

A new species of bandicoot, *Microperoryctes aplini*, from western New Guinea

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Abstract

A distinctive new striped bandicoot of the genus *Microperoryctes* (*M. aplini* new species) is described and compared with *Microperoryctes murina*, another little-known bandicoot with which the new species has been confused in the past. The smallest of all living bandicoots, *M. aplini* is apparently restricted to high-elevation forests in the Arfak Mountains of the Vogelkop Peninsula of western New Guinea. The similarly small *M. murina* is known only from high-elevation forests on Gunung Sumuri, a peak in the Weyland Range of western New Guinea. The two species differ markedly in fur colour and ornamentation, pelage texture, external proportions, and quantitative and qualitative craniodental aspects, and may not be immediately related to one another.

Key words: *Microperoryctes*, bandicoot, taxonomy, New Guinea

INTRODUCTION

The mouse bandicoots (genus *Microperoryctes*) are a group of small-bodied, ground-dwelling marsupials endemic to forested highlands in the Central Ranges of New Guinea. Most species are light brown to reddish-brown, attractively ornamented with a black dorsal stripe, and, in some species, with facial and rump stripes. One species of the genus, *M. murina*, differs from all others in its inornate, smoky-grey pelage, which is soft and woolly like that of many shrews and moles. This unusual bandicoot is the smallest of all described bandicoots, with a total length of < 300 mm. It is a rare species, known only by the type series of three specimens from the Weyland range of western New Guinea. Four additional specimens of another very small, striped bandicoot (in museums on four different continents) were studied, all of which originated from the Arfak Mountains of western New Guinea. Although these latter specimens have been tentatively identified in museum collections and in literature as *M. murina* (almost entirely on the basis of their very small size), it has been recognized for some time that they differ substantially from the type series of that species (see collective discussion by Ziegler, 1977; George & Maynes, 1990; Groves & Flannery, 1990; Menzies, 1991; Flannery, 1995; Aplin, 1998; Aplin, Pasveer & Boles, 1999; Aplin explicitly referred to the Arfak pygmy bandicoot as 'a potentially distinct species'). In this report the

taxonomic content of the genus *Microperoryctes* is briefly reviewed before describing the Arfak pygmy bandicoot as a new species.

MATERIALS AND METHODS

Specimens discussed here are deposited in the collections of the Bernice P. Bishop Museum in Honolulu (BBM), the Museum für Naturkunde in Berlin (ZMB), the Museum Zoologicum Bogoriense in Cibinong, Indonesia (MZB), the Papua New Guinea National Museum and Art Gallery in Port Moresby (PNGM), the American Museum of Natural History in New York (AMNH), and the Australian Museum in Sydney (AM). External measurements were recorded by the original collectors in the field. Craniodental variables were measured by the first author with hand-held callipers to the nearest 0.01 mm (rounded here to 0.1 mm). External variables are abbreviated as follows: head and body length (HB), tail length (TV), hindfoot length (HF), ear length (E).

SYSTEMATICS

Order Peramelemorphia Kirsch, 1968

Family Peramelidae Gray, 1825

Subfamily Echymiperinae McKenna & Bell, 1997

Comments: Familial and subfamilial classification follows Groves (in press).

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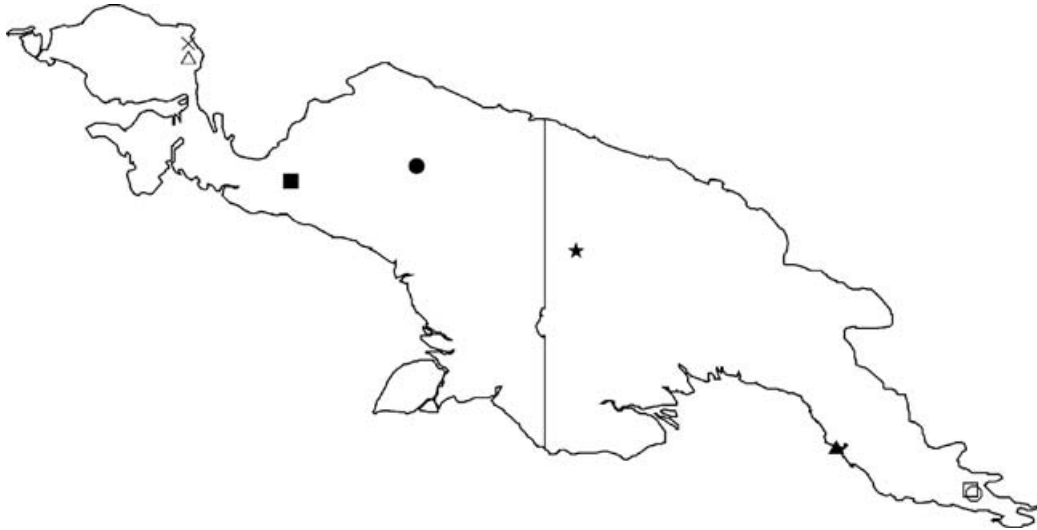


