On a Collection of Mammals from the Lowlands and Islands of North Borneo

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In the "Bulletin of the Raffles Museum, No. 4 (December 1930, pp. 1 – 112) we gave an account of the birds which we obtained during a visit in 1927 to British North Borneo and the islands off its north coast. In this paper we deal with the mammals collected on the same occasion. The following is taken from the introductory remarks to our report on the birds: —

"We were collecting in North Borneo from 9th July to 20th September, 1927. Our main stations on the mainland were a point on the Samawang River, about twenty-five miles west by north of Sandakan; and Bettotan, about twenty-two miles west by south of Sandakan.

The bulk of the collection was made at Bettotan in heavy forest. A few skins were also collected at Kudat and at a point a few miles up the Bengkoka River, opposite to Kudat on the other side of Marudu Bay.

The three islands visited, Mallewallé, Banguey and Balambangan,* are situated off the northern extremity of Borneo. They lie outside the ten-fathom contour line, but on a bank of less than twenty fathoms which also contains the Mangsi Islands and Reefs about twelve miles north of Banguey. Deeper sea separates all these islands from Balabac Island.

Between Banguey and Borneo is a short narrow basin running east and west more than 20 fathoms deep: on the west a few soundings in it are shown up to forty-five fathoms and in the east up to twenty-seven fathoms.

Mallewallé Island (8th – 9th September) is a small island six miles by four lying seven miles from the coast of Borneo.

Banguey Island (31st August – 8th September) measures about ten miles by fifteen and lies about eight miles from Borneo. Our collecting ground was at the southern extremity opposite the small Patanunan Island. The highest point on the island is 1,870 feet.

Balambangan Island (9th – 14th September) is a low, flat island measuring fifteen by five miles but very indented. It lies three miles from Banguey and thirteen from the Bornean coast. The collecting ground was near the site of the settlement of the old East India Company on the south-east coast which was destroyed by pirates in 1775.

*The older, more familiar spelling is used; but Malawali and Banggai are better.

In 1928 a collection was made by one of us in the south-west part of British North Borneo at Rayoh in the 'gorge' of the Padas River which runs into Brunei Bay. Rayoh lies between the better-known townlets of Beaufort and Tenom. The Padas River runs here mostly between forested steep hills, but the altitude from which the specimens came is not great, certainly much less than 1,000 feet."

We have proposed only one new form for the Bornean mainland but have based several on animals of the little islands bordering the north coast: on the other hand we are unable to recognise several names proposed for animals from both areas. Our opinion that *Pygathrix everetti* (Thos.) is the female of *Pygathrix hosei* (Thos.) may be of interest. C. Boden Kloss.

SYSTEMATIC

Martes flavigula saba subsp. nov. North Borneo.

Tragulus javanicus banguei subsp. nov. Banguey Id.

Ratufa affinis banguei subsp. nov. Banguey Id.

Sciurus prevosti caedis subsp. nov. Balambangan Id.

Sciurus notatus malawali subsp. nov. Mallewallé Id.

Rattus cremoriventer malawali subsp. nov. Mallewallé Id.

Rattus rattus banguei subsp. nov. Banguey Id.

Tupaia minor caedis subsp. nov. Balambangan Id.

Tupaia tana banguei subsp. nov. Banguey Id.

PRIMATES

Hylobates moloch* funereus Geoffr.

Hylobates funereus Geoffr. Comp. Rend., xxxi, 1850, p. 874 (North-eastern Borneo); Cat. Meth. Mammif., 1851, p. 7, footnote (Island of Sulu); Elliot, Rev. Prim. iii, 1913, p. 174 (Sulu Id.?).

Hylobates lar mülleri, Pocock (part.), P. Z. S. 1927, p. 728.

Hylobates cinereus funereus, Kloss, P. Z. S. 1929, p. 121.

Bettotan: 3 ♂, 3 ♀. Rayoh: 1 ♂, 2 ♀.

The Bornean Gibbon in general and the specimens before us in detail have been discussed at length by Kloss (l. c. s.).

(For measurements *see* page 50).

**Vide* Cabrera, P. Z. S., 1930, p. 257

Pygathrix rubicunda rubicunda (Müller).

Semnopithecus rubicundus Müll., Tijdsch. Nat. Gesch. Phys., v, 1838, p. 137, pl. (South-eastern Borneo); Müll. and Schl., Verh. Nat. Gesch. Ned. Bezitt., 1839–44, Zool., pp. 61 and 69, Tab. 9, fig. 1, 2, 3 and 4; Tab. 11, fig. 1; Schlegel, Mus. Pays-Bas, vii, 1876, p. 36; Forbes, Handb. Prim., ii, 1894, p. 128; Jentink, Notes Leyd. Mus., xix, 1897, p. 36.

