutch size and fecundity-survival trade-off in adults. It appears the microhabitat and nest tree species are particularly important in the species' breeding biology, reinforcing the need to protect this area. Further study is certainly required to establish the benefit of vocalising before arrival at the nest, the mating system and detailed habitat requirements for foraging and nesting. A comparative study of Taveuni and Natewa Silktails would help to uncover ecological differences and understand possible impacts of different species assemblages and invasive species. Colour ringing as many indidivuals as possible in the population would be a first step to better understand nesting behaviour and responsibilities, as well as to monitor territory size and habitat usage. Genetic analysis examining relatedness within groups would help shed light on whether any form of cooperative breeding occurs in the species' population.

ISSN-2513-9894 (Online)

Unfortunately, significant time constraints on field work resulted in a small sample size of nests from just one area. Due to this small dataset, there are limitations on the conclusions that can be drawn and there is still a degree of speculation surrounding the species' reproductive behaviour. The paucity of historical field work and, therefore understanding of the region's ecology, make it difficult to reach any firm conclusions. This study serves to underline how little we know of the ecology of Pacific island birds, especially local and range-restricted species.

Acknowledgements

This study was supported by and part of the ongoing work being undertaken on the Natewa Peninsula by Operation Wallacea (www.opwall.com) in partnership with the communities of Vusaratu and Natewa. I thank all staff from Operation Wallacea for their logistical support which enabled this study, especially Tim Coles and Greg Kerr. Particular thanks go to my friend and guide Viliame 'Bill' Solomone, who spent countless hours in the field with me. Many thanks also to Thomas Martin for guidance and constructive comments.

References:

Anderson, M. J., Hosner, P. A., Filardi, C. E. & Moyle, R. G. 2015. Phylogeny of the monarch flycatchers reveals extensive paraphyly and novel relationships within a major Australo-Pacific radiation. *Mol. Phyl. & Evol*. 83: 118–136.

Anderson, M. J., Manthey, J. D., Naikatini, A. & Moyle, R. G. 2017. Conservation genomics of the silktail (Aves: *Lamprolia victoriae*) suggests the need for increased protection of native forest on the Natewa Peninsula, Fiji. *Conserv. Genet*. 18: 1277–1285.

BirdLife International. 2017. The IUCN Red List: Natewa Silktail *Lamprolia klinesmithi*. https://www.iucnredlist.org/species/103707799/118499534 (accessed 29 November 2018).

BirdLife International. 2018. Important Bird Areas factsheet: Natewa/Tunuloa Peninsula. http://www.birdlife.org (accessed 5 December 2018).

Chalfoun, A. D. & Martin, T. E. 2007. Latitudinal variation in avian incubation attentiveness and a test of the food limitation hypothesis. *Anim. Behav*. 73: 579–585.

Coates, B. J., Dutson, G. C. L. & Filardi, C. E. 2006. Family Monarchidae (monarch-flycatchers). Pp 350–377 *in* del Hoyo, J., Elliott, A. & Christie, D. A. (eds.) *Handbook of the birds of the world*, vol. 11. Lynx Edicions, Barcelona.

Cottrell, G. W. 1966. A problem species: *Lamprolia victoriae*. *Emu* 66: 253–266.

Ghalambor, C. K. & Martin. T. E. 2001. Fecundity-survival trade-offs and parental risk-taking in birds. *Science* 292(5516): 494–497.

Hau, M., Perfito, N. & Moore, I. T. 2008. Timing of breeding in tropical birds: mechanisms and evolutionary implications. *Orn. Neotrop*. 19: 39–59.

Heather, B. D. 1977. The Vanua Levu Silktail (*Lamprolia victoriae kleinschmidti*): a preliminary look at its status and habits. *Notornis* 24: 94–128.

del Hoyo, J., Collar, N. & Christie, D. A. 2018. Natewa Silktail (*Lamprolia klinesmithi*). *In* del Hoyo, J., Elliott, A., Sargatal, J., Christie, D. A. & de Juana, E. (eds.) *Handbook of the birds of the world Alive*. Lynx Edicions, Barcelona (retrieved from https://www.hbw.com/node/1343797 on 5 December 2018).

