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Birds and bats of Rotuma, Fiji

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Abstract: Rotuma, Fiji, is a small and isolated island in the Central Pacific, rarely visited by ornithologists. We present here our own observations on the avifauna, obtained in 1991 and in 2018, completed by previous records obtained since the 19th Century. The main changes on the species composition concern the extirpation of the white-throated pigeon and the settlement of the reef heron. The status of the four endemic landbirds (one species and three subspecies) is good, especially that of the Rotuma myzomela. However, the recent arrival of the common myna (2017–2018) represents a potential threat. We also observed that the Pacific sheath-tailed bat, which was abundant 30 years ago, has probably been extirpated from the island.

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INTRODUCTION

Rotuma is a small and remote island, located between the Fijian archipelago and the Tuvalu Islands (Fig. 1). Compared to the three main nearby archipelagos (Fiji, Samoa, and Tonga), it has few seabird colonies and a low number of landbirds. The study of bones obtained from archaeological excavations has demonstrated the recent loss of species on many tropical Pacific islands (Steadman 2006). On Rotuma, the Maka Bay excavation (1991–1996) produced a faunal sample of thousands of vertebrate specimens, including birds, but unfortunately the avian bones have not yet been identified (Allen *et al.* 2001), so the past avifauna of Rotuma remains unknown. The island has been rarely surveyed for birds, despite the occurrence of several endemic taxa. We present here an update of the list of birds of Rotuma based on surveys conducted in 1991 by DW and 2018 by JCT and AC. The data of the 2018 survey were initially compiled in an unpublished report (Cibois & Thibault 2019), which forms the basis of the present article. We compare these data with previous surveys conducted between the 19th Century and the 1980's.

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METHODS

Island characteristics

Rotuma is a volcanic group, very isolated in the Pacific Ocean, located 12°30' S latitude and 177'°E

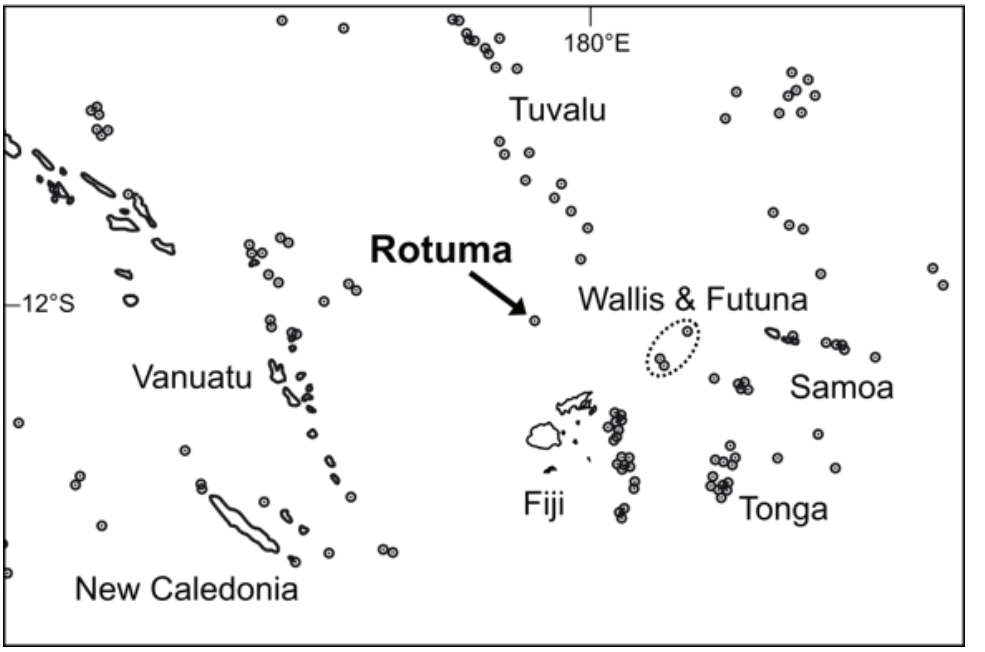

Figure 1. Map showing location of Rotuma and the main archipelagos of the Central Pacific.

longitude. It lies 465 km away from the nearest Fijian island (Yasawa I Rara) and *c.* 1,000 km from the Pentecost Island in Vanuatu. Its closest non-Fijian neighbours are Nukulaelae, an atoll in Tuvalu, 450 km to the north east, and Futuna, part of the French Overseas Collectivity of Wallis & Futuna, 545 km to the east (Fig. 1). Rotuma comprises 10 islands, the largest of which, called Rotuma, is 13 km long and 4 km wide and has an area of about 44 km² (Fig. 2). The group is of Pleistocene origin (*c.* 1.5 million years old) with Holocene lava flows (Woodhall 1987). Uea is the second largest island, having a surface area of just over 1 km². It is the highest of the group, having an elevation of 260 m. Aside from Rotuma, the islands are currently uninhabited and irregularly visited by the Rotuman people. Some of these islets are refuges for rare native plants and also support seabird colonies. The population of Rotuma is estimated at *c.* 2,000, distributed among 7 districts. Although Rotuma is politically part of Fiji, it is a Polynesian outlier that speaks a Polynesian language (Howard & Rensel 2007).