Pygathrix rubicunda rubicunda, Lyon, Proc. U. S. Nat. Mus., 40, 1911, p. 138.

Pygathrix rubicunda (part.) Elliot, Rev. Prim., iii, 1913, p. 35.

Presbytis rubicunda rubicunda, Gyld., Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 8.

Bettotan: 6 ♂, 4 ♀.

This common lowland monkey seems to be a distinct species confined to Borneo with Karimata Island, off its south-west coast.

The two other reddish langurs found in Malaysia, *melalophos* and *cruciger*, are separated from *rubicunda* by fundamental differences in the arrangement of the hair on the top of the head.

P. rubicunda is unique in that the hair on the forehead is arranged in a radiating manner: on the crown there is a vertical bushy crest or tuft which is confluent with long recumbent hair on the occiput.[1] In *melalophos* of Sumatra the hair on the forehead and occiput grows in a normal manner but there is a median vertical, somewhat compressed crest on the crown. *P. cruciger* of Borneo is quite different from either. It has a distinctly compressed median crest, running the whole length of the head from brow to occiput.

Contrary to his usual practice Elliot boldly lumped animals from all parts of Borneo under the earliest name, relegating *ignita*[2] Dollman, of Sarawak, and *rubida*[3] Lyon, of south-western Borneo, to the synonomy of *rubicunda*. In regard to the first of these, at least, his action cannot be upheld.

The ten specimens from North Borneo have been compared with seventeen from Sarawak and the two series are distinct. Those from the North have the hands and feet largely black whereas in the Sarawak series the extremities are concolorous with the limbs, or only slightly darkened owing to an admixture of a few black hairs. With the possible exception of a female from Baram in

1. The colouring of Müller and Schlegel's plate (l. c. s.) is very good and it also shews well the peculiar whorl of hair on the forehead but the upright tuft on the crown is not drawn and none of our large series has the occipital crest quite so pronounced: The separate drawing of the head (Tab. 9, fig. 2) is accurate.

2. Ann. Mag. Nat. Hist. ser. 8, 4, 1909, p. 204, Mt. Mulu, North Sarawak, 1,000 ft.

3. Proc. U. S. Nat. Mus., 40, 1911, p. 139, Hills at mouth of Kendawangan River near the S. W. point of Borneo.

North Sarawak the provenance of all the specimens can be determined by these characters.

In detail the Bettotan specimens may be said to have the digits black or mixed rufous and black, the latter colour predominating: the metacarpus and metatarsus variable but always blackened, sometimes excessively so; and the wrists and ankles more rufous than black.

In the Sarawak skins the hands and feet may be perfectly concolorous with the limbs: the digits may be yellowish and therefore even paler than the limb; or again there may be, exceptionally, a slight darkening of hands and feet due to black or black-tipped hairs.

Excluding the hands and feet the North Bornean skins are very uniform and what variation there is seems entirely individual and chiefly in the depth of the colour. Even three animals in which the last molar is not fully erupted seem in no way separable from adults. The outer sides of the limbs are rather darker and a trifle more richly coloured than the remaining upper parts. The underparts and inner sides of the limbs are paler. The forehead is often like the limbs and therefore rather darker than the crown. The tail is always mixed with black. Worn pelage is characterised by the presence of whitish hairs on the upper parts and such skins have a very faintly grizzled and relative slightly lighter appearance. If the figure given by Müller and Schlegel on Tab. II, fig. 1, is accurate it would appear that, unlike some langurs, the juvenile of this species has no characteristic colour pattern but is merely paler than the adult. The maximum variation in general colour is exhibited by the Sarawak series which is larger than that from North Borneo and furthermore contains specimens taken at more than one season: the extremes, as shewn by specimens from Baram, are so different that we feel thoroughly sceptical about any difference in the general tone of the pelage being of racial value in Borneo. From Sarawak we have skins that are both lighter and darker than any from Bettotan and the palest skins are peculiar in that the long hairs on the occiput are paler than the back, thus forming an ill-defined cap. Like the feet the tail is often uniformly coloured and unmixed with black.

The type locality of *rubicunda* is south-eastern Borneo. The individuals figured, which are the types, came from Mt. Sakoembang (or Sekoempong) which is south-east of Banjermassin in the peninsula Tana Laoet. Elliot states that the presumed type has the hands and feet like the body but darker, caused by the presence of black hairs, as if these members were turning to that colour. This is supposed to be the specimen figured by Müller and Schlegel although our copy of their work depicts a uniformly reddish-brown monkey and it is so described by Schlegel (t. c. s., p. 35). Anderson agrees that the feet of the type are sullied with black. Lyon has examined specimens, from the neighbourhood of Balik Papan in

south-east Borneo and he describes them as darker than any other available Bornean specimens and the hands and feet with a more distinct tendency to be suffused with blackish.