Fig. 1. Map of New Guinea, with important localities mentioned in text. X, Hatam, Arfak Mountains, type locality of *Microperoryctes longicauda*; Δ, Lake Anggi Giji, Arfak Mountains, type locality of *Microperoryctes aplini*; ■, Gunung Sumuri, Weyland Range, type locality of *Microperoryctes murina*; ●, Doormanpad-bivak, Mamberamo Basin, type locality of *M. l. dorsalis*; ★, Star Mountains region, site of apparent overlap between *M. longicauda* and *M. ornata*; ▲, mouth of Aroa River, near type locality of *Microperoryctes ornata*; □, Mount Mura, Owen Stanley Range, type locality of *Microperoryctes papuensis*; ○, Mount Simpson, Owen Stanley Range, type locality of *M. ornata magna*.

Genus *Microperoryctes* Stein, 1932
(type species *Microperoryctes murina* Stein, 1932)

Synonyms

Ornoryctes Tate & Archbold, 1937 (type species *Peroryctes longicauda* Peters & Doria, 1876 [= *Microperoryctes longicauda*]); considered here a valid subgenus (see below).

Diagnosis

The genus *Microperoryctes* was originally erected by Stein (1932) to reflect the diminutive size and unusual pelage characteristics of a then newly discovered bandicoot *Microperoryctes murina* from the Weyland range of the western Central Cordillera of New Guinea. *Microperoryctes murina* is unique among bandicoots in its very small size and its dark and woolly pelage, and most subsequent workers followed Stein and maintained *Microperoryctes* as a monotypic genus (Tate & Archbold, 1937; Tate, 1948; Laurie & Hill, 1954; George & Maynes, 1990). More recently, based on cladistic considerations, Groves & Flannery (1990) united the striped bandicoots of the subgenus *Ornoryctes* under the genus *Microperoryctes* rather than *Peroryctes* (where they have traditionally been placed) and provided revised diagnoses of the resultant redefined genera. According to Groves & Flannery (1990), among the bandicoots, species of *Microperoryctes* (including *Ornoryctes*) can be diagnosed by a unique combination of derived characters: a broadened braincase, a deeply wavy coronal suture, two pairs of palatal

vacuities, with the posterior palatal vacuities extending from P³ to M² or M³ (dental terminology following Lockett, 1993), and straight (rather than bracket-shaped) posterior palatal margins. This revised diagnosis is accepted here. The species of *Microperoryctes* also share a relatively small body size, a relatively long tail (generally > 60% of head and body length), small ears and granular foot pads.

Distribution

All species of the genus *Microperoryctes* are endemic to higher altitude forests (above 1000 m) in the mountain ranges along the Central Cordillera of New Guinea, from Mt Simpson in the far south-eastern Owen Stanley Range (Milne Bay Province, Papua New Guinea) to the mountain ranges of the Vogelkop Peninsula in the north-east (Fig. 1; Flannery, 1995). Aplin, Pasveer & Boles (1999) suggested that *M. longicauda* may occur at elevations lower than 1000 m in the Vogelkop Peninsula based on its presence in upper levels excavated from Kria Cave in the Ayamaru Lakes region, a lowland site. The genus is conspicuously absent from the north coast ranges of northern New Guinea (e.g. the Cyclops, Torricelli and Bewani ranges) and is also unrecorded from the Huon Peninsula, although hunters interviewed by the first author in the Finisterre Range on the Huon universally claim familiarity with an animal similar to *Microperoryctes ornata*.

Each species of *Microperoryctes* is (or is probably) sympatric with one or more congeners in all or some part of its range (see below).

Table 1. Selected external attributes of the species of *Microperoryctes*. Measurements (mm) for *M. longicauda* and *M. ornata* are taken from series at BBM and AMNH. Measurements for *M. papuensis* are taken from Flannery (1995)

	<i>murina</i>	<i>aplina</i>	<i>longicauda</i>	<i>ornata</i>	<i>papuensis</i>
Dorsal stripe	Absent	Present	Variable	Present	Present
Lateral rump stripes	Absent	Absent	Absent/faint	Present	Present
White tail-tip	Absent	Present	Present	Present	Present
Head-body length	152–174	142–160	250–290	239–303	175–205
Tail length	105–111	115–120	160–205	161–258	142–158
<i>n</i> for measurements	2	3	30	73	7

Content

There are five valid species of *Microperoryctes*: *M. murina* Stein, 1932; *M. longicauda* (Peters & Doria, 1876); *M. ornata* (Thomas, 1904); *M. papuensis* (Laurie, 1952); *M. aplina* new species (Fig. 1, Table 1).

