Some fruit bats from remote Moluccan and West-Papuan Islands, with the description of a new subspecies of *Macroglossus minimus* (Megachiroptera: Pteropodidae)

Kompanje, E.J.O. & Moeliker, C.W., 2001 - Some fruit bats from remote Moluccan and West-Papuan Islands, with the description of a new subspecies of *Macroglossus minimus* (Megachiroptera: Pteropodidae) - DEINSEA 8: 143 - 167 [ISSN 0923-9308]. Published 9 November 2001

Recently collected bat specimens from the remote Moluccan and West-Papuan islands of Boano, Kasa, Haruku, Wai, Kri and Boo are described. The material consists of the following pteropodid species (localities between brackets): *Rousettus amplexicaudatus* (Kasa), *Pteropus conspicillatus* (Wai, Kri), *Nyctimene cephalotes* (Boano), *Syconycteris australis* (Haruku, Boano) and *Macroglossus minimus* (Boano, Boo). They all represent new island records. A specimen of *Macroglossus minimus* from the Boo Islands is described here as a subspecies new to science. Among the comparative material a recently collected specimen of *Macroglossus minimus* from the Tanimbar Islands was discovered. This also appeared to be a new island record for this species.

Correspondence: dr E.J.O. Kompanje & C.W. Moeliker, Natuurhistorisch Museum Rotterdam, P.O. Box 23452, NL-3001 KL Rotterdam, the Netherlands; e-mail: moeliker@nmr.nl

Key words: bats; Pteropodidae; biogeography; taxonomy; Indonesia; Moluccas; West-Papuan Islands; *Rousettus amplexicaudatus*; *Pteropus conspicillatus*; *Nyctimene cephalotes*; *Syconycteris australis*; *Macroglossus minimus*.

INTRODUCTION

During the past decade (1990-2001) ornithological surveys in the Moluccan and West-Papuan region of Indonesia by C.J. Heij and co-workers have resulted in new and noteworthy data on the birdlife of remote and/or seldomly visited islands such as Boano (Moeliker & Heij 1995, 1996), Haruku & Kasa (Heij 1995; Heij et al. 1997), Waigeo (Anonymus 2001; Heij & Post 2001) and Kofiau & Boo. Mistnetting birds on these islands by the second author (CWM) and C.J. Heij accidentally yielded bats that were secured and deposited in the collection of the Natuurhistorisch Museum Rotterdam (NMR), the Netherlands. Initially these bats were only provisionally identified and received no further attention. However, a very dark *Macroglossus minimus* specimen from the Boo Islands brought in by the Waigeo Expedition 2000, has recently prompted us to a more detailed examination of all material
accessed so far. The ten complete specimens, two skeletons and three crania (all of pteropodid-species) comprise six taxa, including one to be described here as a new subspecies, all represent ‘new island records’. The taxonomical and distributional data presented below, justify publication of this modest number of specimens, which otherwise would have remained unnoticed. Moreover, they probably are the last (bat)specimens recently collected in a region that now suffers from severe religious and political turmoil, and where fieldworkers probably can not be active for many years to come.

METHODS AND COLLECTING SITES

Fieldwork
Except for one bat, which was shot by locals, and five skeletons/skulls that were found, all other specimens were accidentally caught in standard Japanese mistnets that were set on ground level in gaps in the forest or garden vegetation and left out after sunset (for practical reasons). Nets were not checked during hours of darkness. Bats were removed from the net at first light, the exact hour of capture being unknown, and were immediately preserved in alcohol 70%. All mistnetted specimens were assigned the date of the moment of removal from the net.

Museumwork
Upon arrival in the museum (in most cases within one month after the collecting date) the complete specimens were preserved as a dry skin with one wing stretched and the skull extracted. All body and cranial measurements, as defined by Rookmaker & Bergmans (1981), were taken with vernier callipers (to the nearest 0.1 mm) by the first author and are in mm. Dental measurements were taken by J.W.F. Reumer with a Leitz Ortholux microscope fitted with a movable stage and measuring clocks. Designation of dental characteristics follows Andersen (1912). All measured and most described units are abbreviated in the text and explained in Table 1. Pelage descriptions follow the colour terminology of Smithe (1975): their names begin with a capital and are sometimes followed by remarks (between brackets) such as ‘darker’, ‘lighter’ or ‘tinged silvery’. ‘Clay Color/Fawn Color’ means the colour is intermediate between Clay and Fawn. Museum acronyms are also explained in Table 1. Comparative material (Appendix 1), headed by the island (group) of origin, is listed in the following format and sequence: museum acronym and registration number, age and sex, kind of specimen (between brackets), collecting date, locality, collector(s) preceded by ‘leg.’, measurements and colour designations [between square brackets].

Collecting sites

Haruku (128° 28’ E; 3° 33’ S) lies about 20 km south of West Seram and 5 km east of the northeast part of Ambon Island in the Moluccan province of Indonesia (Fig. 1). Its surface amounts to 138 km² and the vegetation is mostly secondary with scattered ‘cash-crop’ gardens. The interior consists of a pla-

Table 1  Acronyms used in this article.

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>ear length</td>
</tr>
<tr>
<td>FA</td>
<td>forearm length</td>
</tr>
<tr>
<td>L1MC</td>
<td>length of first metacarpal</td>
</tr>
<tr>
<td>L2MC</td>
<td>length of third metacarpal</td>
</tr>
<tr>
<td>L5MC</td>
<td>length of fifth metacarpal</td>
</tr>
<tr>
<td>T</td>
<td>tail length</td>
</tr>
<tr>
<td>GSL</td>
<td>greatest skull length</td>
</tr>
<tr>
<td>ZW</td>
<td>zygomatic width</td>
</tr>
<tr>
<td>CW</td>
<td>cranium width</td>
</tr>
<tr>
<td>PL</td>
<td>palatal width</td>
</tr>
<tr>
<td>C1i-C1</td>
<td>width of rostrum measured at C1-C1</td>
</tr>
<tr>
<td>C1-P</td>
<td>length of the maxilla between C1 and P</td>
</tr>
<tr>
<td>C1-H1</td>
<td>length of the maxilla between C1 and H1</td>
</tr>
<tr>
<td>C1-M1</td>
<td>length of the mandible between C1 and M1</td>
</tr>
<tr>
<td>HW</td>
<td>intra-orbital width</td>
</tr>
<tr>
<td>PMW</td>
<td>post-orbital width</td>
</tr>
<tr>
<td>ML</td>
<td>mandible length</td>
</tr>
<tr>
<td>RL</td>
<td>rostrum length</td>
</tr>
<tr>
<td>DL</td>
<td>dentary</td>
</tr>
<tr>
<td>V</td>
<td>vertebrae</td>
</tr>
<tr>
<td>WM</td>
<td>wing membrane</td>
</tr>
</tbody>
</table>
Figure 1. The Moluccan and West-Papuan Islands of Indonesia. The islands where specimens described in this article were collected, are coloured black and their names are set in bold typeface. The Tanimbar and Aru islands lie outside the boundaries of this map. [map graphics: Jaap van Leeuwen]
teau which gradually rises to about 600 m (Mount Huruano) in the centre of the island. A single bat was shot in Kailolo, the northernmost village situated along the west coast. Heij (1995) and Heij et al. (1997) give detailed ecological and ethnological information about Kailolo and its surroundings. We could not trace any previous records of mammals from Haruku (e.g. Corbet & Hill 1992; Mickleburgh et al. 1992; Flannery 1995b).

