The avifauna of Muna and Wawonii Islands, with additional records from mainland South-east Sulawesi, Indonesia

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Despite being an important centre of endemism, the south-east peninsula of Sulawesi and its satellite islands have remained ornithologically neglected. While relatively extensive surveys have been carried out on Buton Island (the largest satellite of South-east Sulawesi), the avifauna of much of the rest of the region is poorly understood. We visited the islands of Muna and Wawonii, and Lasada village on mainland Sulawesi, in the summer of 2017 to collect data for avian biogeographic research. The 2017 expedition combined transect surveys and mist-netting, allowing for a wide assessment of the avifauna at these sites. During these visits all bird species encountered were recorded, providing the first scientific assessment of the avifauna of Wawonii and providing much needed information on the avifauna of Muna Island and the south-east peninsula of Sulawesi. In total 119 species were recorded, of which 33 are regional endemics, two are classified as Near Threatened, two as Vulnerable and one as Endangered.

INTRODUCTION

The biodiversity hotspot of Wallacea, Indonesia, is notable for its high endemism and its mixed fauna of both Asian and Australasian origin (Myers *et al.* 2000, Whitten *et al.* 2002, Myers 2003). Sulawesi is the largest island in Wallacea. Despite possessing a relatively depauperate avifauna in comparison to some smaller islands such as Java, Sulawesi boasts a high degree of endemism (Michaux 2010, BirdLife International 2016). This is due to an extended period of geological isolation from continental landmasses (Watling 1983). Sulawesi has a tropical climate with mean daily temperatures typically ranging from 22–32°C; the peak of the dry season is between June and September and the peak of the rainy season is between December and March (Whitten *et al.* 2002). Sulawesi's east and south-east peninsulas, including their satellite islands, have received little attention from ornithologists in comparison to the north, south and central provinces. Indeed, detailed ornithological surveying has yet to be carried out in much of South-east Sulawesi (White & Bruce 1986, Rheindt *et al.* 2014).

The majority of information on the avifauna of South-east Sulawesi comes from its largest satellite, Buton Island (c. 5,600 km^2), which lies south-east of mainland Sulawesi (Figure 1). Accounts from Buton (frequently named Butung) have been published from the colonial period to the present (Hartert 1903, van Bemmel & Voous 1951, Schoorl 1987, Catterall 1996, Martin *et al.* 2012, Martin *et al.* 2015, Martin *et al.* 2017). However, neither the islands of Muna and Wawonii, nor the mainland of South-east Sulawesi, have received the same attention. Currently the primary ornithological information on the region comes from White & Bruce (1986), with additional records in Coates & Bishop (1997) and some updated information provided in Eaton *et al.* (2016). The islands of Muna and Wawonii are presently separated from each other and mainland Sulawesi by shallow seas, but historically these islands have been linked during glacial periods (Milsom & Ali 1999, Nugraha & Hall 2018). As a result, the islands would be expected to have a comparable avifauna but, unlike neighbouring Buton (Catterall 1996), they have not been thoroughly surveyed and may host important populations. The nearby islands of Kabaena (c. 16 km west of Muna) and Menui (c. 40 km north of Wawonii) have only recently had an assessment of their avifauna, showing them to be home to 89 and 48 species of birds respectively (Robinson-Dean *et al.* 2002, Iqbal & Tepu 2014, O'Connell *et al.* 2017, Monkhouse *et al.* 2018). It is very likely that further range extensions await discovery in the South-east Sulawesi region.

Muna, the second-largest of South-east Sulawesi's offshore islands (c. 2,890 km^2), lies just west of Buton and south of mainland Sulawesi. It is largely composed of a low-lying (mostly <100 m) limestone plateau, reaching a maximum elevation of 400 m (Milsom & Ali 1999). This relatively flat, easily accessible terrain has led to Muna being almost entirely deforested and mostly covered with plantations, arable farmland and scrubland, with only very small pockets of forest remaining (Gillespie *et al.* 2005). The avifauna of Muna has received some attention in the past (van Bemmel & Voous 1951), but this information is long out of date due to the extensive forest clearance that the island has undergone since then.