Until now, only three species have generally been recognized within the genus *Microperoryctes* (Groves, 1993; Flannery, 1995). This traditional scheme is modified here by describing *M. aplina* as a new species distinct from *M. murina*, and by recognizing both *M. longicauda* and *M. ornata*, previously considered conspecific, as two separate biological species. *Microperoryctes longicauda* has traditionally been divided into three or four subspecies that are thought to form a stepped cline in coloration from west to east (see Tate, 1948; Laurie, 1952; George & Maynes, 1990; Flannery, 1995; Westerman, Springer & Krajewski, 2001; Groves, 2005). These are *M. l. longicauda* of the Vogelkop Peninsula, which lacks a dorsal stripe and rump stripes; *M. l. dorsalis* of the western Central Cordillera (from the Weyland Range to the Strickland River), which generally possesses a moderately pronounced dorsal stripe but lacks rump stripes; and *M. l. ornata* and *M. l. magna* of east-central and south-eastern New Guinea, respectively, which are boldly patterned with a dorsal stripe and lateral rump stripes.

Overall external differences are quite striking between the boldly patterned eastern ‘races’ (*ornata* and *magna*) on the one hand and the weakly patterned western ‘races’ (*longicauda* and *dorsalis*) on the other, and here we note that the two overlap without apparent introgression in the Star Mountains of central New Guinea (Fig. 1), as shown by extensive series of *Microperoryctes* at BBM collected by A. B. Mirza (a point preliminarily noted by Flannery, 1995: 113–114). The BBM series demonstrates that in the Star Mountains region, *ornata* occurs in mid-elevation rainforest and moss forest from *c.* 1400 to 2600 m (see also Flannery & Seri, 1990: 179), while *dorsalis* occurs in higher-elevation moss forests and in subalpine grassland at 3100 m and above (elsewhere in New Guinea where these two forms do not co-exist, each has an elevational range from roughly 1000 to 4000 m; see Tate, 1951: 328–329). The two do not generally differ in overall size and standard external proportions across most of their largely allopatric ranges (see Table 1). However, in the Star Mountains (their area of overlap), series of *dorsalis* have relatively

Table 2. External measurements (mm) for series of *Microperoryctes ornata* and *M. longicauda dorsalis* from the Star Mountains (specimens at AM and BBM). HB, head-body length; TV, tail length; E, ear length; HF, hindfoot length

	<i>ornata</i>	<i>dorsalis</i>
HB	253.8 ± 15.29 232–276 (<i>n</i> = 8)	266.8 ± 11.13 250–290 (<i>n</i> = 11)
TV	183.4 ± 7.80 174–198 (<i>n</i> = 8)	167.7 ± 8.62 156–183 (<i>n</i> = 11)
E	25.1 ± 1.81 22–27 (<i>n</i> = 8)	30.4 ± 0.67 29–31 (<i>n</i> = 11)
HF	58.2 ± 3.27 53–64 (<i>n</i> = 8)	60.1 ± 2.39 57–65 (<i>n</i> = 11)

much shorter tails and longer ears compared to series of *ornata* from lower elevations (Table 2), as well as more elongate rostra, thicker pelage, darker dorsal coloration, a less well-defined dorsal stripe, no lateral rump stripes, and grey-based rather than pure white belly fur. (Interestingly, the Seltaman people of Western Province, Papua New Guinea, may have different names for these taxa; see Whitehead (2000).) Thus *ornata* and *dorsalis* apparently displace one another altitudinally but do not introgress where their ranges overlap along the New Guinean Central Cordillera. This sympatric (if not syntopic) occurrence suggests that two biological species should be recognized within the previous taxonomic boundaries of *Microperoryctes longicauda*. These are *M. longicauda* (Peters & Doria, 1876) (with *M. l. dorsalis* [Thomas, 1922] as a subspecies), occurring on the Vogelkop Peninsula (*M. l. longicauda*) and along the Central Cordillera from the Weyland range to the Star Mountains (*M. l. dorsalis*), and *M. ornata* (Thomas, 1904) (with *magna* [Laurie, 1952] as a subspecies), occurring along most of the eastern Central Cordillera (*M. l. ornata*) and in the Agaun area and on Mt Simpson in far south-eastern Papua New Guinea (*M. l. magna*). However, phylogeographic patterns within *M. ornata* are probably more complicated than current taxonomy suggests (Laurie, 1952; Westerman *et al.*, 2001: 99; K. M. Helgen, pers. obs.).

Only the two pygmy species of the genus are reviewed in further detail below, in the context of describing a new pygmy species of *Microperoryctes*.