**Kasa** (128° 9' E; 3° 18' S) is located in the mouth of Piru Bay, southwest Seram, Moluccas, Indonesia, at approximately 10 km south of Kaibobo village (Fig. 1). The uninhabited islet measures about 2000 x 150 m. It is totally flat, sandy, fringed by a pristine sandy beach in the east and a coral reef in the west. The interior is grown with shrubbery and high trees (*Casuarina equisetifolia*). On the eastern end there is a steel construction which serves as a ‘lighthouse’ (see: Heij et al. 1997). Mistnetting (for birds) by the second author and C.J. Heij with three stretches of 6 m net, placed in an open area in the island interior, from 25 till 27 October 1994, accidentally yielded one bat, most likely being the first record of a mammal for Kasa (e.g. Corbet & Hill 1992; Mickleburgh et al. 1992; Flannery 1995b).

**Boano** (127° 56' E; 2° 56' S) is situated off the northwest coast of Seram, Moluccas, Indonesia (Fig.1). The island has a surface of 149 km² and is mountainous in the south, southwest and (part of the) northwest, and more or less flat in the north, east and northeast. The mountainous part consists of steep, inaccessible, thinly forested limestone rocks with peaks up to 600 m, and holds more dense secondary forest in depressions such as gorges. The flat areas are grown with alang-alang (*Imperata nucifera*), kajaputi trees (*Melaleuca leucodendron*) and some remnants of primary forest (mainly *Ficus* sp.) The southern and southeastern coastal area is fringed with mangroves. The human population, which relies heavily on the natural resources, is concentrated in two major coastal villages, one in the east and one in the north. For further information we refer to Moeliker & Heij (1995). Bats were accidentally caught in mistnets at two localities. In November 1990 the members of the Boano Expedition 1990(II) captured five specimens in the southern mangroves, and the Boano Expedition 1994 yielded two specimens from a patch of dense secondary forest (the habitat of the endemic passerine bird *Monarcha boanensis*, see Moeliker & Heij 1995, 1996) in the more elevated northwestern part of the island. Apart from a record of *Pteropus melanopogon* listed by Mickleburgh et al. (1992) and Flannery (1995b)*, the mammalian fauna of Boano Island is unknown. The Boano Expedition 1990 reported the presence of another mammalian species: *Cervus timorensis moluccensis*. One was cut into pieces after being hunted by locals and two (a female with calf) were seen swimming while crossing a small bay (C.W. Moeliker & C.J. Heij, pers. comm.). See also Appendix 2.

**Boo Besar** (129° 20' E; 1° 10' S) is the westernmost island of the Boo Island group which is situated in the Halmahera Sea, 100 km ESE of the southern tip of Halmahera, 83 km NNW of the western point of Misool, and 20 km E of the westernmost islet of the Kofiau Islands, Raya Ampat Group, West-

---

* We were able to verify this record in the collection of the National Museum of Natural History, Leiden, by the presence of two skulls, both of males, collected on Boano in 1863 by D.S. Hoedt [RMNH 37878 & 37879, see also Jentink (1887)]. Although Flannery (1995b) listed this record as ‘questionable’, we see no reason to doubt the identification and the labelling: Hoedt was indeed the only collector who worked on Boano in the 19th century (Gijzen 1938; Fransen et al. 1997). Later, the Dutch Geological Seram Expedition visited the island in 1918 (Moeliker & Heij 1995) and by the end of the 20th century only Moeliker & Heij surveyed Boano.
Papua, Indonesia (Fig. 1). This group of ten islands and islets, of which Boo Besar ('Big Boo') is the largest and Boo Kecil ('Little Boo') is second in size, is located on a small bank of less than 200 m depth and covers an area of about 7 km north to south and 20 km east to west (Fig. 2) (Sutherland & Willoughby 1944). Although Mayr (1941), Beehler et al. (1986) and other students of the Papuan (avi)fauna did not mention the Boo Islands as part of the Papuan Region, they did include nearby Kofiau in their works. We therefore may safely assume the Boo Islands to have Papuan affinities as was done likewise for Kofiau, Gebe, Batanta and Waigeo by Mayr (1944) although they do not strictly lie east of the 100 m contour line (Lydekkers line) that separates the Sahul Shelf (which carries the landmass of Australia, New Guinea and some adjacent islands) from Wallacea, the zoogeographical transition area between the Oriental and the Australian faunal provinces (Mayr 1944, but see also De Beaufort 1926; Darlington 1957). From the above it appears that the Boo Islands are the last frontier of the Papuan Region: any other island more to the west belongs to the Wallacean Region. The islands are therefore of particular interest, but - surprisingly because nearby Kofiau was regularly visited by the early collectors (see: Frith & Beehler 1998) - we could find no reference to any previous zoological collecting or surveying (of vertebrates) on the Boo Islands. To the best of our knowledge, only the oceanographic Snellius Expedition visited the Boo Islands on 5 March 1930: 'There was only opportunity for a swift survey of a few of the reef islands. The larger of these appear to be mere rings of sand and shingle around wide mangrove swamps.' (Boschma & Kuenen 1938). Their collecting was limited to 'biological material from the shore and the reefs' (Boschma 1936) and Van Riel (1938) reported 'a few natives, who found a scanty shelter in temporary dwellings there ….' These local inhabitants, although 'known to be murderous' were however peaceful (Kuenen 1941).

The Boo Islands were surveyed by C.J. Heij, J.N.J. Post, K. Tindige and C.W. Moeliker (Waigeo Expedition 2000) from 17 till 20
April 2000. They reported (pers. comm.) the following geomorphological and ecological features. Except for some slightly elevated (<25 m alt.) limestone outcrops along the northern fringe of Boo Besar and the east coast of Boo Kecil, the islands are flat and have sandy beaches bordered by coral reefs and shallow lagoons. All islands appeared to be of atoll formation and the coral edges of the smaller islets are thickly forested. Boo Besar is mostly covered by tall (20-30 m) mangrove forest, although on the somewhat higher coral ridges close to the beach other dense evergreen vegetation occurs. On Boo Kecil the Waigeo Expedition 2000 found some fine rainforest. There are no permanent human settlements, although some scattered sheds and adjacent cultivations of palm trees Cocos nucifera are present on both Boo Besar and Boo Kecil. The Waigeo Expedition 2000, however, did not encounter a single human soul. On one occasion a stretch of 6 m mistnet was left out during night on Boo Besar in a neglected palm tree garden next to the beach and close to extensive mangroves (Fig. 3). This net accidentally yielded one Macroglossine bat which was secured.

Kri (130° 40’ E; 0° 45’ S) is a small island of about 3 x 1 km, just east of the much larger Mansuar Island, situated about 8 km south of Gam Island (which lies just south of Waigeo) in the Dampier Strait, Raja Ampat Island Group, West-Papua, Indonesia (Fig. 1). The island is slightly elevated in the centre (alt. 100 m), is heavily forested and holds a small human population (the staff of a diving camp and some local inhabitants). The members of the Waigeo Expedition 2001 (C.J. Heij, J.N.J. Post & K. Tindige) briefly visited Kri on 5 & 6 March 2001 and found one Pteropodid skull of a specimen that apparently washed ashore and collected two specimens of Rattus tanezumi diardi (NMR 9990-01114 & 01123). We found no references of any other mammal records on this island.