Irestedt, M., Fuchs, J., Jønsson, K. A., Ohlson, J. I., Pasquet, E. & Ericson, P. G. P. 2008. The systematic affinity of the enigmatic *Lamprolia victoriae* (Aves: Passeriformes)—an example of avian dispersal between New Guinea and Fiji over Miocene intermittent land bridges? *Mol. Phyl. & Evol*. 48: 1218–1222.

Jetz, W., Sekerçioğlu, C. H. & Böhning-Gaese, K. 2008. The worldwide variation in avian clutch size across species and space. *PLoS Biol*. 6(12): e303.

Magrath, R. D., Haff, T. M., Horn, A. G. & Leonard, M. L. 2010. Calling in the face of danger: predation risk and acoustic communication by parent birds and their offspring. *Advances Stud. Behav*. 41: 187–253.

Martin, T. E. 2002. A new view of avian life-history evolution tested on an incubation paradox. *Proc. Roy. Soc. Lond*. 269: 309–316.

Martin, T. E., Martin, P. R., Olson, C. R., Heidinger, B. J. & Fontaine, J. J. 2000. Parental care and clutch sizes in North and South American birds. *Nebraska Coop. Fish & Wildl. Res. Unit* 58.

Masibalavu, V. & Dutson, G. 2006. *Important Bird Areas in Fiji: conserving Fiji's natural heritage*. BirdLife International Pacific Partnership Secretariat, Suva.

Matysioková, B. & Remeš, V. 2014. The importance of having a partner: male help releases females from time limitation during incubation in birds. *Frontiers Zool*. 11: 24.

Mayr, E. 1945. *Birds of the southwest Pacific*. Macmillan, New York.

Møller, A. P. 1984. On the use of feathers in birds' nests: predictions and tests. *Ornis Scand*. 15: 38–42.

Morley, C. G. 2004. Has the invasive mongoose *Herpestes javanicus* yet reached the island of Taveuni, Fiji? *Oryx* 38: 457–460.

ISSN-2513-9894 (Online)

Nellis, D. W. & Everard, C. O. R. 1983. The biology of the mongoose of the Caribbean. *Stud. Fauna Curacao and the other Caribbean Islands* 64: 1–162.
Olson, S. L. 1980. *Lamprolia* as part of a South Pacific radiation of monarchine flycatchers. *Notornis* 27: 7–10.
Pyle, P., Tranquillo, K., Kayano, K. & Arcilla, N. 2016. Molt patterns, age criteria and molt-breeding dynamics in American Samoan landbirds. *Wilson J. Orn*. 128: 56–69.
Tieleman, B. I., Williams, J. B. & Ricklefs, R. E. 2004. Nest attentiveness and egg temperature do not explain the variation in incubation periods in tropical birds. *Functional Ecol*. 18: 571–577.
Tracewski, Ł., Butchart, S. H., Donald, P. F., Evans, M. I., Fishpool, L. D. C. & Buchanan, G. M. 2016. Patterns of twenty-first century forest loss across a global network of important sites for biodiversity. *Remote Sens. Ecol. Conserv*. 2: 37–44.
Watling, D. 2001. *A guide to the birds of Fiji & western Polynesia: including American Samoa, Niue, Samoa, Tokelau, Tonga, Tuvalu and Wallis-Futuna*. Environmental Consultants, Suva.

Address: Wallacea House, Old Bolingbroke, Spilsby, Lincolnshire PE23 4EX, UK, e-mail: joeengland8@hotmail.co.uk

ISSN-2513-9894 (Online)

Some additions to the avifauna of Central African Republic

by Robert J. Dowsett & Gregory B. P. Davies

Received 5 June 2019; revised 15 July 2019; published 20 September 2019

http://zoobank.org/urn:lsid:zoobank.org:pub:95525D21-CB46-480D-BD11-F13404064701

Summary.—Details are given of four species new to the avifauna of the Central African Republic, based on specimens overlooked in American museum collections and previously unpublished: Madagascar Cuckoo *Cuculus rochii*, Black-necked Wattle-eye *Dyaphorophyia chalybea*, White-browed Scrub Robin *Cercotrichas leucophrys* and Grey Ground Thrush *Geokichla princei*.