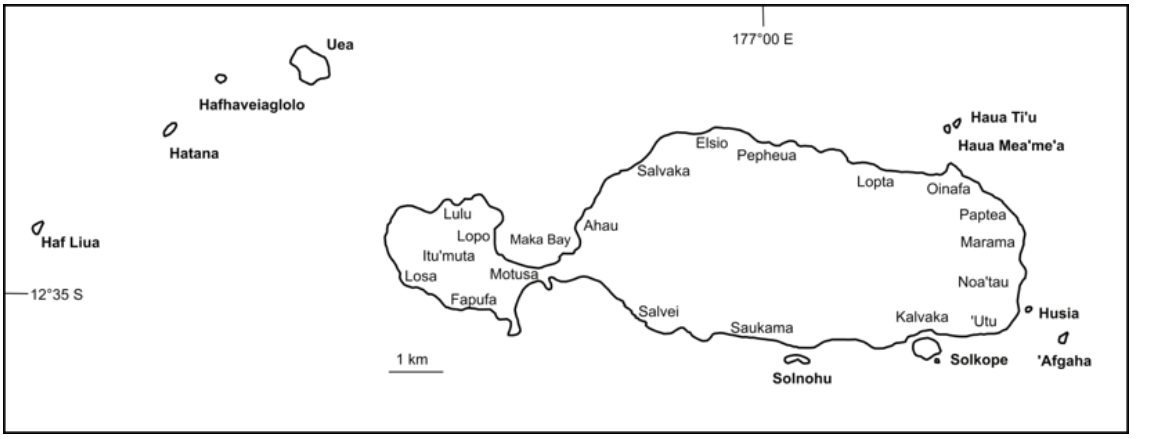

Figure 2. Map of Rotuma, main villages, and islets. The toponymy follows Howard & Rensel (2007), except for the name Itu'muta (one of the district names) that we use to refer to the entire peninsula.

Data collection
Bird specimens were obtained by several scientific expeditions that travelled to the Fijian islands during the 19th and 20th Centuries. The French expedition on the vessel "La Coquille" was one of the first known scientific expeditions to travel to Rotuma, in April 1824. However, the account of the naturalist and health officer René Primevère Lesson, who published many data on Pacific birds, contains nothing on natural history and presents a detailed account only on the Rotuman people (Lesson 1829; see http://www.hawaii.edu/oceanic/rotuma/os/Lesson.html for an English translation). The earliest specimen (a myzomela) arrived in Europe before 1846, but its collector is unknown. This specimen was used as a model for the plate included in Gray's original mention of the species (Gray 1844–1849). The British Museum (UK) received in the 1870s several specimens from G. Brown, an English missionary (Forbes 1878; Wiglesworth 1891; Neumann 1927). The British zoologist J. Stanley Gardiner collected birds on Rotuma in 1896 (Gadow 1898). The Whitney South Sea Expedition stopped on Rotuma from 18 to 25 May 1925 (Correia MS; Watling 1985). More than 130 birds were collected, now held at the American Museum of Natural History, New York. They represent the largest collection of specimens from Rotuma. The most recent contributions on Rotuman birds include: Clunie (1985) from 30 November to 5 December 1985; Zug *et al.* (1988) from 6 to 26 May 1987; DW from 24 July to 3 August 1991 (mainland, and Uea, Haf Liua, Hatana islets); Mizota & Naikatini (2007) from 3 to 10 September 2005 (Hatana islet); the surveys conducted in the 2000s during two "EcoCamps" organized by the NGO LäjeRotuma (Anon. A, B); AC and JCT from 21 September to 23 October 2018. During the 2018 visit, we surveyed the coastal areas, most of Itu'muta Peninsula, several areas inland (in particular around Noa'tau), and one islet ('Afgaha). The identity and presence of species was confirmed visually, but for future molecular studies we also collected blood samples from 86 mist-netted individuals. The status of each species was then compared to previous surveys.

ANNOTATED CHECKLIST
We follow the nomenclature of Gill & Donsker (2019), except for the buff-banded rail for which we used the generic name *Hypotaenidia* (instead of *Gallirallus*, see Thibault & Cibois 2017). The endemic status of four taxa is indicated by an asterisk after their scientific name. We used McClatchey *et al.* (2000) and Meyer (2017) for plant identification and nomenclature. Detailed species accounts for the other Fijian islands can be found in Watling (2004).

Undetermined duck (Anatidae)
No species recorded, but the Rotuman name ME'JIA "*wild duck*" (Churchward 1940) support the occasional visits of ducks.