Figure 3  Mangrove forest on Boo Besar, adjacent to the collecting site of Macroglossus minimus boensis subsp. nov. [photo: Waigeo Expedition 2000]
**Wai** (130°36' E; 0° 50' S) is a tiny islet of about 1 x 0.4 km, situated 15 km south of Mansuar Island, halfway between Waigeo Island and Batanta Island in the Dampier Strait, Raja Ampat Island Group, West-Papua, Indonesia (Fig. 1). The islet is flat, sandy and densely grown with shrub and scattered *Pandanus* and *Casuarina* trees. The islet was visited by the Waigeo Expeditions 1999, 2000 & 2001. They noted the presence of a large roost of ‘flying foxes’ in *Casuarina* trees on the eastern end of the island and collected several skulls and decomposed specimens. The Waigeo Expedition 2001 collected one specimen of *Rattus tanezumi diardii* (NMR 9990-01124). No previous published records of mammals on Wai could be traced.

**SYSTEMATIC SPECIES ACCOUNTS**

**PTEROPODIDAE**

**PTEROPODINAE**

*Rousettus amplexicaudatus* (GEOFFREY, 1810)

NMR 9990-00784, adult male (dry skin, skull extracted), 26-X-1994, collected (mistnetted) at 1.50 m from ground level between trees (*Casuarina equisetifolia*), Kasa Island, Piru Bay, Southwest Seram, Moluccas, Indonesia, leg. C.W. Moeliker & C.J. Heij (Boano Expedition 1994).

**MEASUREMENTS AND COLOUR** FA 79.9, T 12.5, E 17.3, GSL 34.7, ZW 20.6; colour: V Drab, D Olive-Brown (hair bases Clay Color), WM Fuscous.

**DISTRIBUTION** The species has a wide distribution from southern Myanmar, the Malayan peninsula, all over the Indonesian archipelago, the Philippines, New-Guinea and eastwards to New Britain and the Solomon Islands (Rookmaaker & Bergmans 1981). This specimen is the first record of *Rousettus amplexicaudatus* (and the first record of a mammal) for Kasa Island (cf. Rookmaaker & Bergmans 1981; Corbett & Hill 1992; Macdonald *et al.* 1993; Flannery 1995b). It is however listed for nearby Seram - most recently collected there in 1987 by the Operation Raleigh expedition (Macdonald *et al.* 1993) - and it is most likely that our specimen originated from that island as Kasa has no caves where *Rousettus amplexicaudatus* - known as a cave dwelling species (Flannery 1995b) - could roost. In Thailand the species is known to commute up to 25 km from roosting caves to foraging areas (Lekagul & McNeely 1977), so a trip of about 10 km between Seram and Kasa should not be much of a problem for this apparently powerful flyer. Nevertheless it is rather strange that our specimen ventured straight out over the sea in search of food (and found a tiny island), while behind him there was the relatively huge and well forested landmass of Seram.

**Pteropus conspicillatus chrysauchen**

**PETER, 1862**

NMR 9990-00982, adult, sex unknown (incomplete cranium only), 19-IV-1999, collected beneath roosting trees (*Casuarina equisetifolia*), Wai Island, south of Mansuar and Waigeo, Dampier Strait, West-Papua, Indonesia, leg. F. Advokaat (Waigeo Expedition 1999). NMR 9990-01112, adult male (incomplete skeleton, complete dry skull, both legs and wings preserved in alcohol); NMR 9990-01116, adult, sex unknown.

DEINSEA 8, 2001

MEASUREMENTS NMR 9990-01112: FA 179.0, 3rdMC 132.0, 5thMC 126.0. Skull measurements of NMR 9990-00982, 01112, 01116 & 01119 are listed in Table 2.

DISTRIBUTION The species is recorded from Halmahera and adjacent islands, Misool, Gebe, Salawati, Batanta, Biak, Yapen, rather locally on New-Guinea, the Louisiade Archipelago and Cape York (Australia) (Corbet & Hill 1992; Flannery 1995a, 1995b).

IDENTIFICATION AND TAXONOMY The cranium NMR 9990-00982 clearly belongs to a rather large sized Pteropus and, referring to the current knowledge of the distribution of the ten or so species occurring in the Moluccan-Papuan region (Flannery 1995a, b), it should be either P. conspicillatus or P. macrotis. However, other species - such as P. chrysoprostus - do occur on islands relatively close to Wai and Kri and could not be ruled out. Therefore the habitus and measurements of the cranium were compared with complete skulls of eight Pteropus taxa of about the same size (Table 2). It appeared to have a strikingly broad rostrum which fitted well within the sizes of P. conspicillatus chrysauen we examined (from Obi, Morotai, Gebe and Misool) and excluded all other species. A skull from Lifondi, Geelvink Bay, New Guinea (RMNH 38020) showed a much longer, more narrow rostrum and is better attributed to the nominate subspecies (Table 2). The members of the Waiego Expeditions 1999, 2000 & 2001 observed a noisy roosting site of 'large dark flying foxes' in tall Casuarina equisetifolia trees on the eastern end of Wai Island (the collecting-site of the single cranium NMR 9990-00982 in 1999). At sunset on 25 and 26 April 2000 they estimated the total number of individuals that left the roosting trees and headed south in a broad front to Batanta at about 20,000. Surprisingly, none were seen to leave Wai in a northerly direction to Waiego (C.W. Moeliker, pers. obs.; C.J. Heij, F. Advokaat & J.N.J. Post, pers. comm.). The incomplete adult specimen 9990-01112, the juvenile specimen 9990-01113 and the cranium 9990-01116 collected about two years later at the same site; undoubtedly belonged to the same taxon (Table 2). Based on these findings, we can state that Wai Island is an important roosting site for a large population of Pteropus conspicillatus which appears to feed on the much larger Batanta Island (and probably also on Salawati). The cranium that washed ashore on nearby Kri island (NMR 9990-01119) could also be identified as P. c. chrysauen and most likely originates from the Wai roosting-population.

Nyctimene cephalotes cephalotes
P.S. PALLAS, 1767

NMR 9990-00742, adult female, pregnant (dry skin, skull extracted, fetus preserved in alcohol 70%), 02-XI-1994; NMR 9990-00743, adult male (dry skin, skull extracted), 03-XI-1994; both mistnetted 1.50 m from ground level in secondary forest, Boano Island, northwest part, altitude 150 m, off northwest Seram, Moluccas, Indonesia, leg. C.W. Moeliker & C.J. Heij (Boano Expedition 1994).

MEASUREMENTS AND COLOUR NMR 9990-00742: FA 62.2, 3rdMC 46.1, 5thMC 43.6,
Table 2. Some cranial measurements in mm. of eight *Pteropus* taxa compared with those of the skulls from Wai and Kri Island. Ranges between brackets.