Wawonii (c. 650 km^2) lies north of Buton and east of mainland Sulawesi. Substantial tracts of forest persist throughout much of the island's interior (Farida & Dahrudin 2008), which are predicted to possess species of high conservation value (Cannon *et al.* 2007). However, its ecology remains largely unexplored. Only a single bird species has previously been recorded for Wawonii Island, the Lemon-bellied White-eye *Zosterops chloris* (O'Connell *et al.* 2019c). The local people practice shifting agriculture (Farida & Dahrudin 2008); when a field is no longer productive for staple crops it is planted with coconuts. This practice has resulted in the more

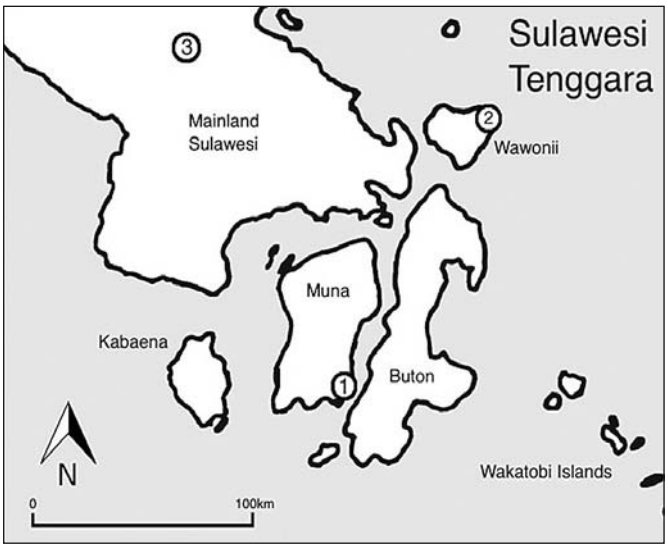

Figure 1: Map of South-east Sulawesi (Sulawesi Tenggara), Indonesia, showing the three survey sites: 1. Kamama Mekar (Muna Island), 2. Dimba (Wawonii Island), 3. Lasada (mainland Sulawesi).

Table 1. Total numbers of species, Sulawesi endemics, Near Threatened (NT), Vulnerable (VU) and Endangered (EN) species recorded at Kamama Mekar (Muna), Dimba (Wawonii) and Lasada (Sulawesi) on the 2017 expedition.

	Species	Sulawesi endemics	NT	VU	EN
Muna	59	18	0	0	0
Wawonii	71	18	2	1	0
Lasada	99	24	2	2	1
Expedition total	**119**	**33**	**2**	**2**	**1**

populated coastal parts of the island forming an almost unbroken ring of coconut plantation around the forested interior.

While the avifauna of peninsular South-east Sulawesi is addressed by White & Bruce (1986) and Eaton *et al.* (2016), the distributions given are broad, often covering the whole peninsula or the entirety of Sulawesi. It is difficult to find detailed checklists for particular areas or habitats, save a few locations (Wardill *et al.* 1998, Wardill 2003). This means that there is little information available on where biodiversity is concentrated on the south-eastern peninsula.

The main purpose of the field expeditions to Muna, Wawonii and mainland Sulawesi in 2017 was to gather data for biogeographical research. All avian species encountered were recorded in order to better understand the region's avian community structure. This paper provides the first scientific assessment of the avifauna of Wawonii and valuable information on the avifauna in the neglected areas of Muna and the south-east peninsula of Sulawesi.

