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INVASION NOTE

Inventory of alien birds and mammals in the Wallis and Futuna Archipelago

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Abstract In November 2007 and November 2008, we conducted a bird and mammal survey on Wallis and Futuna. We found two non-native bird species on Wallis: the Common Myna (*Acridotheres tristis*) and the Chestnut-breasted Munia (*Lonchura castaneothorax*), and one on Futuna: the Jungle Myna (*Acridotheres fuscus*). We also recorded Black Rats *(Rattus rattus*) on Futuna, a recent introduction to this island. The introduction of 3 bird species and Black Rats in the last decade denotes a lack of preventive measures and demonstrates that the issue of invasive species has not received sufficient priority.

Keywords Biological invasions · Myna · Munia · Rat · *Rattus*

Wallis and Futuna (Collectivité Française d'Outre-Mer de Wallis-et-Futuna) is a French dependency under the combined rule of three customary kingdoms and of the representative of the French Government. The archipelago is of mixed volcanic and oceanic origins, and comprises three large islands: Wallis (75 km^2), Futuna (46 km^2) and Alofi (18 km^2). Wallis (also called Uvea) is the most densely populated island (9,227 inhabitants in 2008) and relatively flat (max. elevation 144 m a.s.l), surrounded by a lagoon and a barrier reef with many small islands (totalling 2.5 km^2). Futuna (4,257 inhabitants) and Alofi (1.6 km from Futuna, no permanent inhabitants), situated 230 km south-west of Wallis, are higher islands with elevations of up to

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524 m a.s.l. and without a barrier reef. On request of the Environmental Service of Wallis and Futuna, we conducted an alien bird and mammal survey in November 2007 and November 2008 (23 days on Wallis, 20 days on Futuna, 5 days on Alofi). During this period we searched the islands for introduced species by direct observations and trapping.

In each habitat type of the three islands—native rain forest, planted pine forest, *Dicranopteris* fernland, garden, coconut plantation and taro field—we set a rodent trap line of 25 trapping stations spaced at 25-m intervals. At each trapping station, we placed one Ezeset Supreme Rat Trap (A.W. Stanfield and Co, Australia), one prototype Ka Mate Survey Trap (Ka Mate Traps, New Zealand), and one Victor Professional Mouse Trap (Pest Management Services Ltd, New Zealand) on the ground. We protected the mouse trap with a plastic cover of 15 cm diameter in which we cut a hole of about 3 cm diameter to prevent larger rats from reaching the trap. We baited all traps with raw coconut and set each trap line for two consecutive nights (derived from Rouys and Theuerkauf 2003). We sampled 6 sites on Wallis (5 on the main island, 1 in rain forest of a neighbouring islet), 4 sites on Futuna and 2 sites on Alofi. We identified the species, sex and maturity stage of dead rats and mice morphologically in the field. We took photos of individuals for which the species are clearly recognisable. Additionally, we took tissue samples of 2–33 specimens of each rodent species to genetically differentiate the species or subspecies based on sequences of the mtDNA control region. DNA was extracted from tail tips of 48 morphologically different individuals, then amplified and sequenced using the primers intL (5′ATCCTCCG TGAAACCAACAA) and flankH (5′GCATTTTCAG TGCTTTGCTTT 3′). We used the programme BioEdit 7.0.1 (http://www.mbio.ncsu.edu/BioEdit/bioedit.html) to edit and align the sequences. A blast analyses on the NCBI database was carried out in order to identify the species origin.

We found 3 species of alien birds: the Common Myna and the Chestnut-breasted Munia on Wallis, and the Jungle Myna on Futuna (Table 1). All 3 species lived in modified habitats; none were found in the remnants of rain forest. We saw 20 Common Mynas in gardens of the northeast of Wallis. Although we saw only 66 Chestnut-breasted Munias in grassland areas and along roads with grassy roadside vegetation of Wallis, we think there is a total of at least several hundreds, as they are present in grassland and roadside vegetation all over the island. The Jungle Myna occurred along the west coast of Futuna in gardens. We counted 29 Jungle Mynas and we estimated their total number to be less then 100 individuals.

We confirmed the formerly known rat occurrence on all three islands, with the exception of Norway Rats, which we could not find on Wallis (Table 1). Besides previously known rodents we found Norway Rats on Alofi and House Mice on Wallis and on Futuna. Whereas Black Rats were caught in all habitats on Wallis, we found them on Futuna only in 2008 in the area surrounding the harbour. In total, we caught 221 (of which 10 confirmed by genetic analyses) Pacific Rats, 49 (33 genetic) Black Rats, 13 (2 genetic) Norway Rats, and 4 (3 genetic) House Mice, over 1,681 trap nights (754 Ka Mate rat trap nights, 594 Ezeset rat trap nights, 333 Victor mouse trap nights).

