

Contributions to Mammalogy and Zooarchaeology of Wallacea

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The Mammal Fauna of Kofiau Island, off Western New Guinea

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ABSTRACT. Kofiau's terrestrial mammal fauna shares many taxa with oceanic islands lying close to New Guinea. Its fauna is distinctive in possessing a mixture of Moluccan near-endemics, such as *Pteropus chrysoproctus*, along with Melanesian species, like *Dobsonia beauforti*, that reach their westernmost limit on Kofiau. Very little has been published on the terrestrial vertebrate fauna on Kofiau compared to the adjacent islands. This paper presents two surveys of the terrestrial mammal fauna of Kofiau Island, undertaken in 2011 and 2019, increasing the number of species recorded from the island from 1 to 20: one rodent, two marsupials and 17 bats.

ABSTRAK [Bahasa Indonesia]. Fauna mamalia terestrial di Pulau Kofiau memiliki kemiripan dengan pulau-pulau di sekitar kawasan Papua dan Papua New Guinea. Mamalia terestrial di pulau ini sangat khas yang merupakan campuran dari spesies dengan sebaran terbatas di Kepulauan Maluku, seperti *Pteropus chrysoproctus*, sampai dengan spesies dari Kawasan Melanesia seperti *Dobsonia beauforti* yang mencapai batas paling barat Pulau Kofiau. Sampai saat ini, publikasi tentang fauna vertebrata terestrial di Pulau Kofiau masih sangat sedikit dibandingkan dengan pulau-pulau lain di sekitarnya. Makalah ini menyajikan hasil survei mamalia terestrial di Kofiau yang telah dilakukan pada tahun 2011 dan 2019, dan menunjukkan adanya peningkatan jumlah spesies yang tercatat di pulau ini, dari satu menjadi 20 spesies yang terdiri dari satu spesies hewan pengerat, dua spesies hewan berkantung dan 17 spesies kelelawar.

Introduction

Kofiau Island is a relatively large (144 sq. km) landmass in Southwest Papua Province, Indonesia, which lies around 30 km west of the New Guinean continental shelf (Fig. 1). Being surrounded by water over 200 m deep, it was not connected

with New Guinea during the last glacial maxima (Diamond *et al.*, 2009). Its maximum elevation is 288 m, though most of the island consists of a coralline platform that is raised a few metres above sea level. The uplifted marine limestone plateau is undated, as are the two volcanic hills that project above it (Diamond *et al.*, 2009).

Keywords: Raja Ampat, biogeography, bat echolocation, biodiversity survey

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Kofiau is part of the Raja Ampat islands group. The largest islands of the group are Misool, Salawati, Waigeo, and Batanta. Misool and Salawati are continental land-bridge islands, while Batanta and Waigeo were not connected with the mainland during periods of low sea level, though they were separated only by a narrow channel, and were connected with each other. Both the continental land-bridge islands have relatively rich mammal faunas, including macropodids and other marsupials typical of the New Guinea lowlands. Waigeo/Batanta have a more limited non-volant mammal fauna, but are home to an endemic marsupial, the phalangerid *Spilocuscus papuensis*. Kofiau and Gag are oceanic islands that are separated from the continental shelf by a wide expanse of sea. At 56 sq. km Gag Island is the smallest and most isolated major island in the group, lying around 80 km due north of Kofiau. Thirteen mammal species have been recorded on Gag (Maryanto & Kitchener, 1999; Maryanto *et al.*, 2010), comprising seven pteropodid bats (*Pteropus neohibernicus*, *P. conspicillatus*, *P. personatus*, *Nyctimene* sp. cf. *albiventer*, *Dobsonia beauforti*, *Macroglossus minimus* and *Syconycteris australis*), two emballonurid bats (*Emballonura alecto* and *Mosia nigrescens*), and four murid rodents (*Rattus tanezumi*, *R. exulans*, and *R. nikenii*, and an unidentified murine with a white tail-tip). Of these, the presence of both an apparent endemic (*Rattus nikenii* Maryanto, Sinaga, & Maharadatunkamsi, 2010) and the North Moluccan endemic *Pteropus personatus* is noteworthy (Wiantoro & Maryanto, 2016).

Very little has been published about the vertebrate fauna of Kofiau Island. Only the avifauna has received close attention, and even that is poorly documented relative to that of adjacent landmasses (Ripley, 1959; Diamond *et al.*, 2009). Kofiau's avifauna comprises 78 species, including two endemic allospecies—the Kofiau Paradise Kingfisher (*Tanysiptera ellioti*) and the Kofiau Monarch (*Symposiachrus julianae*), and 5 endemic subspecies (Diamond *et al.*, 2009). It is, according to Diamond *et al.* (2009) “typical of the Papuan region's oceanic islands”. This paper represents the first study that documents the terrestrial mammal faunal on the island (Table 1).