<table>
<thead>
<tr>
<th></th>
<th>C'1-C'1</th>
<th>C'1-P</th>
<th>PL</th>
<th>GSL</th>
<th>ZW</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P. alecto alecto</em> (RMNH 33643 holotype)</td>
<td>14.0</td>
<td>12.2</td>
<td>35.9</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td><em>P. alecto alterrimus</em> (RMNH 37831)</td>
<td>13.0</td>
<td>12.6</td>
<td>34.4</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td><em>P. centiceps</em></td>
<td>13.0 (12.1-14.1)</td>
<td>11.7 (11.3-12.3)</td>
<td>33.1 (31.6-34.1)</td>
<td>--</td>
<td>--</td>
<td>3</td>
</tr>
<tr>
<td><em>P. hypomelanus</em> (RMNH 33640 syntype)</td>
<td>11.3</td>
<td>11.1</td>
<td>31.3</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td><em>P. macrotis</em> (RMNH 16220)</td>
<td>12.5</td>
<td>11.6</td>
<td>30.7</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td><em>P. chrysopterus</em></td>
<td>13.2 (11.7-14.3)</td>
<td>11.6 (10.9-12.8)</td>
<td>38.3+ (37.1-38.7)</td>
<td>--</td>
<td>--</td>
<td>6 (**)</td>
</tr>
<tr>
<td><em>P. conspicillatus conspicillatus</em> (RMNH 38020)</td>
<td>13.1</td>
<td>12.1</td>
<td>39.2</td>
<td>76.9</td>
<td>38.5</td>
<td>1</td>
</tr>
<tr>
<td><em>P. conspicillatus chrysogenus</em></td>
<td>14.6 (13.0-16.1)</td>
<td>13.8 (12.7-14.9)</td>
<td>38.3+ (36.5-40.9)</td>
<td>76.8**</td>
<td>42.9 (40.2-46.8)</td>
<td>9 (<strong>8)</strong></td>
</tr>
<tr>
<td>NMR 9990-00982</td>
<td>15.0</td>
<td>13.6</td>
<td>37.0</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>NMR 9990-01112</td>
<td>14.4</td>
<td>13.7</td>
<td>38.7</td>
<td>76.7</td>
<td>42.4</td>
<td>1</td>
</tr>
<tr>
<td>NMR 9990-01116</td>
<td>14.9</td>
<td>14.5</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>NMR 9990-01119</td>
<td>14.8</td>
<td>13.7</td>
<td>--</td>
<td>--</td>
<td>45.2</td>
<td>1</td>
</tr>
</tbody>
</table>

DISTRIBUTION AND TAXONOMY Nyctimene cephalotes is known from Sulawesi, Mangole & Sanana (Sula Group), Seram, Ambon, Buru, Timor, Numfoor (Geelvink Bay) and Papua New Guinea, but was not reported earlier from Boano (cf. Goodwin 1979; Corbet & Hill 1992; Mickleburgh et al. 1992; MacDonald et al. 1993; Kitchener et al. 1995; Flannery 1990; Bonaccorso 1998). Flannery (1995a), however, doubts if the specimens from (south) Papua New Guinea belong to N. cephalotes, and Kitchener et al. (1995) showed that the populations from Larat, Selaru & Yamdema (Tanimbar Group), previously considered N. cephalotes, belong to the new taxon N. keasti tozeri. According to Kitchener et al. (1995) the Timor Nyctimene, listed by Andersen (1912) and Goodwin (1979) as N. cephalotes, probably does not belong to that taxon but is more likely closer to N. keasti. The Sulawesian population of N. cephalotes appeared to be subspecifically distinct from the Moluccan population and was named N.c. aplini (Kitchener et al. 1995). These recent reviews make Nyctimene cephalotes essentially a Sulawesian and central Moluccan taxon. As Boano is a satellite island of Seram, we expect the specimens NMR 9990-00742 & 00743 to belong to the nominate subspecies of N. cephalotes, which occurs on Buru, Seram and Ambon. A comparison of the measurements of the Boano specimens with those of specimens from N.c. cephalotes as given by Kitchener et al. (1995, table 1) indeed allocates the Boano specimens to the nominate subspecies.

MACROGLOSSINAE

Syconycteris australis (PETERS, 1867)

NMR 9990-00740, adult female (dry skin, skull extracted [Fig. 4a]); NMR 9990-00741, adult male (dry skin, skull extracted); both collected 24-XI-1990 in the same mistnet at 2 m above ground level between coconut palms (Cocos nucifera) on the edge of mangrove forest, Boano Island (off northwest Seram), along the south coast, 2 km east of Cape Hatoealang (altitude: sea level), Moluccas, Indonesia, leg. C.W. Moeliker & C.J. Heij (Boano Expedition 1990-II). NMR 9990-00785, adult male (dry skin, skull extracted [Fig. 4b], all internal parts preserved in alcohol 70%), 21-X-1994, shot by locals while roosting in a tree (Plumeria acuminata) in the centre of Kailolo village (altitude: sea level), Haruku Island (northwest coast), Moluccas, Indonesia, leg. C.W. Moeliker & C.J. Heij.


DISTRIBUTION Syconycteris australis major is known from the Central-Moluccas (Ambon, Seram) (Corbet & Hill 1992; Mickleburgh et al. 1992; Kitchener et al. 1994; Flannery 1995b), but has not previously been reported from Boano. Corbet & Hill (1992) and Mickleburgh et al. (1992) noted as range: Seram, Ambon, probably Buru and other small islands near Ambon. According to

**Identification and taxonomy** Assigning subspecific identity to these three specimens is a perilous undertaking. Both specimens from Boano have FA and MC sizes that fall neatly between the maximum of *S. a. papuana* and the minimum of *S. a. major*, although the skull measurements are exactly those of *S. a. papuana* (Table 3). As to size, the Haruku specimen is clearly smaller than the smallest *S. a. major* (Table 3), and colouration and structure of the fur is different from any other low-altitude specimen we examined: the specimen is darker, woolly, longer and more densely furred, resembling high altitude specimens of this taxon. More material from Haruku is needed to solve this morphological and taxonomical enigma. As both localities (Boano, Haruku) yielded aberrant specimens, this may indicate more (insular) variation than previously recognised. Kitchener *et al.* (1994), based on new material, stated that the Ambon and Seram populations of *S. australis* are strongly differentiated and may even be recognised as a full species (*S. major*). Our material, although from the same region, strongly differs from *S. (australis) major* and

![Figure 4: Two specimens of *Syconycteris australis*: a. NMR 9990-00740 from Boano; b. NMR 9990-00785 from Haruku (the holes in the left wing membrane are caused by a gunshot). [photo: Hans van Middelkoop]]
may either ask for a reconsideration of the possible specific status of S. major or may warrant the description of new subspecies from Haruku and Boano.

NOTE The high-altitude specimens of S. australis also badly need more attention (Koopman 1982; Ziegler 1982; Hill 1983). Among the comparative material (Appendix 1) we found some extremely dark specimens from Enarotali, Wisselmeren, New-Guinea, alt. 1765 m and other elevated locations in Western New-Guinea that may justify (sub)specific separation (Moeliker & Kompanje, in prep.).

### Macroglossus minimus nanus Matschie, 1899

NMR 9990-00738, adult male (dry skin, skull extracted); NMR 9990-00739, adult female (dry skin, skull extracted [Fig. 5a]); NMR 9990-00844, adult female lactating (dry skin, skull extracted); all three specimens collected 24-XI-1990 in the same mistnet at 1.50 m above ground level between coconut palms (Cocos nucifera) on the edge of mangrove forest, Boano Island (off northwest Seram), along the south coast, 2 km east of Cape Hatoealang (altitude: sea level), Moluccas.

<table>
<thead>
<tr>
<th>Specimen / Sample</th>
<th>GSL</th>
<th>ZV</th>
<th>FA</th>
<th>3rdMC</th>
<th>5thMC</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMR 00740 female Boano</td>
<td>25.5</td>
<td>15.0</td>
<td>44.0</td>
<td>34.1</td>
<td>35.1</td>
<td>n=1</td>
</tr>
<tr>
<td>NMR 00741 male Boano</td>
<td>25.6</td>
<td>14.2</td>
<td>43.2</td>
<td>32.2</td>
<td>32.4</td>
<td>n=1</td>
</tr>
<tr>
<td>NMR 00738 male Haruku</td>
<td>27.4</td>
<td>—</td>
<td>45.0</td>
<td>34.4</td>
<td>—</td>
<td>n=1</td>
</tr>
</tbody>
</table>

Table 3 Cranial and body measurements (in mm) of the Boano and Haruku specimens of Syconycteris australis, compared with those of the types and series of S. a. papuana and S. a. major: [* after Andersen (1912) and Ziegler (1982); ^ sample from Papua New Guinea, Mount Kaindi; ^ sample from Aru and West-New Guinea (Vogelkop, Hollandia, Wisselmeren and Sterrengebergte (see Appendix); * sample from Ambon and Seram from USNM and BMNH; * sample from North-Seram; * sample from North Seram; * sample from Ambon]. In all samples sexes combined.
Indonesia, leg. C.W. Moeliker & C.J. Heij (Boano Expedition 1990-II).