Microperoryctes murina* Stein, 1932**Type material and type locality***

The holotype of *murina* is ZMB 44229, adult male, skin and skull, from Gunung Sumuri, 2500 m, Weyland Mountains, west-central New Guinea (Papua Province, Indonesia), collected 31 August 1931 by G. Stein. There are only two other known specimens, both collected by Stein at the type locality: AMNH 103262, young adult, probably female (the sex of this specimen is given as female by Stein (1932) and as possibly male by Tate & Archbold (1937)), collected 27 August 1931; and ZMB 91462, immature female, skin and skull, collected 3 September 1931.

Diagnosis

Microperoryctes murina can be immediately distinguished from all other species of bandicoots by its combination of extremely small body size (head and body length 152–174 mm) and unpatterned, smoky-grey, very soft pelage (reminiscent of many shrews). The scrotum is furry and greyish-white.

Distribution

Microperoryctes murina has been recorded to date only from the type locality (Fig. 1).

Discussion

Almost nothing is known about the basic biology of *M. murina*, although Tate & Archbold (1937) suggested that it is probably 'highly fossorial'. Its woolly, soft, shrew-like pelage is unique among bandicoots and suggests a lifestyle convergent on insectivorous or vermivorous shrews and shrew-mice, small mammals that occupy highland forests elsewhere in south-east Asia and Melanesia (cf. Musser, 1982; Flannery, 1995). (Little is known of the feeding habits of other species of *Microperoryctes*, but most bandicoots are thought to be omnivorous; see Flannery, 1995; Hume, 1999: 82.) Given its extremely limited known distribution (montane forest on Gunung Sumuri), *M. murina* may be vulnerable to extinction.

The Weyland Range has been well-surveyed for mammals thanks to efforts by collectors during the middle decades of the 20th century. Especially notable collections from these mountains were amassed in the 1930s by the collectors G. Stein (series at ZMB and AMNH) and F. Shaw-Mayer (series at the Natural History Museum, London). In addition to *Microperoryctes murina*, several additional mammal species are apparently endemic to the Weyland range. These include the distinctive murine *Macruromys elegans* Stein, 1933 and a mosaic-tailed rat, *Paramelomys steini* (Rümmler, 1935). *Macruromys*

elegans (the lesser small-toothed rat) is known only by the type series of four individuals collected between 1400 and 1800 m on Gunung Kunupi in October 1931 (at ZMB and AMNH, see Tate, 1951; Flannery, 1995), and *Paramelomys steini* (Stein's paramelomys) is known only by the type series collected from 2000 to 2600 m on Gunung Sumuri (see Menzies, 1996; Musser & Carleton, in press). Interestingly, all three endemic mammal species of the Weylands are restricted to Mts Kunupi and Sumuri, and do not extend to the Gebroeders region, another well-surveyed area of the range.

Microperoryctes aplini* new species**Holotype***

BBM 22457, young adult male, study skin (figured by Flannery, 1995: 116) and skull (Fig. 2), from Kampong Sururai, Lake Anggi Giji (01°23'S, 133°58'E), 6200 ft (= 1890 m), Arfak Mountains, eastern Vogelkop Peninsula, western New Guinea (Papua Province, Indonesia), collected 2 March 1963 by M. C. Thompson.

Paratypes

ZMB 40293, unsexed subadult skull, from Koffo (01°25'S, 133°52'E), Lake Anggi Giji, 2000 m, Arfak Mountains, collected 13 June 1928 by E. Mayr. PNGM 25375, adult male, study skin, skull, and body in alcohol, from 'Arfak Mountains', 2200 m, collected 21 September 1986 by I. Craven.

Referred specimen

MZB 2951, adult male, skin only, collected in 1928 by E. Mayr in 'Netherlands New Guinea' (i.e. Papua Province, Indonesia). The locality written on the tag in script seems to be 'Liwi' or 'Siwi'; probably Siwi, 01°29'S, 134°02'E.

Diagnosis

Microperoryctes aplini can be immediately distinguished from all other species of bandicoots by its combination of extremely small body size (head and body length < 160 mm; total length ≪ 300 mm) and sleek brown dorsal fur with a well-pronounced dorsal stripe. It is probably the smallest known species of bandicoot, similar in size only to *M. murina* of the Weyland range (see above).

Distribution

Microperoryctes aplini has been recorded to date only from the Arfak Mountains of the Vogelkop Peninsula of western New Guinea in a narrow elevational band between 1890 and 2200 m (Fig. 1). Remains of *M. aplini* have not