METHODS

The areas surveyed were in the vicinity of the villages of Kamama Mekar in the south-east of Muna Island (5.307°S 122.640°E), Dimba in the north-east of Wawonii Island (4.042°S 123.229°E) and Lasada on the south-east peninsula of Sulawesi (3.708°S 121.864°E), to the north-west of Kendari city, the capital of South-east Sulawesi (Figure 1). Kamama Mekar is an inland lowland site, with habitats comprising scrub and low mixed farmland. High density plantation agriculture was largely absent from the area. Forest was also largely absent apart from a few small patches, mostly along ridge lines. Survey altitudes varied between 15 m and 65 m above sea level. Dimba is a coastal lowland site, with habitats dominated by intensive coconut plantation, with some areas of rice paddy and coastal scrub. Large tracts of forest were visible further inland but were largely inaccessible. Survey altitudes varied between 3 m and 110 m. Lasada is an inland lowland site, dominated by a huge rice paddy of c. 6.75 km^2 (Daft Logic 2018). The rice paddy was fringed by patches of mixed farmland, open grassland, some teak and conifer plantation and patches of scrub. Small areas of forest survived on the hills around the rice paddy. Survey altitudes varied between 120 m and 160 m.

Records of the avifauna of the study sites were collected during line transect surveys and mist-netting in July and August 2017. Transects were 1 km long and all bird species seen or heard were recorded. Data were collected between 06h00–08h30 and 15h15–17h30 each day. A total of 31 hours of transect surveying was carried out covering 21 routes (five in Kamama Mekar, six in Dimba and 10 in Lasada), each surveyed in the morning and evening.

Further records were obtained from mist-netting. Mist-nets were placed in habitat types suited to the capture of small passerines, such as abandoned farmland, forest edge and mangrove habitats. The nets were opened between 05h30–10h00 and were checked every 15 minutes. A total of 74 hours of mist-netting was carried out, covering 24 netting sites (five in Kamama Mekar, nine in Dimba and 10 in Lasada). Opportunistic observations were also added to formal surveys, e.g. during exploration of new sites.

Species identification was confirmed using Coates & Bishop (1997) and Eaton *et al.* (2016). Sulawesi endemics were classified as those found only on mainland Sulawesi and its satellite islands, including Buton, Muna, Wawonii and the Talaud, Sangihe, Togian, Banggai, Sula and Tukangbesi island groups, following the geographic boundaries to the Sulawesi biogeographic region used by Coates & Bishop (1997). All taxonomy followed del Hoyo *et al.* (2018). A record was considered to be a range extension for that species if it had not previously been recorded for that island by White & Bruce (1986), Coates & Bishop (1997) or in the primary literature. Range maps from Eaton *et al.* (2016) or del Hoyo *et al.* (2018) were not considered to be reliable indicators of whether a species had previously been recorded on Muna or Wawonii, as these range maps inferred the presence of the species on these islands based on their presence on Buton, rather than based on primary records as in White & Bruce (1986) and Coates & Bishop (1997). The abundance estimates for each species were based on frequency of sightings, following Martin *et al.* (2012). The designated categories were: abundant (usually recorded several times each day in suitable habitat); common (usually recorded at least once per day); fairly common (typically recorded at least once per week); locally common (usually recorded daily, but restricted to specific habitats); uncommon (recorded less than five or six times in a season); and rare (known only from one or two records).

RESULTS

A total of 119 species were recorded: 59 on Muna, 71 on Wawonii and 99 in Lasada (Tables 1 & 2). Of particular note was the number of Sulawesi endemic species, making up 27.7% of the total species recorded. The following annotated list provides details of notable range extensions for Sulawesi endemics, and details on Endangered populations. Sulawesi endemic species are marked with an asterisk (*).

Ashy Woodpecker *Mulleripicus fulvus* *

Recorded as present on mainland Sulawesi and some satellite islands, including Buton, Muna and Kabaena (O'Connell *et al.* 2017, del Hoyo *et al.* 2018). Observed to be common in plantation and forest edge habitats near Dimba, this being the first recorded encounter for Wawonii.