Norway Rats were most likely introduced to Alofi from Futuna by small boats with which people commute daily to Alofi to work on plantations. We captured Norway Rats from the first night on Futuna and Alofi, making it very unlikely that the absence of Norway Rats on Wallis was due to lack of detection by our method. In New Zealand, Black Rats have replaced Pacific and Norway Rats in most places (Atkinson 1973). Considering that all 3 rat species and House Mice co-exist in the area around the harbour of Futuna, it is very likely that the Black Rat introduction to this island is recent (probably in 2007 or 2008). The introduction was probably by a cargo ship, so Black Rats might origin from another island than Wallis. The recent introduction of Black Rats is of concern, since they are considered as one of the most destructive invasive species worldwide (Lowe et al. 2000). At least one bird species that occurs on Futuna, the Blue-crowned Lory (*Vini australis*), is known from Tonga islands to disappear soon after Black Rats colonised an island (Rinke et al. 1992).

The Common Myna is also considered as one of the 100 world's worst invasive alien species and is usually associated with anthropogenic habitats (Watling 1975; Lowe et al. 2000). R. Hay (cited by Atkinson and Atkinson 2000) had already seen Common Myna on Wallis in 1999. Unfortunately its introduction to Wallis, despite its early detection, did not result in management actions. Our survey was

Table 1 Alien birds and mammals on Wallis and Futuna before and during the inventory in 2007–2008 with estimated arrival time of new species

Species	Wallis		Futuna		Alofi	
	Before	2007/08	Before	2007/08	Before	2007/08
Jungle Myna *Acridotheres fuscus*		–		F[1994–1996]		–
Common Myna *Acridotheres tristis*	F[d]	F[1990–1999]		–		–
Chestnut-breasted Munia *Lonchura castaneothorax*		F[1990]		–		–
Muscovy Duck *Cairina moschata*		D	D[c]	–[e]		–
Red Junglefowl *Gallus gallus*	D[b]	D/F	D[b]	D/F	D[b]	
Domestic Pigeon *Columba livia*	D[a]		D[c]	–[e]		–
House Mouse *Mus* (*musculus*) *domesticus*		F		F		–
Pacific Rat *Rattus exulans*	F[b]	F	F[b]	F	F[b]	F
Norway Rat *Rattus norvegicus*	F[b]	–?	F[b]	F		F
Black Rat *Rattus rattus*	F[b]	F		F[2007/08]		–
Rabbit *Oryctolagus cuniculus*		–	D[e]	–[e]		–
Pig *Sus scrofa*	D[b]	D/F	D[b]	D/F	D[b]	D/F
Cattle *Bos taurus*	D[b]	D	D[b]	–[e]		–
Goat *Capra aegagrus hircus*		D				–
Horse *Equus caballus*	D[b]	D		–		–
Dog *Canis familiaris*	D[b]	D	D[b]	D		D/F
Cat *Felis catus*	D[b]	D	D[b]	D		–

[a] Guyot and Thibault 1987, [b] Guyot and Thibault 1988, [c] Gill 1995, [d] Atkinson and Atkinson 2000, [e] disappeared around 2000: Alofosio Taugamoa, pers. comm.

D domestic, *F* feral, – absent

the first field inventory of invasive species organized by the Environmental Service of Wallis and Futuna but systematic biological monitoring is still to be initiated. Yet, early detection of exotic species is a crucial element of any effective preventive system (Sherley et al. 2000). It is likely that most introductions to Wallis and Futuna arrive via Fiji by cargo ships or by air from New Caledonia. In particular the Chestnut-breasted Munia was probably introduced as caged birds from New Caledonia where it is also exotic and occurs in anthropogenic habitats. The two mynas were likely introduced either voluntarily or accidentally by cargo ships from Fiji where they occur on most islands (Watling 2004).

The introduction of 3 bird species to Wallis and Futuna and Black Rats to Futuna in the last decade illustrates the lack of preventive measures and demonstrates that the issue of invasive species has not received sufficient political support. A ban on the introduction of invasive species to Wallis and Futuna was voted in July 2007 (Code de l'Environnement, Délibération n°09 bis/AT-2007). This ban is limited to species listed as invasive but the list of invasive species has not yet been compiled. The introduction of other species is not regulated. As in most Pacific islands, there is no systematic luggage check with bio-security control (e.g. by dogs or x-ray).

We believe that Black Rat eradication from Futuna is an urgent task that should be implemented immediately. We recommend to first document the current distribution of Black Rats by trapping to decide whether eradication can be tempted (by trapping and poisoning) or only a control of the population is possible (Ogden and Gilbert 2009). In addition, we recommend eradicating the Common Myna from Wallis and Jungle Myna from Futuna, as their numbers are still limited. In contrast, the Chestnut-breasted Munia is already very numerous on Wallis and the elimination of this species seems impractical. Furthermore, its negative impact is likely to be limited because the species feeds mainly on grass seeds, which do not occur in native forest. A restoration of natural habitats would be a proper management measure to reduce the numbers of munias.

We do not recommend restricting an import ban to species that are listed as invasive, as it is difficult to assess if the species might become invasive after introduction to the archipelago. Import and release of any species should be subject to authorisation on Wallis and Futuna as it is already in New Caledonia and French Polynesia. Bio-security control should be established in seaports and airports. Transfer of species between islands within Wallis and Futuna should be restricted to prevent the spread of introduced species. Detection and monitoring of invasive species should be implemented and carried out regularly. Moreover, actions should be taken to inform the islands' inhabitants on the importance of prevention of further introductions.

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