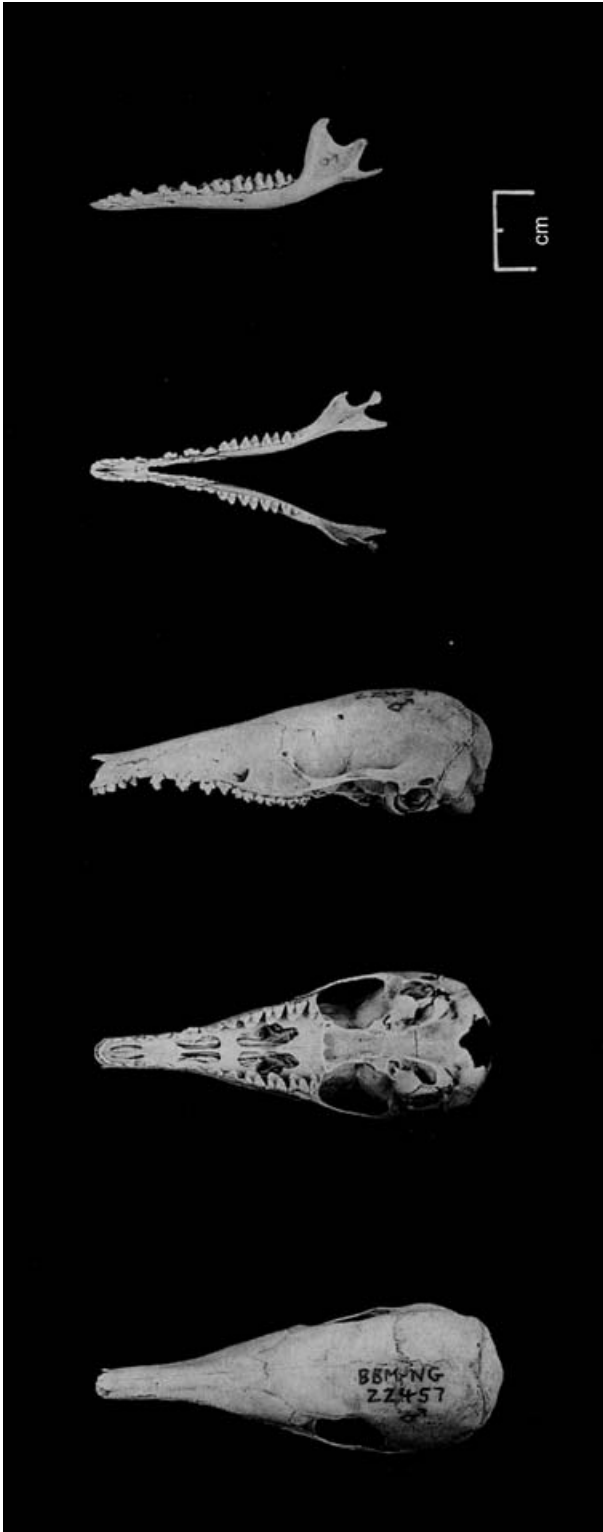


Fig. 2. Skull of BBM 22457, holotype of *Microperoryctes aplini*.

been recovered in extensive Quaternary mammal deposits from Kria and Toe Caves in the Ayamaru Lakes area of the central Vogelkop (Aplin *et al.*, 1999). Likewise, the species is not represented in large lots of trophy material collected in a hunting camp situated in moss forest at 2500 m in the Mokwam area in the Arfaks by T. Flannery

in 1992 (specimens at AM) or in the notable collection of mammals from the Arfaks made by F. Shaw-Mayer in the 1920s, deposited in the Natural History Museum, London. Both museum specimens of *M. aplini* bearing a definite locality originated from the vicinity of Lake Anggi Giji; thus the distribution of this species may be restricted to the vicinity of this highland lake. A label on the holotype notes that it was collected in 'forest', and the collector of the holotype also secured specimens of *Phascolosorex dorsalis* and *Melomys cf. mollis* in the immediate vicinity of the type locality.

Etymology

Named for the zoologist Ken Aplin, to recognize his studies of Australasian vertebrates in general and Vogelkop biogeography in particular. We recommend 'Arfak pygmy bandicoot' as an appropriate common name.

Description

Microperoryctes aplini is a very small bandicoot with sleek, light-brown dorsal fur with grey bases, a relatively wide and moderately pronounced dark stripe extending from crown to rump along the mid-dorsum, and a relatively long tail with a short but distinct white tail-tip (about one-sixth the length of the tail). The tail is dorsoventrally bicoloured (brown above and white below), the venter is grey-brown with a mid-ventral creamy-white stripe, and the claws are long and slender. Superficially *M. aplini* resembles a dwarf version of the other small species of *Microperoryctes* with a prominent dorsal stripe (*M. papuensis* of south-eastern New Guinea) except that it lacks the distinctive lateral rump stripes of that species.

In *M. aplini*, the length of the head and body averages shorter than in the similarly tiny bandicoot *M. murina* (Table 3). However, the tail of *M. aplini* is longer than that of *M. murina*, both absolutely (Table 3) and relative to head and body length (74–83% of HB in *M. aplini* vs 64–69% in *M. murina*). No weights are available for either *M. aplini* or *M. murina*, but both probably weigh < 100 g as adults (see Flannery, 1995: 105).