In the absence of exact topotypes we regard the series from North Borneo as *r. rubicunda* and recognize *ignita* for the pale-footed Sarawak animals.

The colours of this monkey are exceptionally difficult to describe. We consider that the darker areas of the pelage are in the range maroon, claret brown and morocco red and that the paler parts are covered by chestnut and mahogany red to burnt sienna (Ridgway: Colour Standards).

Elliot examined a series of topotypes of *ignita* from Mt. Mulu and said that the dark hue characteristic of typical *rubicunda* and light red answering to typical *ignita* were both present. It is a little unfortunate that *ignita* was based on a specimen from the north of Sarawak where there is a certain amount of intergradation between the two forms but as stated above, we are doubtful of the value of any variation in the general colour. The main facts seem clear: dark-footed animals occur in the eastern half of Borneo and pale-footed animals in the western parts of the island.

Lyon considers that the latter are divisible but we have no topotypes of *rubida* and cannot give an opinion.

The range of typical *rubicunda* must now be considered as extending from Banjermassin through the east of Borneo, and into the territory of British North Borneo. Animals from Baram are *ignita* and specimens from Mt. Murud, North Sarawak, are also said to have no black on the feet.

Excluding those of *carimatæ*[1] the various cranial characters attributed to the proposed forms of this species seem of very doubtful diagnostic value. The contour of the fore-part of the cranium varies in animals of similar sex and age. The dome-shaped forehead is most marked in young skulls and unless typical *rubicunda* has a most remarkably depressed cranium this character cannot be used to define *ignita*.

Excluding those of immature animals we should say that the skulls before us have the outer edge of the posterior zygomatic root separated from the outer mastoid edge by a distinct space. The skull of *rubicunda* is very like that of *melalophos* but that of *cruciger* is quite distinct.

"Face and ears slaty blue or slaty: upper lip and chin brownish grey."

Mr. E. Banks has recently put forward the opinion[2] that the black and red Bornean langur *P. cruciger* is the result of interbreeding between the black species *P. chrysomelas* and the red

1. *Presbytis carimatae*, Miller, Proc. U. S. Nat. Mus., XXXI, 1906, p. 65, Karimata Id., S. W. Borneo.

2. Proc. Zool. Soc., 1930, p. 693.

species *P. rubicundus*. We agree with him that *P. cruciger* is not a "good" species but think that it is a mutation or "sport" of *chrysomelas* and not a hybrid. *P. rubicundus* is also of course not purely a mountain species: it certainly does occur high up on the hills but it is also found commonly at sea level and is, in fact, the common lowland monkey of the territory of British North Borneo.

(For measurements *see* page 51).

Pygathrix hosei (Thos.).

Semnopithecus hosei, Thomas, Proc. Zool. Soc., 1889, p. 159, plate xvi (Baram District, N. Sarawak); Hose, Mamm. Borneo. 1893, p. 10; Forbes, Handb. Primates, II, 1894, p. 117, plate xxxv.

Semnopithecus everetti, Thomas, Proc. Zool. Soc., 1892, p. 582, plate xli (Mt. Kinabalu, N. Borneo, 3,500 ft.); Hose, Mamm. Borneo, 1893, p. 15; Forbes, Handb. Primates, II, 1894, p. 120, pl. xxiv.

Pygathrix everetti, Elliot, Rev. Prim., III, 1913, p. 63.

Pygathrix hosei, Elliot, Rev. Prim., III, 1913, p. 64.

Presbytis hosei hosei, Gyld., Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 9.

Rayoh: 4 ♂, 2 ♀.

It is curious that "*everetti*" has retained an independent status for so long for it is certainly only the female of *hosei*. The occurrence of sexually dimorphic animals in the genus is somewhat remarkable.

The characters of the sexes have been well described and figured in the original references but it should be noted that the cream colour of the pale areas in "*everetti*" is adventitious.[1] In males the black on the head starts with the crest, that is about half an inch from the brow. The dark colour (it is sometimes more grey than black) spreads back over the crown but never embraces the ears: in young males there is a broad white band between the ear and the black cap. On the nape the dark area narrows considerably and in one specimen there is a practically complete white collar round the neck.

Thomas' plate shows the distribution of black on the hands and feet very well. Sometimes the white on the inner side of the forelimb runs rather nearer to the wrist than the specimen he has figured.