Knobbed Hornbill *Rhyticeros cassidix* * VU

Recorded as present on mainland Sulawesi, Muna and Buton (del Hoyo *et al.* 2018). Rare, a single pair seen regularly by the edge of a remaining forest patch near Lasada.

Purple-winged Roller *Coracias temminckii* *

Widespread on mainland Sulawesi and its offshore islands, including Muna and Buton (del Hoyo *et al.* 2018). Uncommon around Dimba, recorded in thicker scrub or village edges, constituting the first recorded encounter for Wawonii.

Black-billed Kingfisher *Pelargopsis melanorhyncha* *

Widespread on mainland Sulawesi and its offshore islands, including Muna, Buton and Kabaena (O'Connell *et al.* 2017, del

Table 2. All species recorded in Kamama Mekar (Muna Island), Dimba (Wawonii Island) and Lasada (mainland Sulawesi) in 2017. Sulawesi endemics are indicated by an asterisk (*). Records which are new additions to the avifauna of Wawonii or Muna are indicated by a dagger (†) beside the abundance estimate for that population. Seasonal migrants are marked by (M). Conservation status is given behind species name if applicable: NT = Near Threatened, VU = Vulnerable, EN = Endangered (BirdLife International 2018). Abundance estimates are given for species recorded: A = abundant; C = common; F = fairly common; L = locally common; U = uncommon; R = rare.

Species	Muna	Wawonii	Lasada
Sunda Teal *Anas gibberifrons* NT		U†	L
Pacific Black Duck *Anas superciliosa*			L
Wandering Whistling-duck *Dendrocygna arcuata*			L
Asian Blue Quail *Synoicus chinensis*			U
Barred Buttonquail *Turnix suscitator*		F†	C
Red-backed Buttonquail *Turnix maculosus*			R
Ashy Woodpecker *Mulleripicus fulvus* *		C†	C
Knobbed Hornbill *Rhyticeros cassidix* * VU			R
Purple-winged Roller *Coracias temminckii* *	U	U†	
Oriental Dollarbird *Eurystomus orientalis*		R†	
Common Kingfisher *Alcedo atthis*	R	F†	R
Blue-eared Kingfisher *Alcedo meninting*	R†	F†	R
Black-billed Kingfisher *Pelargopsis melanorhyncha* *		R†	
Ruddy Kingfisher *Halcyon coromanda*		R†	
Collared Kingfisher *Todiramphus chloris*	A	C†	A
Sacred Kingfisher *Todiramphus sanctus* (M)	R†	F†	L
Rainbow Bee-eater *Merops ornatus*	A†	L†	A
Plaintive Cuckoo *Cacomantis merulinus*	C†	F†	C
Brush Cuckoo *Cacomantis variolosus*	U†		F
Moluccan Drongo-cuckoo *Surniculus musschenbroeki*	U†	U†	C
Little Bronze-cuckoo *Chalcites minutillus*	C†	U†	C
Eastern Koel *Eudynamys orientalis*		L†	
Yellow-billed Malkoha *Rhamphococcyx calyorhynchus* *	U†		C
Lesser Coucal *Centropus bengalensis*	C	L†	C
Bay Coucal *Centropus celebensis* *	L		L
Ornate Lorikeet *Trichoglossus ornatus* *		U†	
Golden-mantled Racquet-tail *Prioniturus platurus* *		U†	F
Blue-backed Parrot *Tanygnathus sumatranus*		F†	F
Sulawesi Hanging-parrot *Loriculus stigmatus* *	R	C†	C
Pygmy Hanging-parrot *Loriculus exilis* * NT		R†	R
Glossy Swiftlet *Collocalia esculenta*	A†	F†	C
Moluccan Swiftlet *Aerodramus infuscatus*			A
Asian Palm-swift *Cypsiurus balasiensis*		R†	U
Grey-rumped Treeswift *Hemiprocne longipennis*	R	L†	F
Sulawesi Masked-owl *Tyto rosenbergii* *			R
Sulawesi Scops-owl *Otus manadensis* *		F†	F
Great Eared-nightjar *Lyncornis macrotis*		U†	U
Sulawesi Nightjar *Caprimulgus celebensis* *			R
Eastern Spotted Dove *Spilopelia chinensis*	F	C†	C
Slender-billed Cuckoo-dove *Macropygia amboinensis*	C	U†	U
White-faced Cuckoo-dove *Turacoena manadensis* *	C	F†	
Grey-capped Emerald Dove *Chalcophaps indica*	F	F†	R
Pink-necked Green-pigeon *Treron vernans*	R†		
Grey-cheeked Green-pigeon *Treron griseicauda*		R†	R
Black-naped Fruit-dove *Ptilinopus melanospila*	C	F†	F
White-bellied Imperial-pigeon *Ducula forsteni* *	R†		
Green Imperial-pigeon *Ducula aenea*	R	L†	L
White Imperial-pigeon (Silver-tipped Imperial-pigeon) *Ducula luctuosa* *	U	F†	
Barred Rail *Hypotaenidia torquata*			R
Buff-banded Rail *Hypotaenidia philippensis*		R†	L
White-browed Crake *Amaurornis cinerea*			R