Table 3. External dimensions (mm) of the pygmy bandicoots *M. aplini* and *M. murina*. Values for MZB 2951 are measured from the study skin by the first author and should be considered approximate. HB, head–body length; TV, tail length; E, ear length; HF, hindfoot length

		HB	TV	HF	E
<i>Microperoryctes aplini</i>					
UPNG 25375	Young adult ♂	142	115	33	20
BBM 22457	Young adult ♂	145	120	38	22
MZB 2951	Adult ♂	160	118	33	–
<i>Microperoryctes murina</i>					
ZMB 44229	Adult ♂	174	111	34	23
AMNH 103262	Young adult ♀	152	105	31	21

Table 4. Selected skull measurements (mm) for *Microperoryctes aplini* and *M. murina*

	<i>aplini</i>		<i>murina</i>	
	UPNG 25375	BBM 22457	ZMB 44229	AMNH 103262
Greatest length of skull	43.2	41.7	45.6	42.4
Condylbasal length	41.1	39.5	44.0	40.2
Zygomatic width	16.8	15.3	16.4	15.6
Nasal length	17.5	17.1	19.2	17.8
Coronoid height of mandible	8.9	7.9	8.8	8.0
Greatest length of mandible	32.3	30.3	34.3	31.1

Although sample sizes are small for both species, currently available series suggest that while *M. aplini* and *M. murina* do not differ from one another in overall skull length, *M. aplini* has shorter nasals (Table 4) and slightly larger molars than *M. murina* (Fig. 3).

In addition to differences in coloration, pelage texture, and external and craniodental proportions, *M. aplini* differs from *M. murina* in some notable qualitative cranial features. For example, the position and size of the incisive and anterior palatal foramina differ characteristically between the two species (Fig. 3). In *M. aplini*, the incisive foramina extend posteriorly to or just beyond the posterior alveolus of I²; in *M. murina* they extend well behind this tooth. In *M. aplini* the anterior palatal foramina are more expansive than in *M. murina*, extending anteriorly only as far as P¹ in *M. murina* but well in front of this tooth in *M. aplini*. In fact, in *M. aplini* the anterior palatal foramina are relatively more expansive and elongate than in any other member of the genus *Microperoryctes*. In dorsal view the occiput of the cranium of both *M. aplini* and *M. murina* appears rounded and convex rather than

concave with the lateral margins protruding, as in most bandicoots.

In other qualitative aspects *M. aplini* agrees closely with the other four species of *Microperoryctes* (as revised and reviewed by Groves & Flannery, 1990), which, despite their occurrence in overlapping sympatry across the island of New Guinea, are very similar to each other in most qualitative craniodental characters (Tate, 1948; Laurie, 1952; Groves & Flannery, 1990).

Discussion

Almost nothing is yet known about the basic biology of *M. aplini*, although Ziegler (1977) suggested that it is subfossorial. Given its extremely limited known distribution (the vicinity of Lake Anggi Giji), it should certainly be considered vulnerable to extinction.

The Vogelkop Peninsula (or 'Bird's Head' of New Guinea) is a notable centre of endemism for vertebrates (see Aplin, 1998). In addition to *Microperoryctes aplini*, several other mammal species are endemic to the Arfaks, including the pseudocheirids *Pseudochirops coronatus* and *Pseudochirulus schlegeli* (Flannery, 1994, 1995) the murine *Stenomys arfakiensis* (see Musser & Carleton, 2004), and undescribed species of the murine genera *Malomys* and *Leptomys* (K. M. Helgen, pers. obs.). A number of other mammals are endemic to the greater Vogelkop region (some including the Arfaks); these include the petaurid *Dactylopsila kambuayai* and the pseudocheirid *Petauroides ayamaruensis* (both of which remain known only by Holocene subfossil remains from the Ayamaru Lakes area; see Aplin *et al.*, 1999), the tree-kangaroo *Dendrolagus ursinus*, and a number of distinctive endemic subspecies, including a dasyure *Phascosorex dorsalis dorsalis*, a wallaby *Dorcopsis muelleri muelleri*, and two