Red Junglefowl (*Gallus gallus*)
Introduced. Present all over the island, although more common in villages than in secondary forests, where it is feral.

Feral pigeon (*Columba livia*)
Introduced. Deliberately introduced at an unknown date after 1991. First mentions in 2008–2009 (Anon. B), qualified then as "*fairly common*". In 2018, a single individual seen in Motusa on 30 September and on 12 October, and a flock of 5 individuals on 22 October in Ahau.

Metallic (White-throated) pigeon (*Columba vitiensis*)
Extirpated. Not recorded by visitors during the 19th Century (G. Brown, J.S. Gardiner). In his diary (23 May 1925, p. 234), Correia (MS) indicated he saw both the "*Samoa pigeon*" and the "*black pigeon*", identified as Pacific imperial pigeon and metallic pigeon, respectively (Correia used these two names consistently in his Journal). However, no specimens of these pigeons were collected on Rotuma (Watling 1985), and only Clunie (1985) mentioned the metallic pigeon on Rotuma again: "*now very scarce and shy, my only seeing one, and otherwise only hearing its mournful call on four occasions*". This species was searched for in 1991, then in 2018, but vainly. Therefore, its status on Rotuma remains uncertain: did a small breeding population become extinct, or do small groups visit the island occasionally?

Pacific imperial pigeon (*Ducula pacifica*)
Breeder. Recorded by all observers. Present all over the main island. Also observed on Uea (1991) and 'Afgaha (2018), and probably a regular visitor in all surrounding islets. Commoner in the villages and farmlands than in the secondary forests where food resources are less abundant. In 2018, we observed single individuals, couples or adults with a juvenile. The lack of larger groups suggests the birds may be territorial. Hunting is rare today, and most birds are very tame, even in villages. The favourable situation encountered on Rotuma is probably exceptional, with a total number estimated at 5,000–10,000 individuals on the island. We recorded birds eating or foraging in the following plant species: *Artocarpus altilis* (fruits also eaten on the ground), fruits of *Calophyllum inophyllum*, *Cananga odorata*, *Elaeocarpus* cf. *tonganus*, *Flacourtia rukam*, cultivated

Sandalwood *Santalum* sp., *Spondias dulcis* and of the palm *Pritchardia pacifica*; also leaves of *Papaya carica* (reducing the leaf to a lace-like pattern).

Crimson-crowned (Purple-capped) fruit dove (*Ptilinopus porphyraceus*)
Breeder. The taxonomy of this species is complex, with four taxa treated as subspecies (Dickinson & Remsen 2013), three species (Pratt & Mittermeier 2016; Hayes *et al*. 2016; Gill & Donsker 2019), or four species (del Hoyo & Collar 2014). The taxa are: *ponapensis* from Chuuk and Pohnpei (Caroline Is.), *hernsheimi* from Kosrae (Caroline Is.), nominate *porphyraceus* from Fiji (small islands), Tonga and Niue, and *fasciatus* from Samoa. Cibois *et al.* (2014) showed that *ponapensis* and *porphyraceus* are not sister taxa, suggesting that the species group is not monophyletic, and Hayes *et al.* (2016) split *hernsheimi* from *ponapensis*. Pratt & Mittermeier (2016) consider the subtle differences between *porphyraceus* and *fasciatus* as not justifying separating them as species, but del Hoyo & Collar (2014) split them. Finally, del Hoyo & Collar (2014) considered a fifth taxon, *graeffei* from Wallis and Futuna, to be a hybrid *porphyraceus* X *fasciatus* population (an idea first expressed by Ripley & Birckhead 1942). Clearly the systematics of this group could profit from a denser genetic sampling. Collected by Correia in 1925 on Rotuma. Uncommon in the 1980's (Clunie 1985). Zug *et al.* (1988) observed the species only once. In 1991, found mainly in the more mature bush of the higher hills. In 2018, its situation was more favourable, as the bird was present all over the island, on the shore and inland, in farmlands, on the outskirts of villages, and in secondary forests. However, its density was considerably lower than that of the imperial pigeon. Also seen on 'Afgaha (2018) but not on Uea (1991). We never observed more than two birds together and rarely in flight. Total number estimated at 500–1,000 individuals. We recorded birds eating fruits or foraging in the following plant species: *Cananga odorata*, *Ficus* sp., ivory nut palm (*Metroxylon warburgii*) (flowers only).

White-tailed tropicbird (*Phaethon lepturus*)
Breeder. Recorded both on the shore and inland in farmlands and secondary forests. Seen also on islets (Solkope, Haua Ti'u, Haua Mea'me'a, 'Afgaha, Uea). Number estimated at a few hundred pairs. Breeds in holes of tall old trees (e. g. *Calophyllum inophyllum* and *Mangifera indica*), but also possibly in cliffs (on islets, or on the coast of Itu'muta).