We present here details of some museum specimens that represent additions to the avifauna of Central African Republic, but which have not appeared in the literature. A list of the species documented for this and other Afrotropical countries is, or will be, presented at: https://www.africanbirdclub.org/dowsett-checklists. In the case of the Central African Republic's avifauna there are numerous unpublished species records that would be new, and work is in progress to document them. Meanwhile, details of these are obtainable from the first author.

Figure. 1. Cuckoo specimens held in Los Angeles County Museum and collected near Baroua, Central African Republic: Madagascar Lesser Cuckoo *Cuculus rochii* (LACM 84699, left) and Dusky Long-tailed Cuckoo *Cercococcyx mechowi* (LACM 84700, right) (Gregory B. P. Davies)

MADAGASCAR CUCKOO *Cuculus rochii*

Friedmann (1978) reported five specimens of Dusky Long-tailed Cuckoo *Cercococcyx mechowi* collected by A. Williams on 1–17 June 1976, near the Ouossi River, *c*.11 km west of Baroua, Mbomou Prefecture (*c*.05°20′N, 24°20′E), housed in the Los Angeles County Museum. However, examination shows that one of them, collected on 12 June (LACM 84699), labelled as a female with ovary not enlarged, stands apart from the other correctly identified *C. mechowi* (Fig. 1). It had been shot '40 feet up in [a] mature forest tree' (specimen label) within an extensive forest where the river had cut into a partially grassy plateau (A. Williams *in litt*. 2019). Its small size, proportions (wing: tail ratio) and plumage pattern indicate it is not a Dusky Long-tailed Cuckoo.

The largely grey throat (with a few dark-barred feathers), folded wings extending far towards the tip of the tail and basic measurements (wing 158 mm, tail 139 mm) suggest that it is attributable to either Asian Lesser Cuckoo *Cuculus poliocephalus* or Madagascar Cuckoo *C. rochii*. These two species are very similar (being often treated as conspecific in the past) and have long caused confusion both in the field and

ISSN-2513-9894 (Online)

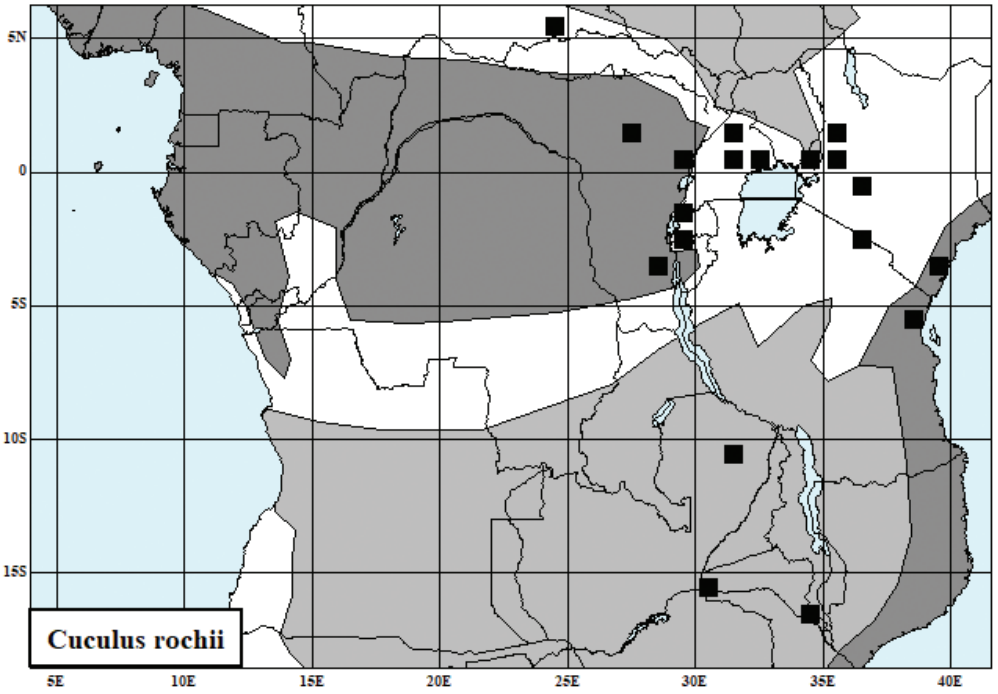


Figure 2. East African records of Madagascar Lesser Cuckoo *Cuculus rochii* (based on published and unpublished records in R. J. Dowsett's *Tauraco* databases).

museum. Several criteria were proposed by Becking (1988) for separating specimens of the two species, specifically wing and tail measurements, body mass, carpometacarpal feather patterning and the form of the mandibular symphysis.