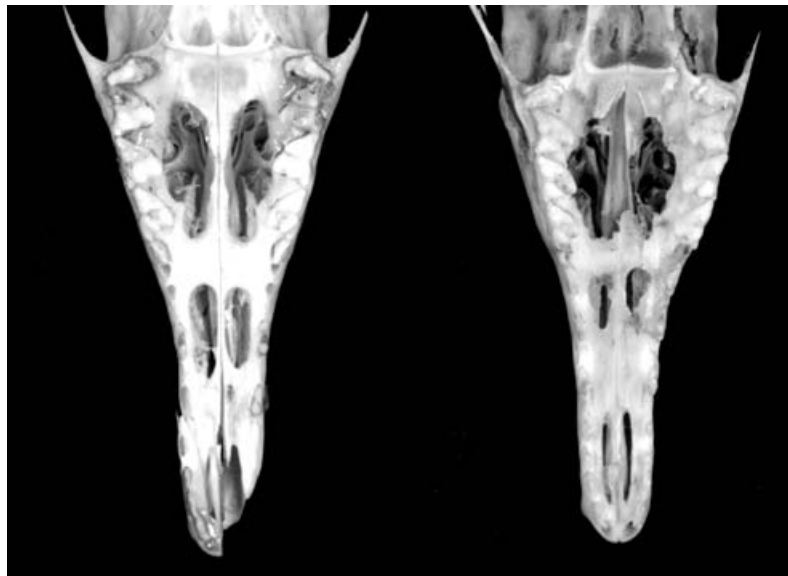


Fig. 3. Conformation of palatal foramina in *Microperoryctes aplini* (left, ZMB 40293, unsexed sub-adult) and *M. murina* (right, ZMB 91462, sub-adult female). Specimens of similar dental development.

ringtails *Pseudochirops albertisii albertisii* and *Pseudochirulus canescens bernsteini*.

In addition to *Microperoryctes aplini*, a larger congener, *M. longicauda*, also occurs on the Vogelkop Peninsula, including the Arfak Mountains (Peters & Doria, 1876; Flannery, 1995), where the two species probably occur syntopically. Judging from modern and fossil collection localities (Flannery, 1995; Aplin *et al.*, 1999), *M. longicauda* is both more common and more widespread on the Vogelkop than *M. aplini*. Species of *Microperoryctes* also occur in sympatry in other mountain ranges of New Guinea, such as throughout south-eastern New Guinea (where *M. ornata* and *M. papuensis* co-occur; see Aplin & Woolley, 1993) and in the Star Mountains of western Papua New Guinea (where both *M. ornata* and *M. longicauda* apparently occur, see above). *Microperoryctes longicauda* and *M. murina* both occur in the Weyland Range of western New Guinea, but have yet to be collected at the same locality.

Microperoryctes aplini shares several derived traits with *M. longicauda*, *M. ornata*, and *M. papuensis*, including a relatively long tail (generally > 70% of head and body length), a white tail tip, and a dorsal stripe (the last of which is variably pronounced in *M. longicauda*). These features are absent in both *M. murina* and in the Melanesian and Wallacean bandicoot genera *Echymipera*, *Rhynchomeles* and *Peroryctes*, all or some of which are closely related to *Microperoryctes* (cf. Groves & Flannery, 1990; Westerman *et al.*, 2001), as well as in all or most of the remaining, less closely related bandicoots (the dry-country, mostly Australian genera *Isoodon* and *Perameles* as well as the more distantly related genera *Macrotis* and *Chaeropus*). Based on this suite of synapomorphic external characters, and despite its previous classification within *M. murina*, *M. aplini* is probably best arranged with *M. longicauda*, *M. ornata*, and *M. papuensis* in the subgenus *Ornoryctes* (see above), while *M. murina* can be retained alone in the subgenus *Microperoryctes* to reflect its more plesiomorphic external features relative to its congeners.