Long-tailed cuckoo (*Urodynamis taitensis*)
Visitor. Only two sightings on Rotuma: Correia (MS) May 1925 and DW July–August 1991.

Buff-banded rail (*Hypotaenidia philippensis*)
Breeder. Common in the 1980s (Clunie 1985; Zug *et al.* 1988) and in 1991. In 2018, recorded everywhere on the coast and inland, in all kinds of habitat: beaches at low tide, villages, cultivations, secondary forests, grasslands. Less abundant in secondary forests. We observed approximately one individual per 50 m on the main road and on the farmlands' "feeder" roads, but its density in secondary forest was probably lower. Its presence on islets was demonstrated only for Uea in 1991.

Australasian swamphen (*Porphyrio melanotus*)
Breeder. Collected by Gardiner in 1896 (Gadow 1898), then by Correia in 1925 (Watling 1985). Uncommon in 1985 (Clunie 1985) and in 1991. Not recorded by Zug *et al.* (1988). Rarely recorded during the surveys in 2008–2009 (Anon. B). In 2018, recorded in 12 different localities, both on shore and inland. Mainly associated with farmlands and cultivations near the villages, and also in the grassland of Paptea School and along the airstrip. Not recorded in the secondary forests. Number tentatively estimated at more than one hundred birds. Considered a pest for banana and pineapple cultivations, but we did not see any traps or snares, and the villagers just use rags as scarecrows.

Petrels or shearwaters (Procellariidae)
No petrel or shearwater has been formally identified on Rotuma. However, evidences suggest the regular presence of Procellariidae on or near the island. Churchward (1940) mentioned two of them: FA'MÄNE for a "*bird seldom seen, but often heard at night-time. It has a habit of uttering its note twice in succession: the Rotumans say IA TŌ□ TĀR, i.e. it speaks and immediately answers*"; and TAIKO for a "*bird which utters at night-time a cry like that of a child*". The first name was also recorded in 2018. Generic names TA'T'O and TAIKO are attributed to several species of petrels in other Polynesian islands (Clark 1982). Another Rotuman name, TOIOKTA, recorded in 1991 and 2018, could also be attributed to petrels or shearwaters. It can be transliterated as TAI–OK, with a long TAI (call) followed by an abrupt OK (the fart), the bird having the reputation to fart and burp at the same time! Correia (MS) described "*a black bird which almost all the time in the sea and rests on the tops of the mountains, in the holes under the ground while nesting*". Several of our informants in 2018 described nocturnal birds, different from the eastern barn owl (*Tyto javanica*), calling in flight above the villages; other mentioned birds on islets entering burrows during the night (on 'Afgaha, Haua Ti'u and Haua Mea'me'a islets). Pratt *et al.* (1987) list the wedge-tailed shearwater (*Ardenna pacifica*) as a likely resident, but hard evidence is lacking.

Pacific reef heron (*Egretta sacra*)
Breeder. First record in 2007 (Anon. A). It may have (re)colonized the island since 1991. In 2018, not abundant but regularly seen on all coasts and on the grassland of Paptea School. Seen on ‘Afgaha and it probably visits regularly all islets. Not recorded inland in the farmlands. For a total of 46 records, we observed 85% grey morphs (N=39) and 15% white morphs (N=7). Although we found no nests, the species undoubtedly breeds now on Rotuma.

White-faced heron (*Egretta novaehollandiae*)
Visitor. One individual seen in the grassland of Paptea School on 7 and 8 October 2018, and at the airport (maybe the same individual) on 23 October.

Lesser frigatebird (*Fregata ariel*)
Breeder. Recorded by previous observers, with single evidence of breeding, on Uea in 1991. In 2018, seen daily in flight, several dozen birds roosting in trees of Haua Ti'u and Haua Mea'me'a.

Great frigatebird (*Fregata minor*)
Visitor. Recorded in 2008–2009 (Anon. B), and in 2018 on several occasions, but less regularly than the lesser frigatebird.

Red-footed booby (*Sula sula*)
Breeder. Breeds on islets, but the inventory of sites remains incomplete and the total population is unknown. In 1991, a few nested in low vegetation on Haf Liua; in 2007 unknown numbers bred on Hatana (Mizota & Naikatini 2007). In 2018, several dozen birds roosted on Haua Ti'u and Haua Mea'me'a; not recorded on Solkope and ‘Afgaha.

Brown booby (*Sula leucogaster*)
Breeder. Breeds on islets, but the inventory of sites remains incomplete and the total number is unknown. In 1991 a major nesting site with probably several thousand pairs recorded on Haf Liua, and a few pairs on Uea and Hatana; breeding was confirmed again on Hatana in 2007 (Mizota & Naikatini 2007). In 2018, the remote islets were not visited, but small colonies (less than 10 pairs) were found on Haua Ti'u and ‘Afgaha, and a roosting place or a small colony on Haua Mea'me'a.