In females the dark cap is much more extensive. It covers the whole of the top of the head, excluding a small isolated white patch on the forehead, sometimes embraces the ears and then narrows down on the nape (but generally less than in males) where

1. The plate given by Forbes (l. c. s.) is clearly copied, although slightly altered from Thomas' original plate; but the pale areas are yellow!

it passes insensibly into the grey of the upperparts. Sometimes the white frontal patch is continued backwards as a grizzled tract in the direction of the ears. Such a specimen occasioned Gyldenstolpe's statement that *everetti* differed from *hosei* in having a blackish stripe running from the eye to the ear. There are no other sexual differences in colour.

It follows that the supposed difference in the habitat of "*everetti*" and *hosei* must now fall: the former has hitherto been considered a submontane form. The species is a lowland one ranging, like many other mammals, up to a height of 3,000 – 4,000 feet on the mountains of its habitat.

Gyldenstolpe's statement that *hosei* seems to be generally distributed throughout the whole island needs confirmation. We only know of it from Mt. Kinabalu in the north, to about the latitude of the Baram River in the west and across to the Boeloengan River (Lat. 3° N.) in the east. North of this area another form is found (*P. sabana*) and we can trace no record of *hosei* or "*everetti*" from west and south Borneo.

The very young juvenile of this monkey is largely white: the outer sides of the limbs greyish and the feet and hands blackish. There is a large isolated blackish area on the top of the head. A dark, almost black, dorsal stripe starts on the shoulders or upper back and is continuous with the wholly dark blackish grey tail. A narrow black "eyebrow" is present.

The only sexed baby we have seen is a male and the only young female examined (considerably older, however, than the juvenile described above) is like the adult male in colour pattern.

Two older females either not quite normal or perhaps immature (skulls not seen) are like the male in colour pattern but there is a black streak connecting the narrow black eyebrow with the crown. Young males are like adults but have even rather less black on the head. It therefore seems probable that the juveniles of both sexes are similar and that females, when immature, pass through a phase in which they are very like the adult male. We have examined twenty-four skins of this monkey.

(For measurements *see* page 51).

Pygathrix sabana (Thos.).

Semnopithecus sabanus, Thomas, Ann. Mag. Nat. Hist. (6), xii, 1893, p. 230, pl. vii (Paitan, N. Borneo); Forbes, Handb. Primates, ii, 1894, p. 116.

Pygathrix sabana, Elliot, Rev. Prim., iii, 1913, p. 63.

Bettotan: 1 ♀.

The specimen before us is the first recorded female of this rare monkey and nothing has been added to our knowledge of the

species since Thomas published his very complete original description based on two males obtained by A. Everett at "Paitan" in North Borneo.[1]

The skin from Bettotan agrees with the original description in all respects excepting the colour pattern on the top of the head; but the sexes of *sabana* are no doubt different as is the case with *hosei*.

In the female the top of the head is grey and uniform with the back. There is an ill-defined darker tract between the orbit and the ear and a small blackish patch on the occiput at the posterior termination of the crest. The narrow, median grey crest commences almost at the brow and, practically, consists only of a tuft of forwardly directly hairs. (In the male the colour-pattern on the head seems to be more decided and approaching that of *P. thomasi*: there are large whitish patches on the crown on each side of the black crest).

In the flesh this monkey had the face and chin pale brownish flesh in colour with a black patch on each side of the nose originating from a point between the orbit and the base of the nose, widening out over the inner parts of the cheeks and terminating on a line parallel to and just short of the upper lip.

Additional measurements taken in the flesh but not included in the table on page 51 are:—nose to toe 1,035 mm.; span of arms 930 mm. Compared with the skulls of two adult females of *hosei* we find that the brain-case of *sabana* is neither broader nor rounder: it is in fact distinctly narrower and in one case decidedly less rounded. The supposed differences in the degree of prognathism and in the profile of the face are individual and not specific characters and the particular arrangement of the facial bones ascribed to *sabana* is also found in *hosei*.

The only tangible differences we can see between our skull of *sabana* and some of *hosei* is that the former is relatively narrower and has the zygomatic arches more nearly parallel and less expanded, but it is more than likely that these differences are again only individual and no doubt such a skull would be produced by a larger series of *hosei*. The mandible of *sabana* is rather heavier than that of *hosei*.

The known range of *sabana* is the flat forest land near the north-east coast of North Borneo from Paitan Bay to Sandakan Bay, a distance of about sixty miles or less.