Species	Muna	Wawonii	Lasada
Isabelline Bush-hen *Amaurornis isabellina* *			L
White-breasted Waterhen *Amaurornis phoenicurus*			F
Dusky Moorhen *Gallinula tenebrosa*			L
Common Sandpiper *Actitis hypoleucos*			R
Black-winged Stilt *Himantopus himantopus*		L†	
Comb-crested Jacana *Irediparra gallinacea*			L
Australian Pratincole *Stiltia isabella*		R†	
Osprey *Pandion haliaetus*		F†	
Black Kite *Milvus migrans*			C
Black-shouldered Kite *Elanus axillaris*			F
Brahminy Kite *Haliastur indus*	R	C†	C
White-bellied Sea-eagle *Haliaeetus leucogaster*	U	F†	U
Sulawesi Serpent-eagle *Spilornis rufipectus* *	F	F†	C
Spotted Harrier *Circus assimilis*			F
Spot-tailed Goshawk *Accipiter trinotatus* *			L
Sulawesi Goshawk *Accipiter griseiceps* *	R	R†	
Sulawesi Hawk-eagle *Nisaetus lanceolatus* *			U
Spotted Kestrel *Falco moluccensis*	U		
Oriental Hobby *Falco severus*			U
Brown Booby *Sula leucogaster*		R†	
Little Pied Cormorant *Microcarbo melanoleucos*		L†	
Little Egret *Egretta garzetta*		U†	L
Intermediate Egret *Ardea intermedia*		U†	L
Great White Egret *Ardea alba*		F†	L
Cattle Egret *Bubulcus ibis*			A
Great-billed Heron *Ardea sumatrana*	R		U
Purple Heron *Ardea purpurea*	R†	C†	L
Green-backed Heron *Butorides striata*	C	A†	
Javan Pond-heron *Ardeola speciosa*			L
Glossy Ibis *Plegadis falcinellus*			L
Cinnamon Bittern *Ixobrychus cinnamomeus*			L
Black Bittern *Ixobrychus flavicollis*			R
Yellow Bittern *Ixobrychus sinensis*			U
Milky Stork *Mycteria cinerea* EN			U
Asian Woollyneck *Ciconia episcopus* VU		L†	L
Sulawesi Pitta *Erythropitta celebensis* *	R†		
Golden-bellied Gerygone *Gerygone sulphurea*	U†	F†	C
Slender-billed Crow *Corvus enca*	C†	C†	C
Piping Crow *Corvus typicus* *	F		
White-breasted Woodswallow *Artamus leucoryn*	C	C†	C
Ivory-backed Woodswallow *Artamus monachus* *			U
Black-naped Oriole *Oriolus chinensis*	A	C†	C
White-rumped Cuckooshrike *Coracina leucopygia* *	U	F†	R
Sulawesi Cicadabird *Edolisoma morio* *		R†	F
Hair-crested Drongo *Dicrurus hottentottus*	C	C†	A
Pale-blue Monarch *Hypothymis puella* *	A†	C†	C
Grey-streaked Flycatcher *Muscicapa griseisticta* (M)			R
Pied Bushchat *Saxicola caprata*	C†		L
Short-tailed Starling *Aplonis minor*	L	L†	R
Southern White-necked Myna *Streptocitta albicollis* *	F		R
Grosbeak Starling *Scissirostrum dubium* *			R
House Swallow *Hirundo javanica*	F	F†	C
Zitting Cisticola *Cisticola juncidis*	R		L
Golden-headed Cisticola *Cisticola exilis*			R
Lemon-bellied White-eye *Zosterops chloris*	A	L	U