**Measurements and Colour**

NMR 9990-00738: FA 39.1, E 13.1, thumb length (incl. claw) 11.6, 3rdMC 31.2, 5thMC 29.9, GSL 23.9, ZW 14.6. NMR 9990-00739: FA 40.4, thumb length (incl. claw) 10.9, 3rdMC 30.6, 5thMC 30.5, GSL 25.3, ZW 12.6. NMR 9990-00844: FA 37.3, thumb length (incl. claw) 12.9, 3rdMC 28.5, 5thMC 27.6, GSL 23.2, ZW 12.7. See also Table 4, 5 & 6 for additional measurements. The colouration of the wing membranes (WM) of the three specimens is Clay, with that of NMR 9990-00738 marginally darker. The fur of the back (D) is Cinnamon with the hair bases lighter in all three specimens, but in NMR 9990-00738 a little darker. Below (V) all three specimens are coloured very light Cinnamon.

**Distribution and Taxonomy**

Hill (1983) summarised the current knowledge of the taxonomy and distribution of the various subspecies of *M. minimus* and states that *M.m. lagochilus* occurs on the Moluccan Islands and *M.m. nanus* on Kai, Misool, New-Guinea and islands further to the east. Maryanto & Kitchener (1999) added Gag Island (95 km NNE of Boo) to this range and identified the
subspecies as *M. m. lagochilus*. Although known from nearby Seram, the species was not previously reported from Boano Island (Corbet & Hill 1992; Mickleburgh et al. 1992; Flannery 1995b). Geographically, the specimens from Boano should therefore belong to *lagochilus* (type locality is Buru Island, close to Boano [Fig. 1]). However, based on measurements, and following the current taxonomical differentiation of the species (Hill 1983), we have to include the three Boano specimens in *M. m. nanus*. The body measurements (Table 4) are not of diagnostic value. Cranial and dental measurements (Table 5 & 6) however undoubtedly come closer to *nanus* than *lagochilus*. Especially the very narrow teeth and the small molars of the mandible are striking and may even justify subspecific differentiation. The colour of the fur of all three specimens from Boano is lighter than in all *M. minimus* specimens examined.

**Note** Among the material we used for comparison, we found a specimen of *M. minimus* (RMNH 37575, adult male [dry skin, skull extracted], 21/22-X-1985, collected by F.G. Rozendaal on Yamdena Island, Tanimbar Group). This specimen (Fig. 5 b) appears to be the first record of this species for Tanimbar (cf. Mickleburgh et al. 1992; Corbet & Hill 1992; Suyanto et al. 1998). Compared to the known subspecies in the region, the Tanimbar specimen has rather long FA, 3rdMC and 5thMC for inclusion in *M. m. nanus* and comes close to *M. m. lagochilus* (Table 4). Cranial and dental measurements, however, are within the range of *M. m. nanus* (Table 5 & 6). Based on this specimen, we include Tanimbar in the range of *M. m. nanus*, although more material is needed to come to a more definite conclusion.

**Macroglossus minimus booensis** subsp. nov. (Figs. 6, 7, 8 & 9)

**Holotype** Natuurmuseum Rotterdam, reg. nr. NMR 9990-00783, sub-adult, fullgrown, female* (dry skin, skull extracted, all internal parts preserved in alcohol 70%), collected by C.J. Heij, C.W. Moeliker, J.N.J. Post & K. Tindige (Waigeo Expedition 2000) on 18-IV-2000 at 06.00 hour.

**Paratypes** None, only known from the holotype and the type locality.

**Type locality** Boo Besar, Boo Islands, Western Papuan Islands (Raya Ampat group), Papua (formerly called Irian Jaya), Indonesia (129° 22' 10" E; 1° 11' 25" N) (Fig. 2).

**Habitat** Mistnetted 1.50 m from ground level in a neglected coconut palm (*Cocos nucifera*) garden, at sea level, 10 m from the beach and adjacent to extensive tall mangrove-forest (Fig. 3). The specimen was probably attracted by and feeding on the numerous blossoming coconut palms that surrounded the mistnet. The same site also attracted large numbers of the olive honey-eater *Lichmera argentaurus*, an avian nectar feeder.

**Diagnosis** Differs from all currently recognised subspecies of *Macroglossus minimus* (see: Hill 1983) by a strikingly darker colouration of the fur and wing membranes, smaller size of most cranial dimensions, and much smaller P1, P1 and narrower teeth of the lower jaw.

---

* The type specimen, however subadult as judged on the ossification of the skull base structures, has adult proportions and is considered fullgrown. Immature specimens of *M. minimus* are easily recognised in hand and in collections by the rather dull fur and proportionally large feet and 'immature-looking' wings. Pregnancy and developed mammae do occur in subadult females of fruitbats (see e.g. Bergmans 1988). *M. minimus* reaches reproductive maturity at about 10 months from birth (Gunnell et al. 1996).
Figure 6  Type specimen of Macroglossus minimus boensis subsp. nov. (NMR 9990-00783): a ventral view; b dorsal view. [photo: Hans van Middelkoop]
DESCRIPTION

Measurements See Tables 4, 5 & 6.

Ventral pelage Soft and fine; chin and throat sparsely furred with thinly short hairs with an almost naked central region; central chest and abdomen with hairs of medium length, coloured Drab-Grey (with silvery tinged hair tips) gradually darkening towards Ground Cinnamon on the flanks; flanks, humerus and forearm with longer hairs of Fawn Color; uropatagium coloured Raw Umber (Fig. 6 a).

Dorsal pelage Soft and fine; occiput, shoulders and back have hairs of medium length (circa 7 mm), colour Burnt Umber, with the base of the hairs Drab (slightly lighter); sacral region, upper part of tibia and uropatagium with longer hairs with the tips as well as the bases coloured uniform Burnt Umber; humerus and proximal third of forearm with short hairs, coloured uniform Burnt Umber (Fig 6 b).

Wing membranes Coloured uniform Burnt Umber (slightly darker in the area between the 5th digit and the body), inserted on the base of the third phalange at the third toe, not in a straight line but (at a distance of 4 mm from the toe) slightly bulged outward (Fig. 6).

Feet Hairless.

Muzzle Narrow and elongated, pelage soft and fine, colour Burnt Umber with the base of the hairs Drab (slightly lighter); upperlip along the entire length with short white hairs forming a hardly visible moustache; nares directed outward, internarial groove shallow and running to the margin of the lip, lateral grooves present but ill defined (Fig. 7).

Skull Morphologically typical of Macroglossus minimus (see: Andersen 1912)

Teeth and palate Both upper and lower incisors are minute and nonfunctional, with a median gap between the first incisors in both jaws, the canines are well developed with an anterior vertical groove, premolars and molars narrow with very low crowns. The dental formula is: maxilla: I'1, C, P, P', P", M', M"; mandibula I, I, C, P, P, P, P, M, M, M, giving a total of 34 teeth (Fig. 8). Eight undivided palatal ridges, the distal five interdental, sixth and seventh postdental and the eight at the palation proximal ridge (Fig. 9).

Weight Not taken.

Etymology Named after the type locality, the Boo Islands.