Using Becking's (1988) criteria, the LACM 84699 cuckoo shows barred carpometacarpal feathering, a rounded mandibular symphysis, heavy mass (61 g) and large measurements (wing, tail), which attributes indicate it to be *C. rochii*. The June collection date is also more consistent with *C. rochii* given these species' known migratory movements—*C. rochii* visiting mainland Africa between May and September (Becking 1988, Payne 2005), with some remaining during the austral summer (Ginn 1999, Spottiswoode & Allan 2000, Dowsett-Lemaire & Dowsett 2006), while *C. poliocephalus* visits Africa exclusively between November and early May (Becking 1988, Payne 2005).

LACM 84699 is a juvenile beginning the transitional moult to adulthood. The few barred feathers on the throat are interpreted to be remnants of the completely barred throat found in juveniles. The remiges and rectrices are old and heavily worn, indicating that moult was not far advanced at the time it was collected.

Fig. 2 maps East African records of *C. rochii*, wherein it can be seen that the Baroua record is *c*.300 km north-west of the nearest, Avakubi, Democratic Republic of Congo (01°22'N, 27°35'E: Chapin 1939).

BLACK-NECKED WATTLE-EYE *Dyaphorophyia chalybea*

A female was collected on 24 May 2001 by D. Willard in the Ndoki sector of Dzanga-Ndoki National Park, 38.6 km south of Lidjombo (02°21'N, 16°03'E). It is in the Field Museum of Natural History, Chicago (FMNH 429637: VertNet.org). This record represents just a slight extension to the east from Lobéké, Cameroon (02°09'N, 15°44'E: Dowsett-Lemaire & Dowsett 2000).

ISSN-2513-9894 (Online)

Figure 3. Specimen of White-browed Scrub Robin *Cercotrichas leucophrys* collected near Beya, Central African Republic (AMNH 832113, middle), two *C. leucophrys munda* (Baudouinville, Democratic Republic of Congo, left) and two Brown-backed Scrub Robins *C. hartlaubi* (Tshibati, Kivu, Democratic Republic of Congo, right) (© American Museum of Natural History, New York)

WHITE-BROWED SCRUB ROBIN *Cercotrichas leucophrys*

Examination of a scrub robin specimen in the American Museum of Natural History, New York, collected on 27 June 1998, *c*.8 km south of Beya (i.e. near Monasao) by A. L. Porzecanski (AMNH 832113), confirms its identification as *C. leucophrys munda*. The bird was collected in a small savannah at 03°17′N, 16°14′E (P. Sweet *in litt*. 2018), and there are populations of *C. l. munda* in enclosed savannahs in several parts of the northern forests, the nearest being to the east, at Gele, Bosobolo (04°48′N, 19°02′E: Schouteden 1962). This specimen is heavily worn, but characters that distinguish it from the forest-dwelling Brown-backed Scrub Robin *C. hartlaubi* include (1) the well-defined streaking on the breast (not diffuse), (2) the large pale yellowish base to the mandible (largely all black in *hartlaubi*) and (3) the warm cinnamon mantle (not drab grey-brown as in *hartlaubi*). Fig. 3 compares AMNH 832113 to skins of *C. leucophrys* and *C. hartlaubi* from the Congo (collected by J. P. Chapin).

Figure 4. Specimen of Grey Ground Thrush *Geokichla princei* (AMNH 832142) collected at Bayanga, Central African Republic (© American Museum of Natural History, New York)

GREY GROUND THRUSH *Geokichla princei*

A female was collected in forest at Bayanga (02°54′N, 16°15′E) on 23 June 1998 by P. Beresford (AMNH 832142; Fig. 4). There

ISSN-2513-9894 (Online)