Pacific golden plover (*Pluvialis fulva*)
Visitor. Recorded by all observers. In September–October 2018, we recorded mostly isolated birds with a total number estimated at several hundred.

Lesser sand plover (*Charadrius mongolus*)
Visitor. A single record of one individual in winter plumage (showing some marks on the breast of summer plumage) seen on 22 October 2018 on a beach in front of Lopo.

Bristle-thighed curlew (*Numenius tahitiensis*)
Visitor. Photographed in October 1959 and seen twice in November–December 1985 (Clunie 1985).

Cf. **whimbrel** (*Numenius phaeopus*)
Visitor. One curlew seen briefly on 23 September 2018, on rocks bordering the Maka Bay at Lopo and then in flight, could possibly be attributed to this species.

Bar-tailed godwit (*Limosa lapponica*)
Visitor. Possibly an annual visitor, but noted only during the surveys of 2008–2009 (Anon. B).

Ruddy turnstone (*Arenaria interpres*)
Visitor. Recorded by all visitors, both during boreal winter and summer. In autumn 2018, it was the commonest shorebird with the Pacific golden plover, seen regularly on most of coasts of the mainland and on the islets (at least on ‘Afgaha and Haua Me’ame’a). Mainly in small flocks, up to 38 individuals, foraging at low tide on beaches, coral reefs, and on grasslands and lawns at high tide. A bird ringed in Japan during spring migration on 20 May 2018 (age estimated at least at 3 years; Australasian Waders Studies Group, email of 20 November 2018) was seen in Motusa and on the beach of Lopo from 30 September – 12 October 2018.

Red knot (*Calidris canutus*)
Visitor. Only recorded during the 2008–2009 surveys (Anon. B).

Sharp-tailed sandpiper (*Calidris acuminata*)
Visitor. One juvenile seen and photographed 16 October 2018 on the beach of Lopo.

Sanderling (*Calidris alba*)
Visitor. Recorded during the 2008–2009 surveys (Anon. B) and in 2018 on the beach of Lopo: one individual on 22 September and 26–27 September, and a darker individual on 1 October.

Pectoral sandpiper (*Calidris melanotos*)
Visitor. Seen and photographed twice in 2018: first

on 29 September on the road near Lopo, and second on 8 October on the grassland of Paptea School. Differences in coloration (bill, legs, nape, and breast) strongly suggest that two different juveniles were present.

Wandering tattler (*Tringa incana*)
Visitor. Recorded by all visitors, both during boreal summer and winter. In September–October 2018, it was commonly distributed on all the mainland shores, and probably on all islets. We found isolated birds every 50–100 m, but no flocks. Number estimated at several hundred birds.

Brown noddy (*Anous stolidus*)
Breeder. On mainland, it breeds in small number, mainly on the coast of Itu'muta, in cliffs or in trees, and locally in the coconuts of Oinafa. However, most breeders are on islets, on the ground and in trees on Haua Ti'u, Haua Mea'me'a, 'Afgaha, Solkope, Uea, and Hatana. No estimate of numbers available.

Black noddy (*Anous minutus*)
Breeder. Gardiner (in Gadow 1898) collected an immature bird. Recorded in 1991. In September–October 2018, a small colony (*c.* 10 pairs) bred in a big tree (*Calophyllum inophyllum*) along the shore in Oinafa Village. Birds were also probably breeding on the islets off Oinafa Village. No estimate of numbers available.

White tern (*Gygis alba*)
Breeder. Recorded by all observers since the 1920s. In 2018, patchily distributed on the mainland, both on the shore and inland; no colonies were found, but we observed isolated pairs, and small groups, up to ten individuals. Number on mainland estimated at a few hundred pairs. Recorded also on Solkope, 'Afgaha, Haua Mea'me'a and Haua Ti'u islets, totalizing several hundred pairs. Number on Hafana and Uea are unknown, but probably relatively high. No doubt that several thousand pairs breed on the Rotuma Group as a whole.

Sooty tern (*Onychoprion fuscatus*)
Breeder. The colony on Hatana Islet, which number was estimated at several thousand pairs (Mizota & Naikatini 2007), is one of six known colonies in Fiji.

Black-naped tern (*Sterna sumatrana*)
Breeder. Recorded in 1991 and one individual appears on a picture taken on an unknown islet during the 2008–2009 surveys (Anon. B). In September–October 2018, several pairs bred on Hau Mea'me'a Islet (feeding juveniles on 8 October) and several single birds or pairs were seen fishing in different places.

Swamp harrier (*Circus approximans*)
No known record, apart from linguistic evidences. Churchward (1940) mentioned the name RUTAI for a "*hawk*", a name known also by those Rotumans who know the bird in the main islands of Fiji.

Fiji goshawk (*Accipiter rufitorques*)
No confirmed record. Gardiner mentions it in Gadow (1898), where the name JERLEVA is attributed to a goshawk, "*repeatedly seen in Rotumah*" but no bird was collected. Correia (MS) tried unsuccessfully to obtain a specimen, and Clunie (1985) attributed Gardiner's mention to a Pacific long-tailed cuckoo.