Kofiau's marine mammals have received more attention than the terrestrial mammal fauna. Twelve cetacean species have been recorded from the Kofiau Marine Protected Area, which surrounds the island (Ender *et al.*, 2014), including the spinner dolphin (*Stenella longirostris*), pantropical spotted dolphin (*Stenella attenuata*), common bottlenose dolphin (*Tursiops truncatus*), Indo-Pacific bottlenose dolphin (*Tursiops aduncus*), Fraser's dolphin (*Lagenodelphis hosei*), Risso's dolphin (*Grampus griseus*), short-finned pilot whale (*Globicephala macrorhynchus*), killer whale (*Orcinus orca*), Bryde's whale (*Balaenoptera edeni*), sperm whale (*Physeter macrocephalus*), false killer whale (*Pseudorca crassidens*) and pygmy killer whale (*Feresa attenuata*).

Prior to this report, the only existing published terrestrial mammal record for Kofiau was a single museum specimen of *Pteropus chrysoproctus* (Flannery, 1995; see below).

Table 1. List of mammals recorded for Kofiau.

Taxa	Kofiau local name	Nature of record
Diprotodontia		
Phalangeridae		
<i>Phalanger orientalis</i>	Rambau	photograph
Petauridae		
<i>Petaurus</i> sp. cf. <i>breviceps</i>	Mantuan	local report
Rodentia		
Muridae		
<i>Melomys</i> sp.	Intowek	local report
Chiroptera		
Pteropodidae		
<i>Pteropus chrysoproctus</i>	Mambikaf	historic voucher sighting
<i>Dobsonia beauforti</i>		voucher
<i>Rousettus amplexicaudatus</i>		voucher
<i>Macroglossus minimus</i>	Mamquai	voucher
<i>Nyctimene</i> sp. cf. <i>albiventer</i>	Mamquai	voucher
<i>Paranyctimene raptor</i>		voucher
<i>Syconycteris australis</i>		voucher
Emballonuridae		
<i>Emballonura</i> sp. cf. <i>alecto</i>		bat detector
<i>Mosia nigrescens</i>		voucher, bat detector
Vespertilionidae		
<i>Myotis</i> sp. cf. <i>stalkerii</i>		sighting, bat detector
Miniopteridae		
<i>Miniopterus</i> sp. cf. <i>australis</i>		bat detector
Hipposideridae		
<i>Aselliscus tricuspidatus</i>		voucher, bat detector
<i>Hipposideros diadema</i>		bat detector
<i>Hipposideros</i> sp. cf. <i>maggietaylorae</i>		voucher
<i>Hipposideros ater</i>		voucher
Rhinolophidae		
<i>Rhinolophus</i> sp. cf. <i>euryotis</i>		bat detector
Molossidae		
<i>Chaerephon jobensis</i>		bat detector

Materials and methods

Here we report the results of two independent investigations of Kofiau's mammal fauna. The first, undertaken by one of us (SW) occurred in December 2011 when a bat survey was undertaken over two consecutive nights using a four-bank harp trap and a mistnet in two uninhabited areas in the central (1.184°S 129.847°E) and west coastal parts of the island (sites marked by stars on Fig. 1). This survey resulted in the recording of 10 species of bat, as documented by voucher specimens deposited at the Museum Zoologicum Bogoriense in Cibinong, Indonesia (Table 2). The second investigation, on 2 October 2019, occurred when the *Spirit of Enderby*, carrying 42 tourists visited Kofiau and two of us (TF and DB) took the opportunity to record what we could of the island's mammals. Evidence was gathered for the presence of 20 terrestrial mammal species (1 phalangerid marsupial, 1 petaurid marsupial, 1 murid rodent, 7 pteropodid bats, 1 rhinolophid bat, 4 hipposiderid bats, 2 emballonurid bats, 1 miniopterid bat, 1 vespertilionid bat, 1 molossid bat, see Table 1).

In 2011, during the first night of bat trapping, one mistnet and harp trap were deployed in the secondary forest close to the coast. The mistnet was set up from 6 pm until midnight, while the harp trap was left overnight. Periodic checks were done on both types of traps. During this survey, one of us (SW) found a lot of fallen ripe mango under the wild mango trees along the trail from the beach to the sampling site. It was mango fruit season in the island. On the second night,

we moved the mistnet and harp trap to the other sampling site which was dominated by mangrove vegetation. There was no rain on the first night, however, light rain fell on the second night.