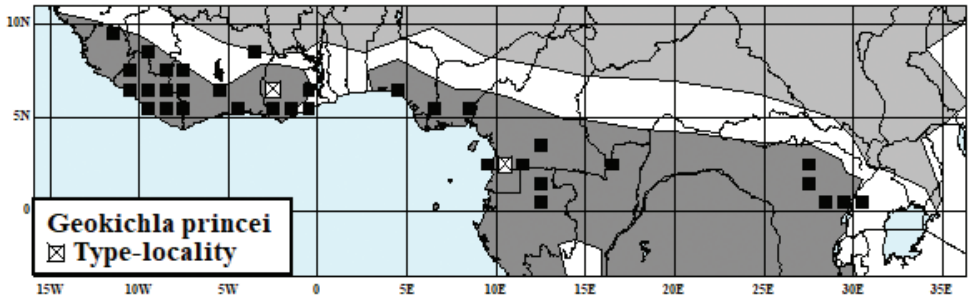


Figure 5. Distribution of Grey Ground Thrush *Geokichla princei* (based on the *Tauraco* databases).

have been several observations in the area (R. Cassidy *in litt*. 2019). This is an easterly extension of the known range from Bitye, Cameroon (03°10′N, 12°20′E: Good 1953) and M'Passa, Gabon (00°30′N, 12°50′E: Brosset & Erard 1986).

Acknowledgements

We are grateful to Paul Sweet and Tom Trombone for access to information concerning specimens in AMNH, and to Kimball Garrett and Allison Shultz for access to specimens in Los Angeles (LACM). Nik Borrow is thanked for comments on some points of identification. Andrew Williams kindly provided details concerning the 1976 Lathrop expedition to the Central African Republic. For useful comments on the submitted manuscript we thank Rod Cassidy, Ron Demey and Guy Kirwan.

References:

Becking, J.-H. 1988. The taxonomic status of the Madagascar Cuckoo *Cuculus* (*poliocephalus*) *rochii* and its occurrence on the African mainland, including southern Africa. *Bull. Brit. Orn. Cl.* 108: 195–206.

Brosset, A. & Erard, C. 1986. *Les oiseaux des régions forestières du nord-est du Gabon*, vol. 1. Soc. Natl. Protection de la Nature, Paris.

Chapin, J. P. 1939. The birds of the Belgian Congo. II. *Bull. Amer. Mus. Nat. Hist*. 75: 1–632.

Dowsett-Lemaire, F. & Dowsett, R. J. 2000. Birds of the Lobéké Faunal Reserve, Cameroon, and its regional importance for conservation. *Bird Conserv. Intern*. 10: 67–87.

Dowsett-Lemaire, F. & Dowsett, R. J. 2006. *The birds of Malawi. An atlas and handbook*. Tauraco Press & Aves, Liège.

Friedmann, H. 1978. Results of the Lathrop Central African Republic Expedition 1976, ornithology. *Contrib. Sci*. 287: 1–22.

Ginn, P. 1999. Madagascar Lesser Cuckoo in the Bvumba. *Honeyguide* 45(1): 22–23.

Good, A. I. 1953. The birds of French Cameroon, vol. 2. *Mém. Inst. Fr. Afr. Noire, Sci. Nat*. 3: 1–269.

Payne, R. B. 2005. *The cuckoos*. Oxford Univ. Press.

Schouteden, H. 1962. La faune ornithologique des districts de la Mongala et de l'Ubangi. *Mus. Roy. Afr. Centr., Doc. Zool*. 3: 1–144.

Spottiswoode, C. N. & Allan, D. G. 2000. Madagascar Cuckoo. *Bird Numbers* 9(2): 25.

Addresses: Robert J. Dowsett, Le Pouget, Sumène, F.30440, France, e-mail: Dowsett@aol.com. Gregory B. P. Davies, Research Associate, Ornithology Dept., Natural History Museum of Los Angeles County, Los Angeles, USA, e-mail: seicercus@gmail.com

ISSN-2513-9894 (Online)

Bulletin of the British Ornithologists' Club
ISSN 2513-9894 (Online)
Edited by Guy M. Kirwan
Associate Editors: Frank D. Steinheimer; Robert Prŷs-Jones; Lincoln Fishpool
Volume 139 Number 3, pages 187–306

CONTENTS

BOC Office
c/o Natural History Museum at Tring,
Akeman Street, Tring, Herts. HP23 6AP, UK
E-mail: info@boc-online.org
Tel. +44 (0)208 8764728 / 07919174898

Registered Charity No. 1169733

www.boc-online.org

Published by the British Ornithologists' Club
Typeset by Eng-Li Green, New Mexico, USA