Eastern barn owl (*Tyto javanica delicatula*)
Breeder. Recorded by all observers since the 19th Century, but in very small number. In September–October 2018, we noted it only four times in Itu'muta and inland, always in cultivated areas.

Rotuma myzomela (*Myzomela chermesina**)
Endemic breeder. In 1846, G.R. Gray first provided the name *chermesina* to a new species of bird belonging to the family of Meliphagidae, but from an unknown origin. He did not describe the bird but D.W. Mitchell illustrated a male. The description of the species was done subsequently in 1878 by W.A. Forbes, who compared the plate to the specimens sent by a missionary from Rotuma. Considered for a long time as a subspecies of the cardinal myzomela (*M. cardinalis*), it is now treated as a full species (Dickinson & Christidis 2014; del Hoyo & Collar 2016; Gill & Donsker 2019). According to the phylogenetic tree of the genus *Myzomela* proposed in Marki *et al.* (2017), the Rotuma myzomela is closely related to the Micronesian myzomela (*M. rubratra*) (an hypothesis also proposed by Koopman 1957). But their relationships with other myzomelas are unclear, in particular with the Samoan myzomela (*M. cardinalis nigriventris)*, never sequenced. Koopman (1957) suggested that the taxon from Samoa derived from the same ancestor as the cardinal myzomela from Vanuatu. Pratt & Mittermeier (2016) recognized the Samoan myzomela as a distinct species based on vocal and morphological differences compared to the Melanesian populations.

Very common all over the mainland, more frequent in open areas (villages, coastland, and farmlands) than in the dense secondary forests.

Present also on islets: Uea (1991), 'Afgaha (2018), and it probably visits or stays on all islets; some birds do not hesitate to fly above the sea, as observed regularly in Maka Bay. However, the mainland is the main reservoir and most efforts of conservation should be concentrated there (the total area of the islets represents only less than 2 km² *vs*. 44 km² for the mainland). Using the data by F. Clunie in 1985 and DW in 1991, BirdLife International (2018) estimated the population number at 10,000–19,999 individuals. Estimate in 2018 based on observations and captures using mist-nets is within the same range, with a mean of five birds/ha in villages and farmland, and approximately one bird/ha in dense secondary forest. Thus, population number remained stable, at least for the last 30 years. However, the introduction of the common myna, feared by NatureFiji-MareqetiViti (Anon. C), occurred recently (see below) and its impact on the Rotuma myzomela population is uncertain. It forages in all vegetation levels, from grasslands to high trees. All observers admired its acrobatic feeding techniques, gleaning or hanging in the vegetation and, according to Clunie (1985), fly-catching. It forages mainly solely, but also in groups up to 20 or thirty birds – seen for instance eating, flying, chasing congeners in a great confusion on ivory nut palm inflorescences. Recorded feeding also in the following plants: *Cocos nucifera* (and gleans invertebrates in dead dry leaves), *Morinda citrifolia*, *Pritchardia pacifica*, *Spathodea campanulata*, the very common introduced flower *Stachytarpheta* (cf. *cayennensis*, ex. *urticaefolia*), and in cultivated *Hibiscus* sp. (piercing the basis of the flower from behind). Breeding data are scarce with occupied nests in October–November, and feeding of fledglings in May, September–November [Gardiner (in Gadow 1898); Clunie 1985; Zug *et al.* 1988; this work]. Gardiner (in Gadow 1898) gave an accurate description of the nest placed "*in any fork formed by the twigs of the hifo tree (*Callophyllum inophyllum*). The nest is made of grass and rather deep. The eggs, numbering from three to five, are white, with a few red spots, very large for the size of the bird*".

Polynesian triller (*Lalage maculosa rotumae**)
Breeder. The Polynesian triller includes 16 subspecies distributed in Temotu (South Solomon), Vanuatu, Fiji and surrounding islands (Rotuma and Futuna), Tonga, Samoa, and Niue. The endemic subspecies *rotumae* is larger than *woodi* from Northern Fiji, with a more tawny coloration of the tips of the back and rump feathers and on the underparts (Mayr & Ripley 1941). It occupies both the coastland and the inland, in all types of habitats (coconut groves, cultivations, villages, secondary forests, open coastal forests), even along the airstrip when the grass has been freshly cut. It is less common in secondary forests when the cover is too dense, whereas it is abundant at the edge of forests and in open habitats (generally cultivations). Recorded on 'Afgaha (2018) and Uea (1991) and it probably occupies other islets. On mainland, density is high with several individuals/ha. Population number is similar to that of the myzomela, i.e. 10,000–19,999 individuals. Relatively tame in villages, some birds do not hesitate to visit vegetables and fruits baskets in the market at Ahau, in the middle of people. Breeding period spreads at least from September to December, but is probably longer, starting in August or earlier.