It will be noted that both the grey langurs dealt with in this paper have been left under a specific name and in the present state of our knowledge it seems inadvisable to link up *hosei*, *thomasi* and *sabana* although these forms are undoubtedly very closely

1. This is a village up the Paitan River which flows into Schomburgk Bay between Paitan Bay and Labuk Bay.

allied. Very little is known of their geographical ranges but at present they are not known to overlap. Excluding *fusco-murina*[1] which we have not seen all the described forms seem characterized by small but fundamental differences in the arrangement of the hair on the top of the head. These differences have been summarized by Thomas in his original description of *sabana*. If they are ignored we are destroying one of the few characters available for the taxonomy of this difficult genus.

Like *P. thomasi* and *P. hosei* this monkey shows sexual differences.

Macaca nemestrina nemestrina (Linn.)

Macacus nemestrina, Forbes, Handb. Prim., II, 1897, p. 17; Hose, Mamm. Borneo, 1893, p. 6; Jentink, Notes Leyd. Mus., xix, 1897, p. 39.

Macaca broca, Miller, Proc. U. S. Nat. Mus., xxix, 1906, p. 1436.

Macaca nemestrina, Lyon, Proc. U. S. Nat. Mus., xxxiii, 1907, p. 565; op. cit. 40, 1911, p. 136.

Bettotan: 2 ♂ .

These specimens can be regarded as topotypes of *broca* the type of which was collected on the Sapagaya River, Sandakan Bay, north-east Borneo. They are both fine adult males and very similar in appearance excepting that one has the tuft at the end of the tail bright rufous in colour and the forearms and hands rather more ochraceous. In both the dark dorsal area only commences on the shoulders and the dark cap is thus isolated. In the type of *broca* the dark area is described as extending from forehead to tail.

Neither on colour nor cranial characters can we separate these two examples from *nemestrina* as represented by specimens from the Southern Malay Peninsula: the terra typica is Sumatra.

(For measurements *see* page 50).

Macaca irus irus Cuv.

Macacus cynomologus (part), Forbes, Handb. Prim., II, 1897, p. 31.

Macacus cynomologus, Hose, Mamm. Borneo, 1893, p. 8.

Macaca fascicularis, Lyon, Proc. U. S. Nat. Mus., xxxiii, 1907, p. 565.

Macaca irus, Elliot, Mon. Prim. II, 1913, p. 229.

Bettotan: 1 ♂ . Rayoh: 1 juv. Banguey Island: 2 ♂ , 1 ♀

1. Perhaps not a good species: c. f. Collett's description of young *thomasi* in P. Z. S., 1892, p. 615.

Elliot did not include Borneo in the geographical distribution of *irus*, but in the text applies the name to specimens from Baram: *mandibularis*[1] was based on an animal from Pontianak, western Borneo, and no further range is given; but Gyldenstolpe has used the name for a female from Kaboerau on the Boeloengan River in eastern Borneo.

The characters on which *mandibularis* was erected are individual: similar characters can be found in series of skulls from various localities.

The skins and skulls before us are as variable as usual. One male and one female from Banguey are very dark but they are young. The other two males are of the greyish-olive type. That from Banguey, an aged example, is distinguished by a fairly well defined, narrow, richer dorsal area: it has a pronounced sagittal crest and one of the largest skulls of any macaque of this species we have seen.

(For measurements *see* page 50).

CARNIVORA

Viverra tangalunga tangalunga Gray.

Viverra tangalunga, Jentink, Notes Leyd. Mus., xix, 1897, p. 42; Lyon, Proc. U. S. Nat. Mus., 40, 1911, p. 115; Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 24.

Samawang: 1 ♂ imm; Bettotan: 1 ♂ adult.

The immature animal is much paler than the adult the external measurements of which are:—head and body 625; tail 280; hind-foot 95; ear 40 mm.

Cranial measurements:—Condylo-basal length 112; basal-length 107.5; palatal length 58 mm.; zygomatic breadth 59.2; upper molar row 38 mm.

The type locality of *tangalunga* is West Sumatra for it is the *V. zibetha* of Raffles[2] from that island.

We have no Sumatran specimens before us but can at present see no reason for separating animals from Borneo and the Malay Peninsula.

Paradoxurus hermaphroditus sabanus (Thos.).

Paradoxurus hermaphroditus, Jentink, Notes Leyd. Mus., xix, 1897, p. 43.

Paradoxurus sabanus, Thomas, Ann. Mag. Nat. Hist. (8), iii, 1909, p. 376 (Sipitang, N. Borneo).

1. Elliot, Proc. U. S. Nat. Mus., xxxviii, 1910, p. 347.
2. Trans. Linn. Soc., xii, 1821, p. 251.

Paradoxurus philippinensis, Lyon, Proc. U. S. Nat. Mus., xxxiii, 1907, p. 559; op. cit. 40, 1911, p. 116.