Just prior to the 2019 visit some rain had fallen on Kofiau. Throughout September, however, the region had experienced a severe dry season. We saw large numbers of tall, leafless (possibly dead) trees, and the *Terminalia catappa* trees were in the process of shedding red leaves. The expedition stopped at two locations: (1) Kampong Deer, on Deer Islet off the north coast, and the adjacent mainland; and (2) an islet off the largely uninhabited south coast of Kofiau (1.216757°S 129.737884°E, see circle on Fig. 1). At both locations, most of the 42 passengers participated in an opportunistic survey for mammals.

Location 1: Kampong Deer and adjacent coast of Kofiau. The expeditioners undertook a 20-minute walk on the mainland of Kofiau directly opposite Kampong Deer. The group was led from the coast to Jenyan Lake by Naftali, a ranger with a Nature Conservancy funded conservation initiative. He confirmed the presence of *Phalanger orientalis*, and the absence of bandicoots, on Kofiau. The only mammal sighting made during the walk was a group of 4 scats, consistent with those of a juvenile *P. orientalis*, found on a palm spathe on a path through young regrowth. At Kampong Deer, using Flannery (1995) as a source of illustrations, Josias, the Kepala Kampong, was questioned about Kofiau's mammals.

Table 2. Measurements from captured bat species from the expedition conducted by MZB (SW) in 2011. All length measurements in millimetres (mm). Means, with range in parentheses.

Species	n	Weight (g)	Head and body length	Tail length	Ear length	Tragus length	Forearm length	Tibia length	Hindfoot length
<i>Aselliscus tricuspidatus</i>	1♀	2.5	40	24	11	—	40	14	5
<i>Dobsonia beauforti</i>	1♂1♀	170 (150.0–190.0)	150 (135–165)	26 (24–29)	24 (22–25)	—	111 (110–112)	46 (44–49)	23 (22–24)
<i>Hipposideros ater</i>	1♀	5	49	30	17	—	43	18	6
<i>Hipposideros</i> sp. cf. <i>maggietaylorae</i>	1♂	—	—	32	16	—	50	22	10
<i>Macroglossus minimus</i>	3♂	13 (12.0–14.0)	49	—	14 (13–15)	—	38 (38–39)	14 (12–15)	11 (10–11)
<i>Mosia nigrescens</i>	1♀	2	37	9	10	4	34	12	6
<i>Nyctimene</i> sp. cf. <i>albiventer</i>	1♂2♀	29 (26.0–30.0)	82 (73–86)	21 (18–26)	14 (11–15)	—	55	20	12 (11–13)
<i>Paranyctimene raptor</i>	3♂4♀	30 (25.0–35.0)	82 (78–86)	20 (17–24)	13 (12–15)	—	56 (53–59)	21 (20–21)	13 (12–13)
<i>Rousettus amplexicaudatus</i>	1♀	67	108	18	18	—	83	35	20
<i>Syconycteris australis</i>	2♂2♀	16 (15.0–16.0)	67 (65–70)	—	15 (14–16)	—	43 (41–44)	17 (15–18)	12 (11–12)

MZB registration numbers:

Aselliscus tricuspidatus: MZB 35057

Dobsonia beauforti: MZB 35096, MZB 35097

Hipposideros ater: MZB 35118

Hipposideros sp. cf. *maggietaylorae*: MZB 35119

Macroglossus minimus: MZB 35112, MZB 35113, MZB 35064

Mosia nigrescens: MZB 35071

Nyctimene sp. cf. *albiventer*: MZB 35091, MZB 35092, MZB 35093

Paranyctimene raptor: MZB 35065, MZB 35068, MZB 35101, MZB 35102, MZB 35098, MZB 35099, MZB 35100