Species	Muna	Wawonii	Lasada
Pale-bellied White-eye *Zosterops consobrinorum* *	A		C
Sulawesi Babbler *Trichastoma celebense* *	A†	L†	A
Sooty-headed Bulbul *Pycnonotus aurigaster*			A
Yellow-sided Flowerpecker *Dicaeum aureolimbatum* *	F	U†	C
Grey-sided Flowerpecker *Dicaeum celebicum* *	C	F†	C
Brown-throated Sunbird *Anthreptes malacensis*	A†	A†	A
Black Sunbird *Leptocoma aspasia*	C	A†	A
Olive-backed Sunbird *Cinnyris jugularis*	C†	L†	L
Crimson Sunbird *Aethopyga siparaja*	U†		U
Eurasian Tree Sparrow *Passer montanus*	L†	L†	L
Black-faced Munia *Lonchura molucca*	C†	R†	U
Scaly-breasted Munia *Lonchura punctulata*	R†	U†	C
Chestnut Munia *Lonchura atricapilla*			C

Hoyo *et al.* 2018). A single individual was seen near Dimba in coastal mangrove, constituting the first recorded encounter for Wawonii.

Yellow-billed Malkoha *Rhamphococcyx calyorhynchus* *
Widespread on mainland Sulawesi and also present on Buton and Kabaena (del Hoyo *et al.* 2018). Found in forest edge and thicker scrub, uncommon around Kamama Mekar, constituting the first recorded encounter for Muna, with groups of 6–8 observed following troops of Booted Macaques *Macaca ochreata*.

Ornate Lorikeet *Trichoglossus ornatus* *
Recorded as present on mainland Sulawesi and some satellite islands, including Muna, Buton and Kabaena (O'Connell *et al.* 2017, del Hoyo *et al.* 2018). Uncommon in coconut planation near Dimba, constituting the first recorded encounter for Wawonii.

Golden-mantled Racquet-tail *Prioniturus platurus* *
Widespread on mainland Sulawesi, also occurs on several satellite islands, including Muna, Buton and Kabaena (O'Connell *et al.* 2017, del Hoyo *et al.* 2018). Uncommon around Dimba, observed flying overhead in small groups along forest edge, constituting the first recorded encounter for Wawonii.

Sulawesi Hanging-parrot *Loriculus stigmatus* *
Widespread on mainland Sulawesi, also occurs on Muna, Buton, Kabaena and the Togian islands (O'Connell *et al.* 2017, del Hoyo *et al.* 2018). Common around Dimba, occurring in most habitats, constituting the first recorded encounter for Wawonii.

Pygmy Hanging-parrot *Loriculus exilis* * NT
Fragmented distribution on mainland Sulawesi (del Hoyo *et al.* 2018) and also recorded on Buton and Kabaena (Catterall 1996, Martin *et al.* 2012, O'Connell *et al.* 2017). Much rarer than the similar Sulawesi Hanging-parrot. A single individual seen at Dimba constitutes the first island record for Wawonii.