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REFERENCES

- Aplin, K. P. (1998). Vertebrate zoogeography of the Bird's Head of Irian Jaya, Indonesia. In *Perspectives on the Bird's Head of Irian Jaya, Indonesia*: 803–890. Miedema, J., Odé, C. & Dam, R. A. C. (Eds). Amsterdam: Rodopi.
- Aplin, K. P., Pasveer, J. M. & Boles, W. E. (1999). Late Quaternary vertebrates from the Bird's Head Peninsula, Irian Jaya, Indonesia, including descriptions of two previously unknown marsupial species. *Rec. West. Aust. Mus. Suppl.* **57**: 351–387.
- Aplin, K. P. & Woolley, P. A. (1993). Notes on the distribution and reproduction of the Papuan bandicoot *Microperoryctes papuensis* (Peroryctidae, Peramelemorphia). *Sci. New Guinea* **19**: 109–112.
- Flannery, T. F. (1994). *Possums of the world: a monograph of the Phalangeroidea*. Sydney: GEO Productions.
- Flannery, T. F. (1995). *Mammals of New Guinea*. Revised edn. Ithaca, NY: Cornell University Press.
- Flannery, T. F. & Seri, L. (1990). The mammals of southern West Sepik Province, Papua New Guinea: their distribution, abundance, human use, and zoogeography. *Rec. Aust. Mus.* **42**: 173–208.
- George, G. G. & Maynes, G. M. (1990). Status of New Guinea bandicoots. In *Bandicoots and bilbies*: 93–105. Seebeck, J. H., Brown, P. R., Wallis, R. L. & Kemper, C. M. (Eds). Norton, New South Wales: Surrey Beatty.
- Groves, C. P. (1993). Order Peramelemorphia. In *Mammal species of the world: a taxonomic and geographic reference*: 39–42. 2nd edn. Wilson, D. E. & Reeder, D. R. (Eds). Washington, DC: Smithsonian Institution Press.
- Groves, C. P. (in press). Order Peramelemorphia. In *Mammal species of the world: a taxonomic and geographic reference*. 3rd edn. Wilson, D. E. & Reeder, D. R. (Eds). Washington, DC: Smithsonian Institution Press.
- Groves, C. P. & Flannery, T. F. (1990). Revision of the families and genera of bandicoots. In *Bandicoots and bilbies*: 1–11. Seebeck, J. H., Brown, P. R., Wallis, R. L. & Kemper, C. M. (Eds). Norton, New South Wales: Surrey Beatty.
- Hume, I. D. (1999). *Marsupial nutrition*. Cambridge: Cambridge University Press.
- Jelsma, J. (1998). Room with a view. An excavation in Toe Cave, Ayamaru district, Bird's Head, Irian Jaya. *Mod. Quatern. Res. SE Asia* **15**: 41–65.
- Laurie, E. M. O. (1952). Mammals collected by Mr. Shaw Mayer in New Guinea 1932–1949. *Bull. Br. Mus. (nat. Hist.) Zool.* **1**: 271–318.
- Laurie, E. M. O. & Hill, J. E. (1954). *List of land mammals of New Guinea, Celebes, and adjacent islands, 1758–1952*. London: British Museum (Natural History).
- Luckett, W. P. (1993). An ontogenetic assessment of dental homologies in therian mammals. In *Mammal phylogeny* **1**: 182–204. Szalay, F. S., Novacek, M. J. & McKenna, M. C. (Eds). New York: Springer-Verlag.
- Menzies, J. I. (1991). *A handbook of New Guinea marsupials and monotremes*. Madang, Papua New Guinea: Kristen Press.
- Menzies, J. I. (1996). A systematic revision of *Melomys* (Rodentia: Muridae) of New Guinea. *Aust. J. Zool.* **44**: 367–426.
- Musser, G. G. (1982). Results of the Archbold Expeditions. No. 110. *Crunomys* and the small-bodied shrew rats native to the Philippine islands and Sulawesi (Celebes). *Bull. Am. Mus. nat. Hist.* **174**: 1–95.
- Musser, G. G. & Carleton, M. D. (in press). Family Muridae. In *Mammal species of the world: a taxonomic and geographic reference*. 3rd edn. Wilson, D. E. & Reeder, D. R. (Eds). Washington, D.C.: Smithsonian Institution Press.
- Peters, W. & Doria, G. (1876). Diagnosi di tre nuove specie de Mammiferi della Nuova Guinea e di Salawatti. *Ann. Mus. Civ. Stor. Nat. Genova* **8**: 335–336.

- Rümmler, H. (1935). Neue Muridae aus Neuguinea. *Z. Säugetierkd.* **10**: 105–118.
- Stein, G. (1932). Eine neue Beuteltiere aus Neuguinea. *Z. Säugetierkd.* **7**: 254–257.
- Stein, G. (1933). Weitere Mitteilungen zur Systematik papuanischer Säuger. *Z. Säugetierkd.* **8**: 87–95.
- Tate, G. H. H. (1948). Results of the Archbold Expeditions. No. 60. Studies in the Peramelidae (Marsupialia). *Bull. Am. Mus. nat. Hist.* **92**: 313–346.
- Tate, G. H. H. (1951). Results of the Archbold Expeditions. No. 65. The rodents of Australia and New Guinea. *Bull. Am. Mus. nat. Hist.* **97**: 183–430.
- Tate, G. H. H. & Archbold, R. (1937). Results of the Archbold Expeditions. No. 16. Some marsupials of New Guinea and Celebes. *Bull. Am. Mus. nat. Hist.* **68**: 331–467.
- Thomas, O. (1904). Exhibition of specimens and descriptions of new species of mammals from New Guinea. *Proc. zool. Soc. Lond.* **2**: 196–202.
- Thomas, O. (1922). On mammals from New Guinea obtained by Dutch Scientific Expeditions of recent years. *Nova Guinea* **13**: 723–740.
- Westerman, M., Springer, M. S. & Krajewski, C. (2001). Molecular relationships of the New Guinean bandicoot genera *Microperoryctes* and *Echymipera* (Marsupialia: Peramelina). *J. mamm. Evol.* **8**: 93–105.
- Whitehead, H. (2000). *Food rules: hunting, sharing, and tabooing game in Papua New Guinea*. Ann Arbor: University of Michigan Press.
- Ziegler, A. C. (1977). Evolution of New Guinea's marsupial fauna in response to a forested environment. In *The biology of marsupials*: 117–138. Stonehouse, B. & Gilmore, D. (Eds). London: Macmillan.