Rousettus amplexicaudatus: MZB 35117

Syconycteris australis: MZB 35067, MZB 35081, MZB 35082, MZB 35083

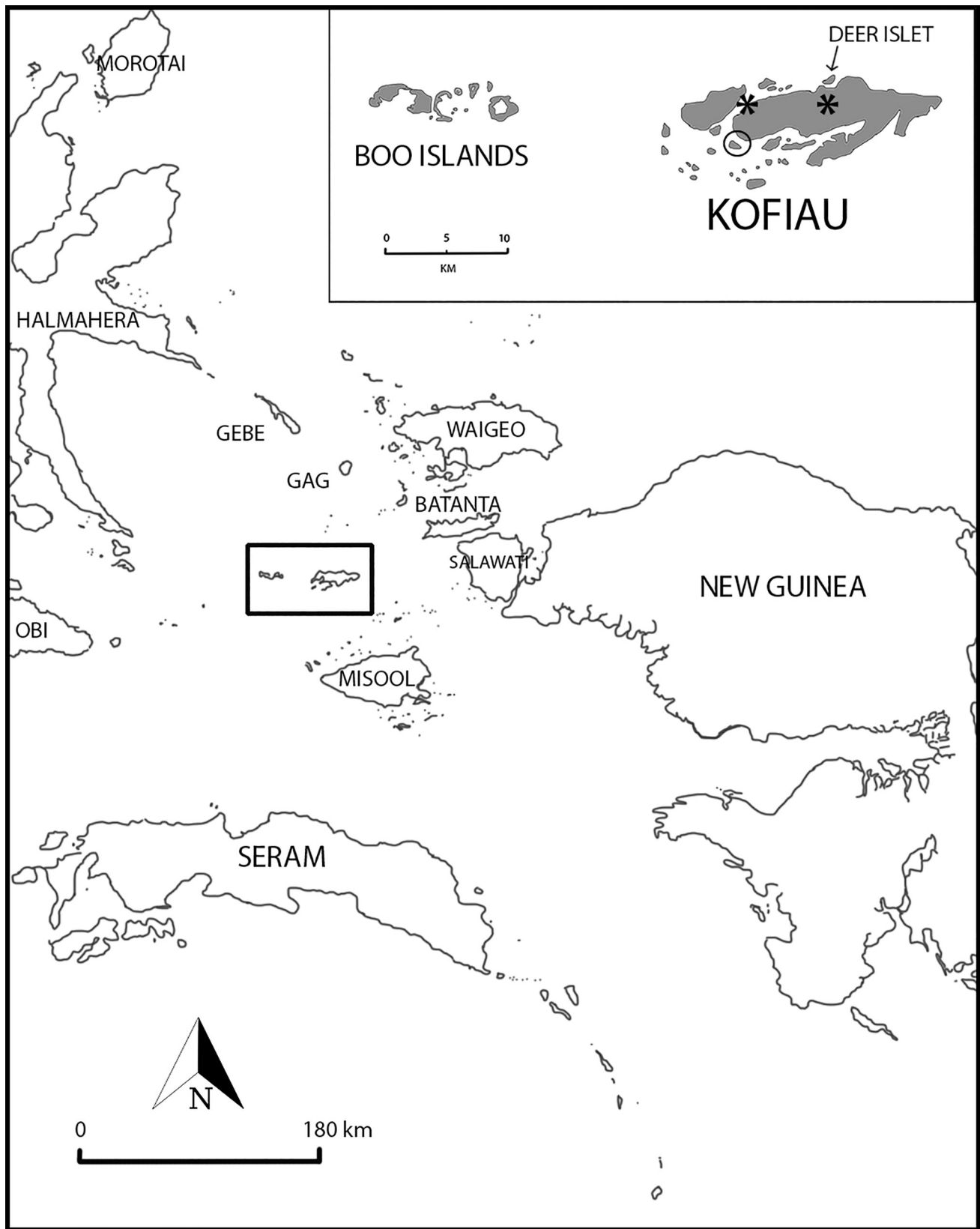


Figure 1. Map of Kofiau Island and wider region. The stars denote survey locations from 2011 and the small circle indicates the south coast islet survey location in 2019.

Josias incidentally noted that the nearest cave inhabited by bats was *jauh sekali* (very far away) from Kampong Deer, as well as confirming the presence of several species (see below), and the absence of some species we had suspected might occur on Kofiau.

Location 2: Islet off the south-west coast of Kofiau. Observations were conducted between approximately 6 pm and 7 pm, from four Zodiacs. DB had a bat detector and torch, TF had Swarovski X10 binoculars. Attention was focussed on bats. Little bat activity was noted until around 6.30 pm, when a flowering *Syzygium* tree (jambu) was located growing adjacent to the shore, and several fruit bats were seen flying in the vicinity. At least eight species of echolocating bat were identified from the bat detector recordings. Bat echolocation calls were recorded at a resolution of 256 kHz with a Wildlife Acoustics Echo Meter Touch 1 connected to an Apple iPhone. Calls were inspected in Adobe Audition CS6 version 5.0.2 and identified based on the similarity of calls documented from Papua New Guinea (Armstrong & Aplin, 2011, 2014; Leary & Pennay, 2011; Armstrong *et al.*, 2015; Armstrong, 2017; see these references also for call type nomenclature used herein).

Results

The terrestrial mammal fauna of Kofiau

Diprotodontia Owen, 1866

Phalangeridae Thomas, 1888

Phalanger orientalis orientalis (Pallas, 1766). Common throughout the island. Two juvenile females (both large pouch young) were being held in the village at the time of our visit. Both individuals were photographed by expeditioners, one of which is shown in Fig. 2. Based on our examination of their external morphology, they are not distinguishable from individuals from mainland New Guinea.

Phalanger orientalis is widespread and abundant in the northern lowlands of New Guinea and adjacent islands, as well as in the Raja Ampat Islands, Seram, Buru and Timor (Flannery, 1995). It has been introduced to Timor, and probably to many other islands in its distribution, including possibly Kofiau.