Sulawesi Scops-owl *Otus manadensis* *
Recorded as present on mainland Sulawesi and some satellite islands, including Muna, Buton, Menui and Kabaena (O'Connell *et al.* 2017, Monkhouse *et al.* 2018, del Hoyo *et al.* 2018). Fairly common around Dimba, heard calling at night in secondary forest areas. This constitutes a new island record for Wawonii.

White-faced Cuckoo-dove *Turacoena manadensis* *
Recorded as present on mainland Sulawesi and some satellite islands, including Muna, Buton and Kabaena (Ng & Rheindt 2016, O'Connell *et al.* 2017, del Hoyo *et al.* 2018). Fairly common around Dimba, a new record for Wawonii, where it is found in forest edge, plantation and thicker scrub.

White-bellied Imperial-pigeon *Ducula forsteni* *
Widespread and fairly common on Sulawesi and several satellite islands, including Togian, Banggai and Sula islands (del Hoyo *et al.* 2018), also recorded from Buton and Kabaena (Catterall 1996, Martin *et al.* 2012, O'Connell *et al.* 2017). Rare, heard once calling from a forest fragment at Kamama Mekar, constituting a new record for Muna.

White Imperial-pigeon (Silver-tipped Imperial Pigeon) *Ducula luctuosa* *
Widespread and generally uncommon on Sulawesi and several satellite islands, including Buton, Muna, Togian, Banggai and Sula islands (del Hoyo *et al.* 2018). Fairly common near Dimba (seen along the forest edge), which constitutes a new island record for Wawonii.

Sulawesi Serpent-eagle *Spilornis rufipectus* *
Recorded as present on mainland Sulawesi and some satellite islands, including Muna, Buton, Menui and Kabaena, east to the Sula islands (O'Connell *et al.* 2017, Monkhouse *et al.* 2018, del Hoyo *et al.* 2018). The most regularly encountered raptor, seen flying over open areas, fairly common around Dimba, which constitutes a new island record for Wawonii.

Sulawesi Goshawk *Accipiter griseiceps* *
Recorded as present on mainland Sulawesi, Muna and Buton (del Hoyo *et al.* 2018). Rare, observed once near Dimba along forest edge, constituting a new island record for Wawonii.

Milky Stork *Mycteria cinerea* EN
This Endangered species (BirdLife International 2018) has a fragmented distribution in Cambodia, Malaysia, Sumatra, Java and south and South-east Sulawesi (Catterall 1996, O'Connell *et al.* 2017, del Hoyo *et al.* 2018). A breeding population is present in Rawa Aopa Watumohai National Park, South-east Sulawesi (Wardill *et al.* 1998). A flock of 12–15 individuals was seen in the rice paddy near Lasada on several occasions.

Sulawesi Pitta *Erythropitta celebensis* *
Found throughout mainland Sulawesi and some satellite islands, including Buton and Togian (del Hoyo *et al.* 2018). Rare near Kamama Mekar, heard once calling along the forest edge, constituting a new record for Muna.

White-rumped Cuckoo-shrike *Coracina leucopygia* *
Recorded as present on mainland Sulawesi and some satellite islands, including Muna, Buton and Kabaena (del Hoyo *et al.* 2018). Fairly common around Dimba, constituting a new record for Wawonii.

Sulawesi Cicadabird *Edolisoma morio* *
Recorded as present on mainland Sulawesi and some satellite islands, including Muna, Buton and Kabaena (del Hoyo *et al.* 2018). Found in forest edge and plantation, rare around Dimba, constituting a new island record for Wawonii.

Pale-blue Monarch *Hypothymis puella* *
Recorded as present on mainland Sulawesi and some satellite islands, including Muna, Buton and Kabaena, east to the Sula islands (del Hoyo *et al.* 2018). Commonly found in mixed farmland and forest edge habitats at Dimba, constituting a new record for Wawonii.