Figure 7 Muzzle of the type specimen of Macroglossus minimus booensis subsp. nov. just after it was removed from the net; showing position of nares and morphology of internarial and lateral grooves. [photo: Waigeo Expedition 2000]

Figure 8 Left upper and lower dentition of the type specimen of Macroglossus minimus booensis subsp. nov. in lateral view. [illustration: Jelle W. F. Reumer]
the lateral groove on upper lip is 'as a rule ill defined or even practically absent' (Andersen 1912). In *M.m. booensis* the lateral grooves are present, but ill defined. So, the direction of the nares and the morphology of the internarial groove and lateral grooves are not of differential diagnostic value. Cranial dimensions of *M.m. booensis* are smaller in all measurements (Table 5). Dental measurements of *M.m. booensis* are significantly smaller in both length and width of P\textsuperscript{1}, P\textsuperscript{3}, P\textsubscript{1}, P\textsubscript{3} and M\textsubscript{2}. All other teeth are about equal in length but narrower (Table 6).

**Compared with Macroglossus m. lagochilus**

Differs from this subspecies by strikingly darker colouration of the fur and wing membranes. In *M.m. lagochilus* the nares are directed half outward - half forward (Andersen 1912), in *M.m. booensis* the nares are clearly directed outward (Fig. 7). In *M.m. lagochilus* the internarial groove is sharply defined (Andersen 1912), in *M.m. booensis* it is shallow. In *M.m. lagochilus* the lateral groove on upper lip always well pronounced, sometimes converted into a notch in the margin of the lip (Andersen 1912). In *M.m. booensis* the lateral grooves are present, but ill defined (Fig. 7). Body measurements of *M.m. booensis* fall within the (lower) range of *M.m. lagochilus* (Table 4) and are of no diagnostic value in this comparison. Cranial dimensions of *M.m. booensis* are smaller in all except one measurement (Table 5). Dental measurements of *M.m. booensis* are significantly smaller in both length and width of P\textsuperscript{1}, P\textsuperscript{3}, P\textsubscript{1}, P\textsubscript{3} and M\textsubscript{2}. All other teeth are about equal in length but, again, narrower (Table 6).

**Compared with Macroglossus m. nanus**

Differs from this subspecies by strikingly darker colouration of the fur and wing membranes. Differences in nares, internarial and lateral grooves as in *M.m. lagochilus*. Body measurements of *M.m. booensis* fall within the (lower) range of *M.m. nanus* (Table 4) and are of no diagnostic value in this comparison. Cranial dimensions of *M.m. booensis*
are smaller for GSL, ZW, PL, ML, C1-M1, and equal for IOW, POW and C1-M1\(^3\) (Table 5). Dental measurements of \textit{M. m. booenisis} are significantly smaller in both length and width of \(P^1\) and \(P_1\). All other teeth are about equal in length and width in the upper jaw, but, again, narrower in the lower jaw (Table 6).

Table 4  Body measurements in mm of \textit{M. m. booenisis} subsp. nov. (holotype) compared with minimum and maximum values of \textit{M. m. minimus}, \textit{M. m. lagochilus} and \textit{M. m. nanus}. [\(^1\) after Andersen 1912, p 770; \(^2\) this study, see Appendix 1; \(^3\) specimens NMR 9990-00738, 00739 & 00844 from Boano; \(^4\) RMNH 37575, adult male, new island record; \(^5\) this study, see Appendix 1 (average 41.3 mm, n=10)]

<table>
<thead>
<tr>
<th></th>
<th>M. m. booenisis</th>
<th>M. m. minimus(^2)</th>
<th>M. m. lagochilus</th>
<th>M. m. nanus(^3)</th>
<th>BOANO(^4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FA</td>
<td>38.0</td>
<td>40.6-41.5</td>
<td>38.0-44.5</td>
<td>37.0-49.0</td>
<td>37.1-40.7</td>
</tr>
<tr>
<td>PMC</td>
<td>11.9</td>
<td>11.9</td>
<td>11.9</td>
<td>11.9</td>
<td>11.9</td>
</tr>
<tr>
<td>PMC</td>
<td>28.1</td>
<td>28.5-32.0</td>
<td>27.5-32.0(^1)</td>
<td>27.5-30.5</td>
<td>28.5-32.0</td>
</tr>
<tr>
<td>SPM</td>
<td>29.5</td>
<td>30.0-32.0</td>
<td>29.5-32.1(^1)</td>
<td>28.5-30.5</td>
<td>29.5-31.2</td>
</tr>
<tr>
<td>Ti</td>
<td>14.6</td>
<td>15.0-15.7</td>
<td>15.0-15.7(^1)</td>
<td>15.0-16.0</td>
<td>16.4</td>
</tr>
<tr>
<td>T</td>
<td>1.0</td>
<td>0.0-2.5</td>
<td>0.0-1.0(^1)</td>
<td>0.0-2.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Table 5  Cranial measurements in mm of \textit{M. m. booenisis} subsp. nov. (holotype) compared with minimum and maximum values of \textit{M. m. minimus}, \textit{M. m. lagochilus} and \textit{M. m. nanus}. [\(^1\) after Andersen 1912, p 770; \(^2\) after Rozendaal 1984, table 7; \(^3\) specimens NMR 9990-00738, 00739 & 00844 from Boano, new island record; \(^4\) RMNH 37575 adult male, new island record]

<table>
<thead>
<tr>
<th></th>
<th>M. m. booenisis</th>
<th>M. m. minimus(^2)</th>
<th>M. m. lagochilus</th>
<th>M. m. nanus(^3)</th>
<th>BOANO(^4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSL</td>
<td>23.65</td>
<td>24.8-27.5</td>
<td>24.6-27.2</td>
<td>24.0-30.6</td>
<td>23.15-25.3</td>
</tr>
<tr>
<td>ZW</td>
<td>11.95</td>
<td>12.5-15.8</td>
<td>12.8-15.8</td>
<td>12.5-15.0</td>
<td>12.55-14.30</td>
</tr>
<tr>
<td>PL</td>
<td>10.2</td>
<td>10.8-12.5</td>
<td>10.8-12.5</td>
<td>10.8-11.9</td>
<td>10.8-11.9</td>
</tr>
<tr>
<td>IOW</td>
<td>4.60</td>
<td>4.5-5.2</td>
<td>4.5-5.2</td>
<td>4.3-5.2</td>
<td>4.35-4.75</td>
</tr>
<tr>
<td>POW</td>
<td>6.70</td>
<td>6.8-7.8</td>
<td>6.8-7.7</td>
<td>6.7-7.7</td>
<td>6.8-7.8</td>
</tr>
<tr>
<td>ML</td>
<td>17.37</td>
<td>18.0-20.0</td>
<td>18.3-20.7</td>
<td>17.8-19.0</td>
<td>18.15-18.3</td>
</tr>
<tr>
<td>C1-M</td>
<td>4.15</td>
<td>–</td>
<td>–</td>
<td>4.15</td>
<td>4.52-4.75</td>
</tr>
<tr>
<td>C2-M</td>
<td>8.01</td>
<td>8.2-9.0</td>
<td>8.0-9.2</td>
<td>8.0-9.2</td>
<td>7.5-8.0</td>
</tr>
<tr>
<td>N-M</td>
<td>5.50</td>
<td>–</td>
<td>–</td>
<td>5.50</td>
<td>5.5-5.9</td>
</tr>
<tr>
<td>C-M</td>
<td>8.57</td>
<td>9.0-10.2</td>
<td>9.0-10.5</td>
<td>9.0-9.7</td>
<td>8.50-9.40</td>
</tr>
<tr>
<td>C-M</td>
<td>8.57</td>
<td>9.0-10.2</td>
<td>9.0-10.5</td>
<td>9.0-9.7</td>
<td>8.50-9.40</td>
</tr>
</tbody>
</table>
Table 6  Dental measurements (length x width in mm) of *M.m. booensis* subsp. nov. (holotype) compared with minimum and maximum values of *M.m. minimus*, *M.m. lagochilus* and *M.m. nanus*. [* after Andersen 1912, p 770; *2 after Rozendaal 1984, table 7; *3 specimens NMR 9990-00738, 00739 & 00844 from Boano; *4 RMNH 37575 male, new island record]. The listed values of *M. m. booensis* and the specimens from Boano and Tanimbar are the average of measurements of both left and right dental elements.