Petauridae Bonaparte, 1838

Petaurus sp. cf. breviceps Waterhouse, 1838. Sugar gliders were confirmed by Josias as being present in coconut plantations and elsewhere. None were seen by members of the 2019 expedition. As currently constituted, it is one of the most widespread of marsupials, occurring from southeastern Australia to New Guinea, New Ireland, Halmahera and many smaller islands. However, *Petaurus breviceps* is almost certainly a species complex in the New Guinea region (Helgen, 2007), as has recently been demonstrated for the Australian portion of its formerly recognized range, which is now classified in 3 distinct species, *P. breviceps*, *P. notatus*, and *P. ariel*. Previously, sugar gliders have been recorded on Salawati and Misool in the Raja Ampats. *Petaurus* may have been introduced by humans to some Melanesian and particularly to Moluccan islands (Flannery, 1995).

Rodentia Bowdich, 1821

Muridae Illiger, 1811

Melomys sp. After careful examination of a photograph, and a description of the creature given by TF, Josias confirmed that a species of *Melomys* resembling *M. rufescens* occurs on Kofiau. *Melomys rufescens* is widespread in the New Guinea lowlands as well as on adjacent islands, but several similar island endemics also occur in Melanesia, e.g., *M. matambuai* on Manus, and *M. bougainville* in the Solomon Islands (Flannery, 1995). Other species of *Melomys* occur throughout the Moluccas, including the widespread species *Melomys lutillus* in Halmahera and a variety of endemic taxa in Seram, Obi, the Tanimbars, and Talaud Islands (Flannery, 1995; Helgen, 2003; Fabre *et al.*, 2017).

Chiroptera Blumenbach, 1779

Pteropodidae Gray, 1821

Nyctimene sp. cf. albiventer (Gray, 1863). This taxon represents a species complex and requires systematic revision (Helgen, 2007; Aplin & Armstrong, 2021). It has been recorded on Salawati, Waigeo and Batanta in the Raja Ampats, as well as on Gebe, Halmahera, New Guinea and nearby islands (Flannery, 1995). It was recorded during the 2011 survey but was not encountered in 2019. However, a photograph of *Nyctimene albiventer* was recognized by Josias (Kepala Kampong), who commented that it roosted in foliage on Kofiau.

Paranyctimene raptor Tate, 1942. Seven individuals of *Paranyctimene* were captured during the 2011 survey, but the taxon was not recorded in 2019. The genus is widespread below around 1,000 m in elevation in New Guinea and has been recorded from Salawati and Waigeo in the Raja Ampat group (Wiantoro, 2011). The two currently recognized species of *Paranyctimene*, *P. raptor* and *P. tenax*, are difficult to distinguish (Bergmans, 2001).

Macroglossus minimus (Geoffroy, 1810). This is an extremely widespread species of blossom bat, being recorded from Thailand and Vietnam through to the Solomon Islands and Australia. It is one of the most commonly mistnetted species in lowland Melanesia. It was recorded from the Boo Islands near Kofiau by Kompanje & Moeliker (2001). This species was captured in a mistnet in the 2011 survey. In 2019, between 6.30 and 7.00 pm, blossom bats probably representing both *Macroglossus* and *Syconycteris* (which were not possible to distinguish in the spotlight) were present in abundance, feeding on the blossoms of a *Syzygium* that was growing on an islet just south of Kofiau. Feeding frequency dropped from its initial high rate by around 6.50 pm.

Syconycteris australis (Peters, 1867). This species is distributed in eastern Australia, New Guinea and nearby islands, as well as on Salawati and Batanta in the Raja Ampat group, and on Halmahera, Gebe, Seram, and Buru in the Moluccas (Flannery, 1995). This species was captured in a mistnet during the 2011 survey and probably sighted by spotlight feeding on a flowering *Syzygium* growing on an islet just south of Kofiau, in 2019.



Figure 2. Juvenile *Phalanger orientalis*, Kampong Deer (Location 1), Kofiau.

Dobsonia beauforti Bergmans, 1975. This species is endemic to the Raja Ampat group. It occurs on Batanta, Gebe, Salawati, Gag and Waigeo, and is possibly present on Misool (Mildenstein, 2016). It is otherwise known only from the Biak-Supiori group in Cenderawasih Bay. It has been recorded roosting in caves, and also under fallen logs (Flannery, 1995). It was captured in a mistnet in the 2011 survey. In 2019 around a dozen individuals likely to be this species were seen emerging from the forest in the vicinity of the flowering *Syzygium*, before flying at low elevation (2–3 m) towards another islet.