Paradoxurus philippensis baritensis, Lonnberg, Mag. f. Naturvidenskaberne, 62, 1925, p. 60 (Barito River, Central Borneo).

Paradoxurus hermaphroditus sabanus, Chas. and Kloss, Journ. Malayan Branch, Roy. Asiat. Soc., vi, pt. 1, 1928, p. 39.

Bettotan: 1 ♀ (aged).

External measurements:—head and body 480; tail 370; hind-foot 73; ear 38 mm.

Cranial measurements:—Condylo-basal length 95.1; basal length 91; palatal length 53.4; upper molar row 27.8 mm.

Hemigalus derbianus boiei (Müll.). Plate I.

Viverra boiei, Müller, Tijd. Nat. Gesch. Phys., v, 1838, p. 144 (S. E. Borneo).

Hemigalus hardwickii, Lyon, Proc. U. S. Nat. Mus. 40, 1911, p. 117.

Hemigalus derbianus, Gyldenstolpe, Kungl. Sv. Akad. Handl., Band 60, No. 6, 1920, p. 25.

Bettotan: 4 ♂, 5 ♀.

This species is found in Tenasserim, the Malay Peninsula, Sumatra and Borneo. It seems common in Borneo but exceedingly rare in the Malay Peninsula. Two specimens from the latter locality indicate that the Bornean race is a trifle greyer and less yellow in general tone and has a rather larger skull and perhaps relatively smaller teeth (especially the carnassial tooth) than typical *derbianus* (*hardwickii* auct) of Malacca: there is however much variation in the size of the teeth and we need a larger series from the Malay Peninsula to confirm the last suggested distinction. Our two Malayan *derbianus* (a male and an unsexed example) are both adult although not aged: they have the basal length of the skull 88.9 and 86.2 mm. respectively. According to the measurements given by Lyon[1] (adult males, basal length of skull 97–98 mm.) the Sumatran race also seems to be *boiei* which was described from south-eastern Borneo. The Tenasserim race is *incursor*[2] Thomas, and "*Chrotogale*" *owstoni*[3] Thomas, may perhaps be regarded as the Indo-Chinese representative.

All of the skulls have a median septal foramen but sometimes it is very small, the septum then being short and thick and the anterior palatine foramina reduced in size. In one immature female in which the last upper molars are not erupted the narrow

1. Proc. U. S. Nat. Mus., xxxiv, 1908, p. 657.
2. Journ. Bombay Nat. Hist. Soc., 1915, xxiii, p. 613.
3. P. Z. S., 1912, p. 499.

septal foramen is rather longer than the palatine foramina but in no case are these three foramina as elongate as in the two known skulls of *owsteni*.

In detail the skulls from Bettotan are rather variable especially in the size of the teeth. The exceptionally small female (No. 3269) is by no mean young but has the teeth considerably worn.

In pattern no two are exactly the same. The range of variation is illustrated on Plate I: in the main it consists of differences in the width of the longitudinal neck bands and transverse bands of the trunk and irregularities in the two anterior transverse bands which show a marked tendency to break up, the specimen with the exceptionally small skull mentioned above being an extreme case of this last modification: it has large isolated spots on the fore-part of the body.

In most of our series the hair of the nape is directed forwards between the occiput and the withers where there are generally whorls (Pl. 1, Nos. 1 – 7), but in one adult it is directed uniformly backwards (Pl. 1, No. 9) and in another the hair points backwards on the anterior and forwards on the posterior nape (Pl. 1, No. 8). Hair growing backwards on the nape was regarded by Thomas as a generic character of *Crossogale*: but it appears that in these animals the nuchal pelage is as variable as the whorl on the shoulders in *Mydaus*.

(For measurements *see* page 53).

Mungos brachyurus rajah (Thos.).

Herpestes brachyurus, Jentink, Notes Leyd. Mus., xix, 1897, p. 44; Lyon, Proc. U. S. Nat. Mus., 40, 1911, p. 117.

Herpestes brachyurus rajah Thomas, Ann. Mag. Nat. Hist. (9), viii, 1921, p. 135 (Balingian, Sarawak).

Herpestes brachyurus dyacorum, Thomas, Ann. Mag. Nat. Hist. (9), viii, 1921, p. 135 (Mt. Dulit, Sarawak).

Mungos brachyurus rajah, Chas. and Kloss, Journ. Malayan Branch Roy. Asiat. Soc., vi, pt. 1, 1928, p. 40.

Samawang River and Bettotan: 1 ♂, 2 ♀.