Fiji shrikebill (*Clytorhynchus vitiensis wiglesworthi**)
Breeder. This shrikebill is present on most of the Fijian archipelago and surroundings islands (Futuna, Rotuma), in Tonga, and Samoa, with 12 recognized subspecies. The endemic subspecies *wiglesworthi* is more rufous and darker on face than *buensis* from Northern Fiji (Mayr 1933), but the differences between populations are weak. Forest dweller found all over the mainland, although markedly less common than the three other endemic Rotuman passerines. In 1991 it was much commoner on Uea than on mainland, and a singer was heard on 'Afgaha in 2018. Relatively more abundant in dense secondary forests inland, where it was often the commonest passerine. However, it occupies all woody groves, even of very small range (e.g. Malvaceae trees), in farmlands, villages, and on the coast. Population number estimated in 2018 at a few thousand individuals. However, the destruction of several hectares of forest along the airstrip, in addition to the cutting of the larger trees at Elsio and Pepheua, has clearly reduced available habitat. Breeding habits remain poorly known; its nest and eggs were never described. In 2018, we captured several females with brood-patches, and we found a dead chick (less than a week old) fallen from a nest on 1 October, suggesting that the breeding season had begun. Most birds collected in May 1925 by Correia were "*in badly worn plumage or molting*" (Mayr 1933), thus past the breeding season.

Polynesian starling (*Aplonis tabuensis rotumae**)
Breeder. The Polynesian starling has 12 subspecies, distributed on Temotu (South Solomon), Fiji Is. and surrounding islands [Futuna, Uea (Wallis), and Rotuma], Tonga, Samoa, and Niue. The endemic subspecies *rotumae* has paler underparts than *vitiensis* (Viti Levu), with broad greyish margins on back and rump feathers (Mayr 1942). Present all over the island, and probably on all islets (seen on Kalvaka, 'Afgaha, Uea, and in flight toward the islets off Oinafa). Abundance varies greatly among habitats. Very common in cultivations and around

villages where food is plentiful (up to ten birds/ha), but less abundant in coconut groves and in very low density in dense secondary forests. Population number similar to the Rotuma myzomela and Polynesian triller, i.e. 10,000–19,999 individuals. Recorded feeding on the following plants or fruits: *Carica papaya*, *Flacourtia rukam*, ripe mangoes (*Mangifera indica*) on the ground, *Micromelum minutum*, bananas (*Musa*), *Psidium guajava*, and according to Zug *et al.* (1988) chili peppers (*Piper* sp.). No observations were obtained in secondary forests where they probably eat berries and fruits of the native trees. We also observed a starling attempting to open a hermit-crab with its bill, on rocks off the shore, and we found broken shells of small terrestrial molluscs in the forests, possibly predated by starlings. In September and October, we caught birds showing brood-patches, fledglings, and one dead chick fallen from its nest, suggesting that the breeding season had begun. Clunie's (1985) observations of birds carrying food or nest materials indicated that it extended at least to December.

Common myna (*Acridotheres tristis*)
Introduced. It arrived on Rotuma, ship-assisted, at the end of 2017 or early 2018 and it settled first around the jetty in Oinafa. In September–October 2018, we found five isolated pairs in the following coastal localities: Oinafa (near the jetty), Paptea, Marama, Noa'tau, and 'Utu. The myna did not disperse west of Oinafa in the North, suggesting that the large stand of dense secondary forests between the jetty and Lopta constituted a barrier. It might however continue its spread west of 'Utu in the South, where such forests are not present. Not recorded inland. Two pairs were probably visiting nesting sites, and two others were feeding chicks at nest. They were seen foraging for invertebrates in grasslands. The myna's future expansion on the island could likely be possibly to the detriment of the endemic passerines, in particular of the Rotuma myzomela, which occupies the same habitat.

Sheath-tailed bat (*Emballonura semicaudata*)
Extirpated. First recorded by Correia in 1925, in the thousands. Clunie (1985) described movements in the evening of thousands of bats in the caves of Itu'muta, noting that they were in far larger numbers than was usual in Fiji. In 1991, it was still seen every evening and some were found roosting in an overhang. But in September–October 2018, we did not observe any bats or caught any in mist-nets, nor did we obtain any information suggesting their presence. Our visits to four caves at Itu'muta (1 in Lulu, 2 in Losa, 1 in Fapufa) were unsuccessful. We questioned numerous villagers (in Itu'muta, Noa'tau, Oinafa, Lopta, Ahau) and found that people younger than 30 years old did not know the bat, and older people only remember seeing them when they were young, but none for at least a decade. We concluded that the bats are probably extirpated on Rotuma, but the causes of their disappearance remain unknown. Predation by cats or other introduced animals can be excluded. Primary forests have been transformed to cultivations and secondary forests long since the colonization by Polynesians, with no major changes since the 1990's. Except for the cave at Losa that is used by people to bath in a little fresh water basin, the caves are seldom visited, although during WW II some were used as shelters. Pesticides on the other hand cannot be excluded: they were apparently used in great quantity still in the early 2000s (McKay 2007), and then banished only recently by all islanders. The introduction of a new pathogen agent could also be a possible explanation. Despite its large range, the species has declined in all archipelagos from Micronesia to Western Polynesia since the beginning of the 20th Century (Lemke 1986; Helgen & Flannery 2002; Tarburton 2002; Palmeirim *et al.* 2007; Wiles *et al.* 2011; Anon. D). The species is still included in the category "endangered" by the IUCN (Bonaccorso & Allison 2008), but probably best considered now "critically endangered".