Rousettus amplexicaudatus (Geoffroy, 1810). This species has a wide distribution, from Myanmar through to Indonesia in southeast Asia, and on to New Guinea and satellite islands, eastwards to the Solomon Islands (Flannery, 1995). During the 2011 survey, this species was captured. In 2019, a few individuals, likely to be this species, were observed flitting around a flowering *Syzygium* growing on an offshore islet.

Pteropus chrysoproctus Temmick, 1837. Otherwise known only from the north and central Moluccan islands of Gebe, Obi, Buru and Seram and satellite islands, including Ambon, Gorong, and Pulau Panjang (Flannery, 1995; Tsang, 2016). A single medium-sized flying-fox with a yellowish mantle, identified as this species, was seen flying parallel to the coast at an elevation of about 10 m in the channel between the islet off the south coast and the main island of Kofiau. This species was first recorded on Kofiau over a century ago: the only museum specimen of a mammal previously reported from Kofiau is a single specimen of *Pteropus chrysoproctus* in the Naturalis Museum in Leiden, RMNH 38000, an adult female, mounted skin with skull. Matschie (1899: 14) and Jentink (1887) referred to the locality for this specimen as “Koffian”, and Andersen (1912: 261, 263) interpreted this as Keffing (= Seram Rei), an island in the Seram Laut group. However, according to labels associated with RMNH 38000 (an adult female, mounted skull and skin), the specimen was indeed collected on Kofiau by D. S. Hoedt in 1867 (or perhaps

actually his assistant D. Hokum—Ripley, 1959) during a bird-collecting trip, and letters from Hoedt in the Leiden archives confirm the validity of this record (C. Smeenk, *in litt.*). There is thus no confirmed record of *P. chrysoproctus* from Seram Rei.

Rhinolophidae Gray, 1825

Rhinolophus sp. cf. euryotis Temminck, 1835. Recorded from Sulawesi to Timor, New Guinea and the Bismarck Archipelago, it also occurs on smaller islands in the region, including Batanta and Waigeo in the Raja Ampat group (Wiantoro, 2011). It roosts in caves and appears to be far more common in the Moluccas than on islands further east (Flannery, 1995). On Kofiau, long duration echolocation calls indicative of a species of *Rhinolophus* were detected with a characteristic frequency of 55 kHz, which is similar to *R. euryotis* in New Guinea (call type 55 *ICF*; Armstrong & Aplin, 2017).

Hipposideridae Lydekker, 1891

Aselliscus tricuspis (Temminck, 1835). Temminck's horseshoe bat occurs from Halmahera in the west to New Guinea and on to the Solomon Islands and Vanuatu in the east (Flannery, 1995). In the Raja Ampat group, it has previously been recorded only from Waigeo (Meinig, 2002; Wiantoro, 2011). It was captured on Kofiau during the 2011 survey, and in 2019 was detected unambiguously based on its echolocation calls that have a shape typical of hipposiderids and a characteristic frequency between 115 and 120 kHz (call type 118 *sCF*) (Fig. 3).

Hipposideros sp. cf. maggieltaylorae Smith & Hill, 1981. This medium-sized hipposiderid has been recorded from the Bismarck Archipelago, New Guinea and some nearby islands (Armstrong & Wiantoro, 2021b; Flannery, 1995). Meinig (2002) and Wiantoro (2011) have recorded individuals provisionally assigned to this species from Waigeo and Batanta in the Raja Ampat group. A single specimen also provisionally referred to this species (pending a more detailed systematic review) was collected on Kofiau during the 2011 survey. Its echolocation calls were not recorded with the bat detector on the 2019 survey.

Hipposideros diadema (Geoffroy, 1813). This species is widely distributed from Thailand to New Guinea, Australia and the Solomon Islands, and has previously been reported from Batanta and Waigeo in the Raja Ampat group (Aguilar & Waldien, 2021). It was detected unambiguously based on its low frequency echolocation calls that have a shape typical of hipposiderids and a characteristic frequency typical of the species throughout its range (call type 55 *mCF*; Leary & Pennay, 2011; Armstrong, 2017) (Fig. 3).

Hipposideros ater Templeton, 1848. This species occurs from India eastwards to the Philippines, Australia, New Guinea and the Bismarck Archipelago (Flannery, 1995; Armstrong, 2021a). It is uncommon in Melanesia. Meinig (2002) reports it from Batanta. A single specimen was captured on Kofiau during the 2011 survey.

Emballonuridae Gervais, 1855

Emballonura alecto (Eydoux & Gervais, 1836). This taxon has its centre of distribution on Borneo, the Philippines and

Sulawesi. The nearest occurrences to Kofiau are on Gag Island and Seram (Armstrong & Wiantoro, 2021a). Members of the genus *Emballonura* produce distinctively shaped calls that resemble the short tonal calls of *Hipposideros* with a dominant second harmonic, but at much lower frequencies. The most likely candidate for call type 35 *i.fFM.d* given the low frequency of the calls (relative to calls known from New Guinea and similar to *E. diana*) is the relatively large-bodied *E. alecto* (Armstrong & Wiantoro, 2021a), to which we attribute these recorded calls.