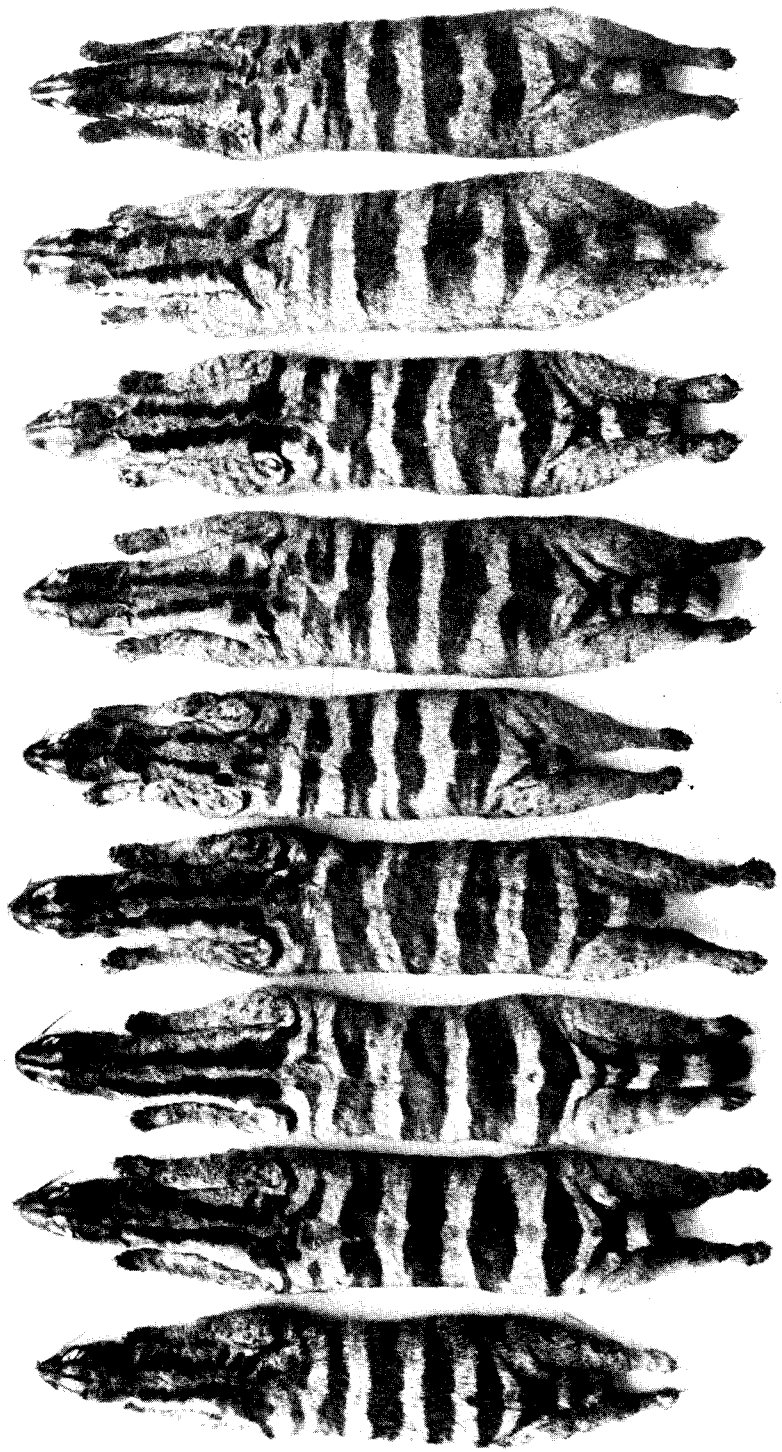
One specimen has the grizzling of the upper parts rather more rufous than in the others, but all are very near to *brachyurus* of the Malay Peninsula and perhaps only separable by their much more buffy tails.

(For measurements *see* page 53).

Mungos semitorquatus semitorquatus (Gray).

Herpestes semitorquatus, Lyon, Proc. U. S. Nat. Mus., xxxiii, 1907, p. 559; op. cit. 40, 1911, p. 117.

Bettotan: 1 ♀.



Hemigalus derbianus boiei (Müll.) from North Borneo.

External measurements:—head and body 410; tail 285; hind-foot 82; ear 25 mm.

Cranial measurements:—condylo-basal length 80; basal length 74.5; palatal length 42.1; zygomatic breadth 45.2; upper molar row 27 mm.

The type locality of *M. semitorquatus* is Borneo, opposite the island of Labuan.

Martes flavigula saba subsp. nov.