ACKNOWLEDGEMENTS

This study would not have been possible without the leading role of dr Cornelis J. Heij in numerous surveys and expeditions in the Moluccan-Papuan region of Indonesia. All material described here was obtained during Heij's surveys (in cooperation with Bogor Agricultural University [IPB], Indonesia) together with the second author, and - during the Waigeo Expeditions 1999, 2000 and 2001, also in the company of mr Johannes N.J. Post, mr Kris Tindige and mr Frans Advokaat (1999). Their efforts and willingness to deposit the material in the Natuurmuseum Rotterdam is greatly acknowledged. We thank dr Wim Bergmans (ZMA) and dr Christiaan Smeenk (RMNH) for allowing us to study the collections under their care. Dr Wim Bergmans provided essential literature and critically read the manuscript. Dr Jelle W.F. Reumer (Natuurhistorisch Museum Rotterdam) kindly took the dental measurements listed in Table 6 and produced Figure 8. Mr Jacobus H. van Leeuwen (Natuurhistorisch Museum Rotterdam) produced the maps and mr Hans van Middelkoop photographed the specimens. Mrs Shirley Herst improved our English. The Topografische Dienst, Emmen and the Koninklijk Instituut voor de Tropen (KIT), Amsterdam supplied maps of the study areas. The second author personally thanks dr Heij for allowing him to visit the Moluccas in the early nineties and for inviting him to join the Waigeo Expedition 2000.

REFERENCES


Anonymus, 2001 - Long-lost bird raises its head - Science 291 [5512]: 2309


Bergmans, W., 1988 - Taxonomy and biogeography of African fruit bats (Mammalia, Megachiroptera) 1. General introduction and methods; results: the genus *Eptomophorus* Bennett, 1836 - Beaufortia 38: 75-146

Bergmans, W. & Rozendaal, F.G., 1988 - Notes on collections of fruit bats from Sulawesi and some off-lying islands (Mammalia, Megachiroptera) - Zoologische Verhandelingen 248: 3-74


Moeliker, C.W. & Kompanje, E.J.O., in prep. - Taxonomical implications of morphological variation in high- and low-altitude populations of Syconycteris australis -

Rookmaaker, L.C. & Bergmans, W., 1981 - Taxonomy and geography of Rousettus amplexicaudatus (Geoffrey, 1810) with comparative notes on sympatric congeners (Mammalia, Megachiroptera) - Beaufortia 31: 1-29

Rozendaal, F.G., 1984 - Notes on macroglossine bats from Sulawesi and the Moluccas, Indonesia, with the description of a new species of Syconycteris


Sutherland, R.K. & Willoughby, C.A., 1944 - Terrain study No. 79 Area study of Radja Ampat Group - Allied Geographical Section, Southwest Pacific Area

Suyanto, A., Yoneda, M., Maryanto, I., Maharadatkamsi, & Sugardjito, J., 1998 - Checklist of the Mammals of Indonesia - Lipi, Jica, Bogor


received 09 May 2001
APPENDIX 1  Comparative material examined

*Rousettus a. amplexicaudatus* (Geoffrey, 1810)

**SERAM:** RMNH 38116 (Cat. Jentink 1888, p.151), adult female (mounted skin, skull in situ), Seram. Leg. E.A. Forsten. **AMBON:** RMNH 28119, adult female (skin in alcohol, skull extracted), 00-V-1922, Ambon, leg. H. Kopstein [FA 75.3]. **HALMAHERA:** RMNH 37612, adult male, 37613, adult female (both complete in alcohol), 31-07/01-08-1985, Akelamo-Jenama, Halmahera, leg. F.G. Rozendaal [FA 78.6 (37612), 71.8 (37613)]. RMNH 37607 adult male, 37608 adult female, 37609 adult male, 37610 adult female, 37611 adult female, (all complete in alcohol), 7/8-VIII-1985, Akelamo, Halmahera, leg. F.G. Rozendaal [FA 71.6, 69.6, 68.9, 70.7, 70.9 respectively]. **BACAN:** RMNH 37614, 37615, 37616, 37617, 37618, all adult females (complete in alcohol), 7/10-VII-1985, Wayana, Bacan, leg. F.G. Rozendaal [FA 86.8, 84.0, 75.4, 75.0, 83.9 respectively]. **TANIMBAR:** RMNH 37604, 37605, 37606, all adult females (complete in alcohol), 7/8-X-1985, Loloulung, Tanimbar Island, leg. F.G. Rozendaal [FA 78.3, 80.4, 79.6 respectively]. **NEW GUINEA:** RMNH 37372 adult male, 37373 adult female (both complete in alcohol), 7 & 28-X-1961, Hollandia, New Guinea [FA 88.8 male, 73.1 female].

*Pteropus alecto alecto* Temminck, 1837

**SULAWESI:** RMNH 33643, holotype (skull only), Menado, Sulawesi. Leg. E.A. Forsten [C1-C1 14.0, C-P 12.2, PL 35.9].

*Pteropus alecto alterrimus* Matschie, 1899

**KANGEAN:** RMNH 37831, male (skull only), Kangean, Bawean. Leg. P. Diard [C1-C1 13.0, C-P 12.6, PL 34.4].

*Pteropus caniceps* Gray, 1870

**TERNATE:** RMNH 33641, (skull only), Ternate, Leg. E.A. Forsten [C1-C1 14.1, C-P 11.5, PL 33.7]. **HALMAHERA:** RMNH 37747, male (skull only), 27-XI-1862, Halmahera, Leg. H.A. Bernstein [C1-C1 12.1, C-P 11.3, PL 31.6]. **MOROTAI:** RMNH 37748, male (skull only), 1862, Morotai, Leg. H.A. Bernstein [C1-C1 12.9, C-P 12.3, PL 34.1].

*Pteropus chrysoproctus* Temminck, 1837

**AMBON:** RMNH 37986, female (skull only), 1828, Ambon, Leg. S. Muller & H.C. Macklot [C1-C1 13.2, C-P 11.7, PL 38.7]; RMNH 37980, female (skull only), 28-IX-1863, Ambon, Leg. D.S. Hoedt [C1-C1 11.7, C-P 10.9, PL 37.1]. **SERAM:** RMNH 37994, female (skull only), 4-IV-1863, Seram, leg. D.S. Hoedt [C1-C1 13.1, C-P 11.9, PL 38.5]. **KOFLAU:** RMNH 38000, female (skull only), 27-VIII-1867, Koflau, Leg. D.S. Hoedt [C1-C1 13.3, C-P 11.0]. **PANDJANG:** RMNH 37997, male (skull only), 1865, Pulau Panjang, leg. C.B.H. von Rosenberg [C1-C1 13.4, C-P 11.4, PL 38.7]. **GORAM:** RMNH 37998, male (skull only), 24-IX-1865, Goram, leg. C.B.H. von Rosenberg [C1-C1 14.3, C-P 12.8, PL --].