Sulawesi Babbler *Trichastoma celebense* *
Widely distributed on mainland Sulawesi and also recorded on Buton and Kabaena (O'Connell *et al.* 2017, del Hoyo *et al.* 2018). Found in most habitats. Abundant around Kamama Mekar (constituting a new record for Muna) and locally common (in thicker plantation) around Dimba (constituting a new record for Wawonii).

Yellow-sided Flowerpecker *Dicaeum aureolimbatum* *
Recorded as widespread on mainland Sulawesi and its offshore islands, including Muna, Buton and Kabaena (O'Connell *et al.* 2017, del Hoyo *et al.* 2018). Uncommon in farmland and scrub around Dimba, which constitutes a new record for Wawonii.

Grey-sided Flowerpecker *Dicaeum celebicum* *
Recorded as widespread on mainland Sulawesi and its offshore islands, including Muna, Buton, Tukangbesi and Kabaena (Kelly *et al.* 2014, O'Connell *et al.* 2017, del Hoyo *et al.* 2018). Found in farmland and scrub, fairly common around Dimba, constituting a new record for Wawonii.

DISCUSSION

Despite the Sulawesi region being a hotspot of endemism (Myers *et al.* 2000), knowledge of the avifauna of the area is fragmentary. This study has shed new light on the avifaunal community of some of the lesser known parts of South-east Sulawesi and is the first scientific assessment of the avifauna of Wawonii Island. Many of our expedition's records were unsurprising as the species recorded at our three sites were already well known on the neighbouring island of Buton. However, these results highlight the presence of potentially important populations of Vulnerable and Endangered species such as the Knobbed Hornbill, Asian Woollyneck *Ciconia episcopus* and Milky Stork.

The checklist recorded (Table 2) adds a large number of new records but is unlikely to be an exhaustive account of the avian community present at the expedition sites. Our surveys were not designed to record general avian biodiversity, but to target small passerines and kingfishers as part of research into biogeographic patterns in South-east Sulawesi. As a result, marine species, nocturnal species and those restricted to primary forest habitat may have been under-recorded or overlooked entirely. Furthermore, in order to assess the migratory species that utilise this region, surveys at different times of year would be required. Despite such caveats, our data make an important contribution to filling knowledge gaps about the biodiversity of Sulawesi.

The records of Milky Stork and other species of conservation concern from the south-eastern peninsula of Sulawesi highlight the potential conservation value of this relatively unknown area. Outside of Rawa Aopa Watumohai National Park (Wardill *et al.* 1998), very little is known about the avifauna of this biodiverse peninsula outside a handful of other accounts (Trochet *et al.* 2014, Martin *et al.* 2018, O'Connell *et al.* 2019a,b,c). Additionally, the biodiversity of Muna was not as impoverished as had been feared, despite the intensive agricultural development on that island. Some forest species such as the Sulawesi Pitta survived in strips of forest along exposed ridges. Our survey even recorded 23 species not previously noted for Muna (van Bemmel & Voous 1951, White & Bruce 1986, O'Connell *et al.* 2019b,c). However, all habitats observed on Muna were highly degraded, so it is unlikely that the section of the island that was surveyed is home to any populations of conservation significance.

In particular, it is hoped that this paper will draw attention to the neglected fauna of Wawonii. The forested core of Wawonii may be of high conservation value (Cannon *et al.* 2007) and the island has been shown to be important for other threatened taxa (Farida & Dahrudin 2008). Nearby Buton Island is home to some of the most biodiverse remaining lowland forest in Sulawesi, but is experiencing serious deforestation (Howard & Gillespie 2007, Martin *et al.* 2012, Martin *et al.* 2019). Much like Buton, Wawonii is experiencing continued habitat loss and degradation, lending urgency to the need for more rigorous surveying and protection of its almost uncharted biodiversity.

Author contributions: DOC, DJK, NMM, KA and AK conceived this study. DOC, DJK, NMM, AON, RG and AK carried out field work. FOM searched the literature for historical records. DOC led the writing. All authors contributed to revising and improving the manuscript.

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