Mosia nigrescens (Gray, 1843). This small sheath-tailed bat is distributed from Sulawesi, through New Guinea and to the Solomon Islands (Flannery, 1995). It roosts in the twilight zone of caves, as well as in vegetation and possibly in houses (Flannery, 1995), and occurs on many smaller islands in this region including Salawati, Batanta and Waigeo in the Raja Ampat group (Flannery, 1995). It was collected during the 2011 survey, and in 2019 was detected unambiguously on the basis of its distinctively shaped echolocation calls that have a characteristic frequency above 60 kHz (call type 63 *i.fFM.d*) (Fig. 3).

Miniopteridae Dobson, 1875

Miniopterus sp. cf. australis Tomes, 1858. Recorded from Sumatra eastwards to Borneo, New Guinea, Australia and as far east as Vanuatu and New Caledonia, this widespread species has previously been reported from Batanta and Waigeo in the Raja Ampat group and nearby Gebe in the North Moluccas (Flannery, 1995; Meinig, 2002; Armstrong *et al.*, 2021). Frequency modulated calls with a characteristic frequency of ca. 53 kHz and a terminal droop have been attributed to small species of bent-winged bat in Papua New Guinea (call type 53 *st.cFM.d*) (Fig. 3). The revision of Indo-Australasian *Miniopterus* by authors SW and KNA did not include a sample from Kofiau Island, but this call type is likely attributable to an undescribed species of small *Miniopterus*.

Vespertilionidae Gray, 1821

Myotis sp. cf. stalker Thomas, 1910. This distinctive fishing bat has been recorded from the Moluccan islands of Gebe and Kai Kecil, as well as from Waigeo and Batanta in the Raja Ampat group (Meinig, 2002; Bouillard, 2021). Our tentative identification from Kofiau involves observation of a large insectivorous bat seen hawking within centimetres of the ocean surface off the south coast. The bat had narrow wings and appeared to be silvery in colour in torchlight. Although no calls were recorded from the bat detector while it was under observation, at least one, and possibly two, distinct echolocation call types, attributable to different species of *Myotis* were recorded at other times (call types 20 *bFM* and 30 *bFM*) (Fig. 3). Given that *Myotis* can vary their calls depending on their activity, it is possible that both calls derive from one species.

Molossidae Gervais, 1856

Chaerephon jobensis (Miller, 1902). Distributed across New Guinea, Seram, Yapen and New Britain and northern Australia (Flannery, 1995; Armstrong, 2021b), Kofiau is the smallest island this taxon has been recorded on. A single recorded sequence of very narrowband ("flat") echolocation