*Pteropus conspicillatus conspicillatus* Gould, 1850

**NEW GUINEA:** RMNH 38020, female (skull only), 18-IX-1903, Mios Lifondi, Geelvink Bay, leg. Exp. Wichman [C1-C1 13.1, C-P 12.1, GSL 76.9, ZW 38.5, PL 39.2].
**Pteropus conspicillatus chrysauchen Peters, 1862**

**Morotai**: RMNH 37779, male (skull only), 1862, Morotai, leg. H.A. Bernstein [C1-C1 16.1, C1-P 14.9, ZW 46.8, PL 36.5]; RMNH 37781, male (skull only), 1862, Morotai, leg. H.A. Bernstein [C1-C1 15.2, C1-P 14.2, GSL 76.8, ZW 43.1, PL 37.2]; RMNH 37782, male (skull only), 1862, Morotai, leg. H.A. Bernstein [C1-C1 14.5, C1-P 13.7, ZW 43.7, PL 40.3]; RMNH 37780, male (skull only), 1862, Morotai, leg. H.A. Bernstein [C1-C1 15.0, C1-P 14.5, PL 37.8].

**Obi**: RMNH 37770, subadult male (skull only), Obi, leg. H.A. Bernstein [C1-C1 13.5, C1-P 12.7, PL 38.9, ZW 37.7]; RMNH 37769, adult female (skull only), Obi, leg. H.A. Bernstein [C1-C1 13.9, PL 37.1, ZW 40.6].

**Misool**: RMNH 37787, subadult male (skull only), 6-VIII-1867, Waigamma, Misool, leg. D.S. Hoedt [C1-C1 12.8, C1-P 12.5, PL --]; RMNH 37785, male (skull only), 1862, Kasim, Misool, leg. D.S. Hoedt [C1-C1 15.3, C1-P 13.6, PL --].

**Gebe**: RMNH 37777, male (skull only), 25-II-1863, leg. H.A. Bernstein [C1-C1 15.0, C1-P 13.8, ZW 43.4, PL 37.6]; RMNH 37777, male (skull only), 25-II-1863, Gebe, leg. H.A. Bernstein [C1-C1 13.8, C1-P 13.5, PL 40.9, ZW 40.3]; RMNH 37774, male (skull only), 25-II-1863, Gebe, leg. H.A. Bernstein [C1-C1 13.0, C1-P 13.2, PL 36.8, ZW 40.2].

**Pteropus hypomelanus Temminck, 1853**

**Ternate**: RMNH 33640, male, syntype (skull only), Ternate, leg. E.A. Forsten [C1-C1 11.3, C-P 11.1, PL 31.2].

**Pteropus macrotis epularius Ramsay, 1878**

**New Guinea**: RMNH 16220, male (skull only), 12-XII-1957, south of Lake Sentani, south of Hollandia, leg. P.H. Bool [C1-C1 12.5, C1-P 11.1, PL 30.7].

**Nyctimene keasti tozeri Kitchener, 1995**

**Yamdena**: RMNH 37585 female, 37586 male, 37587 female, 37588 female, 37589 female, 37590 male, 37591 male, 37593 female, 37594 male, 37596 female, 37597 female, 37598 male, 37600 female, 37601 female, 37602 female, (all adults, complete in alcohol), 16 & 20-IX-1985, 6 km NW of Bomaki, Yamdena, Tanimbar Islands, leg. F.G. Rozendaal [FA 59.3, 59.6, 57.9, 59.9, 60.6, 58.6, 62.3, 60.7, 60.4, 62.2, 60.6, 60.9, 58.8, 59.9 respectively].

**Macroglossus minimus minimus Geoffrey, 1810**

**Java**: RMNH 14749, juvenile female (dry skin, skull extracted), 4-V-1933, Parbawat, Gunung Pangrango, W-Java, collection Bartels [GSL 22.1, V Cinnamon/Cream Colour, D Clay Colour]; RMNH 14690, adult male (dry skin, skull extracted), 12-V-1936, Goedik, Central Java, collection Bartels [FA 41.7, E 13.5, GSL 24.4]; RMNH (unregistered), adult male (complete in alcohol), 00-IX-1977, Bogor, Java, leg. P.H. van Doesburg [FA 44.9, 3rdMC 34.1, 5thMC 34.8].

**Nias (off Sumatra)**: RMNH 27795 adult female (complete in alcohol), 8-V-1908, Nias Island, leg. E.E.W.G. Schröder [FA 38.8, 3rdMC 27.7, 5thMC 29.2, TI 15.4, E 10.4].

**Macroglossus minimus lagochilus Matschie, 1899**


**Sanghi**: RMNH 35672, female, lactating (dry skin, skull extracted), 00-V-1985, Gunung Sahendaruman, Sangihe Island, leg. F.G. Rozendaal [FA 40.1, 3rdMC 30.4, 5thMC
31.3, GSL 25.1, ZW 13.7, V Drab (lighter), D Cinnamon, WM Cinnamon-Brown]; RMNH 35676, adult female (dry skin, skull extracted), 00-V-1985, Gunung Sahendaruman, Sangihe Island, leg. F.G. Rozendaal (FGR 389) [FA 42.3, GSL 25.2, ZW 13.1]; RMNH 35673, adult male (complete in alcohol), 00-V-1985, Gunung Sahendaruman, Sangihe Island, leg. F.G. Rozendaal [FA 42.4, 3rdMC 31.3, 5thMC 30.4]; RMNH 35674, adult male (complete in alcohol), 00-V-1985, Gunung Sahendaruman, Sangihe Island, leg. F.G. Rozendaal [FA 41.0, 3rdMC 31.7, 5thMC 31.5]; RMNH 35675, adult female (complete in alcohol), 00-V-1985, Gunung Sahendaruman, Sangihe Island, leg. F.G. Rozendaal [FA 39.6, 3rdMC 29.2, 5thMC 27.4]; RMNH 35677, adult male (complete in alcohol), 00-V-1985, Gunung Sahendaruman, Sangihe Island, leg. F.G. Rozendaal [FA 42.8, 3rdMC 32.4, 5thMC 32.6]; RMNH 35678, adult male (complete in alcohol), 00-V-1985, Gunung Sahendaruman, Sangihe Island, leg. F.G. Rozendaal [FA 44.0, 3rdMC 34.3, 5thMC 34.4]; RMHN 35679, adult male (complete in alcohol), 00-V-1985, Gunung Sahendaruman, Sangihe Island, leg. F.G. Rozendaal [FA 42.8, 3rdMC 32.3, 5thMC 33.0].

**Macroglossus minimus nanus** MATSCHIE, 1899


**Syconycteris australis papuana** MATSCHIE, 1899

**NEW GUINEA:** RMNH 36717, adult female, gravida (skin in alcohol, skull extracted), 00-XII-1961, Kota Radja, Hollandia, New Guinea, leg. L.W. Quate [FA 41.6, 3rdMC 31.0, 5thMC 30.7, GSL 25.4, ZW 15.0, V Drab (tinged Salmon Color), D Clay Color, WM Clay Color]; RMNH 24377, adult male (dry skin, skull extracted), 25-I-1962,


Syconycteris australis major Andersen, 1911


KOMPANJE & MOELIKER: fruit bats from the Moluccas and West-Papua
APPENDIX 2 An unidentified fruitbat from Boano Island

An unidentified medium-sized fruitbat (probably Dobsonia sp.), 24-XI-1990, mistnetted on Boano Island, south coast, 2 km east of Cape Hatoealang (altitude: sea level), Moluccas, Indonesia. The bat was released after the picture was taken. [photo: C.J. Heij]