DISCUSSION

Because of the small size of the islands and the relatively easy accessibility of most habitats, the record of the breeding landbirds is quite straightforward. On the other hand, the nocturnal Procellariiformes remain under-investigated and further investigations will be necessary, particularly on the smaller islets. The landbird species found today on Rotuma are generalists that live preferentially in the cultivation areas rather than in the dense secondary forests. It is possible that the more specialized species vanished after the arrival of humans, because of habitat changes and hunting. Rotuma's current avifauna can be compared to that of Futuna and Alofi, two islands 545 km east, which are comparatively small and isolated in the Pacific Ocean (Fig. 1). These two islands are only separated by a 1.7 km strait that some birds cross regularly (Thibault *et al.* 2015). Both avifaunas are similar at 65% (Table 1), having in common widespread Western Polynesian species that are successful in colonizing small and remote islands [the "supertramp" of Diamond (1974)]. The honeyeaters are the exception, the two island groups having two different species of Meliphagidae with similar ecological niches; the Rotuma myzomela on Rotuma and the Polynesian wattled honeyeater (*Foulehaio carunculatus*) on Futuna and Alofi. The absence of some groups of birds on Rotuma could be attributed to 1) extinction for the Tongan ground dove (*Alopecoenas stairi*), the spotless crake (*Zapornia tabuensis*), the collared kingfisher (*Todiramphus*

Table 1. Comparison of the landbirds of Futuna and Rotuma. † indicates extinct populations.

	Futuna-Alofi	Rotuma and islets
Area (km²)	46 + 32	47
Altitude (m a.s.l.)	524	260
Species		
Metallic pigeon †		X
Pacific imperial pigeon	X	X
Crimson-crowned fruit dove	X	X
Buff-banded rail	X	X
Australasian swamphen	X	X
Pacific reef egret	X	X
Eastern barn owl	X	X
Meliphagidae sp.	X	X
Polynesian triller	X	X
Fiji shrikebill	X	X
Polynesian starling	X	X
Pacific black duck	X	
Spotless crake	X	
White-rumped swiftlet	X	
Collared kingfisher	X	
Blue-crowned lorikeet	X	
Tongan ground dove †	X	

chloris), and the blue-crowned lorikeet (*Vini australis*); 2) the absence of wetlands for the Pacific black duck (*Anas superciliosa*); and 3) competition for roosting in caves for the white-rumped swiftlet (*Aerodramus spodiopygius*) on Futuna *vs*. the sheath-tailed bat on Rotuma.

The high density of the Rotuman landbirds is unusual today among tropical Pacific islands. The Pacific imperial pigeon is suspected to be in decline on several Pacific islands because of habitat destruction and unsustainable levels of exploitation (see for instance Powlesland *et al.* 2008 for Tonga, Thibault *et al.* 2015 for Futuna). The Fiji shrikebill disappeared from several islands of its range: Mamanuca and Yasawa groups in Fiji (Masibalavu & Dutson 2006; Gregory 2018), and Tau in American Samoa (Gregory 2018); in Tonga its range has contracted significantly due to deforestation, understorey clearance by pigs and goats, and predation by cats and rats (Gregory 2018). Finally, the Polynesian triller, common on Rotuma, is rare and localized on Futuna and Alofi (Thibault *et al.* 2015). For a long time, Rotuma was relatively protected by its remoteness and by the absence of a wharf, but recently two alien species managed to reach the island: the common myna in 2017 and the cane toad (*Rhinella marina*) in 2018 (Cibois & Thibault 2019). The project to enlarge the jetty for allowing the docking of cargo-ships will lead to an increase of the number of containers, and in parallel to a higher risk of introductions. The small Indian mongoose (*Herpestes auropunctatus*) arrived at Tonga inside such containers (BirdLife 2016). A similar introduction to Rotuma is possible, and the risk of shipping black rats (*Rattus rattus*), not recorded yet on Rotuma, is even higher. Thus, the vigilance of the Biosecurity Authority of Fiji in controlling containers and cargo-ships, both at their departure from Suva and at their arrival to Rotuma, will be crucial for the protection of the native biodiversity.

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