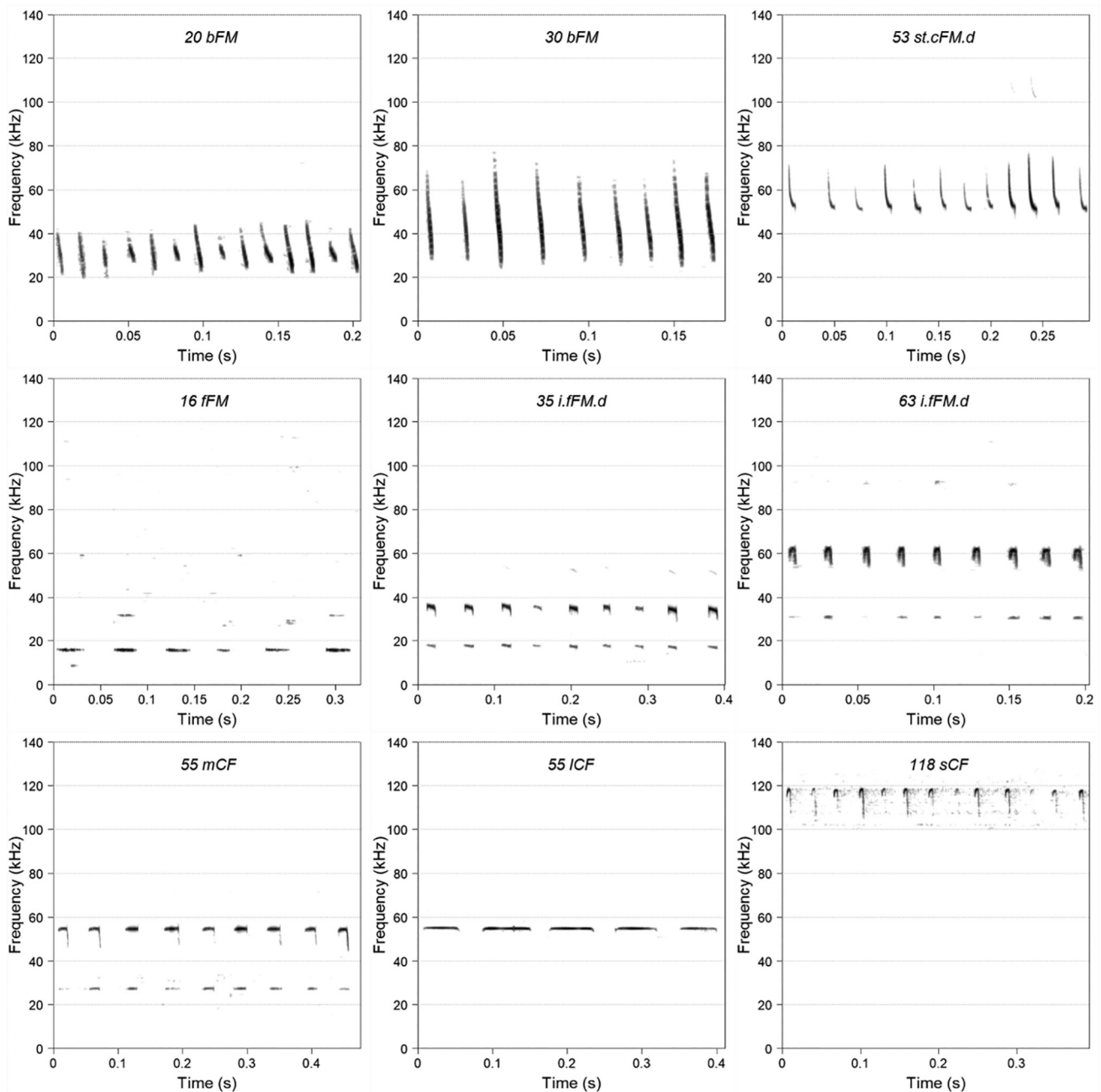


Figure 3. Representative echolocation call sequence portions of the species identified (time between pulses has been compressed). 20 bFM and 30 bFM: *Myotis* sp. cf. *stalkerii*; 53 st.cFM.d: *Miniopterus* sp. cf. *australis*; 16 fFM: *Chaerephon jobensis*; 35 i.fFM.d: *Emballonura alecto*; 63 i.fFM.d: *Mosia nigrescens*; 55 mCF: *Hipposideros diadema*; 55 ICF: *Rhinolophus euryotis*; 118 sCF: *Aselliscus tricuspidatus*.

calls with a characteristic frequency at the fundamental of ca. 16 kHz (and weaker second harmonic at 32 kHz) most likely represents *C. jobensis* (call type 16 fFM) (Fig 3).

Discussion

The records reported here bring the number of terrestrial mammals known from Kofiau from one, *Pteropus chryso-proctus*, to 20. Six species of the 20 recorded (*Macroglossus minimus*, *Syconycteris australis*, *Dobsonia beauforti*, *Rousettus amplexicaudatus*, *Mosia nigrescens* and *Aselliscus tricuspidatus*) were reported in both 2011 and 2019, by specimen collecting, direct observation, or by bat echolocation call recordings.

Several mammal species that are widespread on Melanesian islands were noted by local residents to be absent from Kofiau. These taxa were often known by Kofiau residents as occurring on other islands and could be unequivocally identified. The absent taxa include all bandicoots, *Hydromys* spp., and *Rattus praetor*. This last absence seems remarkable, because the species is widespread on Melanesian islands, but neither Josias (Kepala Kampong) nor other residents recognized images and descriptions of *Rattus praetor*, claiming that no large, harsh-furred rats existed on Kofiau. Josias also noted that spotted cuscuses (*Spiloglossus* spp.) were absent from Kofiau, but another villager told DB that a spotted cuscus did in fact occur on the island. These issues highlight the need for further work exploring the mammal fauna of Kofiau.

Our surveys reveal that the mammal fauna of Kofiau is typical of that of oceanic islands in having a very limited non-volant element. It is notable that there are no endemic taxa so far identified. This may be a function of the island's small size, but may also suggest that Kofiau might be a relatively young island, despite its endemic birds (see above). The island is however of interest in that it marks a zone of overlap between the distinctive Moluccan fauna, and the mammal fauna typical of non-land bridge islands lying near New Guinea. *Pteropus chrysoproctus* and *Myotis* sp. cf. *stalker*i are principally Moluccan species that may reach their easternmost limit on Kofiau, while others, such as *Hipposideros* sp. cf. *maggietyalorae* and *Dobsonia beauforti*, are Melanesian taxa that reach their westernmost distributional limit on the island.

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