Mustela henrici, Jentink (part., Borneo), Mus. d'Hist. Nat. Pays-Bas, XI, 1892, p. 140; Lyon, Proc. U. S. Nat. Mus., 40, 1911, p. 119.

Mustela flavigula henricii, Bonh. (part., Borneo), Ann. Mag. Nat. Hist. (7), VII, 1901, p. 346; Lönnberg and Mjöberg, Ann. Mag. Nat. Hist. (9) XVI, 1925, p. 516.

Bettotan and Rajoh: 2 ♂, 2 ♀.

Not differing materially in colour from *Martes flavigula henricii* (Westerm.) of Sumatra and Java, but smaller. Greatest known condylo-basal length of *henrici*; males 97, females 91 mm: of Bornean males 90, females 81 mm. Darker and smaller than *M. f. peninsularis* (Bonhote) of the Malay Peninsula.[1]

Lyon (l. c. s.) records a specimen from Borneo in which "the anterior portions of the upper parts are practically as dark as are the posterior portions and tail". A specimen from Malacca is very near in colour to our Bornean examples and only to be separated by its browner, rather less blackened upperparts: a skin from western Sarawak is on colour, but not on size, certainly with the Malayan rather than the Bornean series;[2] but the existence of these animals, from intermediate localities does not invalidate the main division of the species into races the extremes of which are well marked. In Malaysia we have a pale, continental race (*peninsularis*) and normally dark, insular races (*henricii* and *saba*). Bonhote stated (on inadequate material) that the skull of *henricii* is smaller than that of *peninsularis*, but Robinson and Kloss[3] record Sumatran *henricii* as being apparently larger and give 93.8 and 97.0 mm. for the condylo-basal length of two male skulls. At present we have no dimensions of skulls of male *peninsularis*, but the skulls of the Bornean animals before us are small. The largest male is about equal in size to a female from the Malay Peninsula and no female skull before us from the Peninsula is so small as the Bornean females listed above.

1. Ann. Mag. Nat. Hist. (7), vii, 1901, p. 346, Bankasun, South Tenasserim.

2. Lönnberg and Mjöberg record a male from Mt. Dulit (condylobasal length of skull 86 mm.) resembling the Malayan animal in colour.

3. Journ. Fed. Mal. States Mus., vii, 1919, p. 304.

Type.—Adult male (skin and skull) collected at Bettotan near Sandakan, British North Borneo, on 15th August, 1927. Raffles Museum No. 3271.

(For measurements *see* page 52).

Mustela nudipes leucocephalus (Gray).

Gymnopus leucocephalus, Gray, Proc. Zool. Soc., 1865, p. 119.

Putorius nudipes, Lyon, Proc. U. S. Nat. Mus., 40, 1911, p. 119.

Bettotan: 1 ♀.

External measurements:—head and body 320 mm.; tail 215 mm.; hind-foot 49 mm.; ear 23 mm.

Cranial measurements:—basal length 50.6 mm.; condylo-basal length 55 mm.; palatal 23.1 mm.; zygomatic breadth 28.2 mm.; upper molar row 13 mm.

Robinson and Kloss wrote in 1919 (Journ. Fed. Malay States Mus. VII, p. 304). "This species is founded on an animal with a white-tipped tail said to have come from Java. We are aware of no recent specimens from that island, while S. Mueller (Verh. Nat. Gesch. Ned. Ind., Zoogdieren, p. 30, 1839–44) states 'I once found *Mustela nudipes* on the west coast of Sumatra and saw two dried skins in Borneo. According to French writers it is also found in Java, but neither Reinwardt, Kuhl, Van Hasselt, Boie nor myself ever observed it there. Its Javanese origin is more doubtful in that, in the west of the island at least, none of the natives know anything about it'.

"Vigors also writes (Appendix to the Life of Raffles, 1830, p. 634) 'This species, although supposed by the French writers to have been sent from Java, was never met with by Dr. Horsfield in his extensive researches in that island. It is probable that the specimen sent by M. Diard from Batavia had been originally imported from Sumatra'. Under the circumstances substitute for Java the type locality West Sumatra."

Gray renamed the animal as follows, probably considering its specific name unsuitable:—

"*Gymnopus leucocephalus*, Golden fulvous, nearly uniform, scarcely paler beneath; head white; toes elongate, webbed, nakedish.

Putorius nudipes, F. Cuv.; *Mustela nudipes*, Desm.

Var. End of tail paler; feet darker; front of the back with a pale vertebral streak, wider and more distinct between the shoulders B. M.

Hab. Sumatra and Borneo.

Tail of the specimen in the Paris Museum [type] is nearly destitute of hair; the soles of the feet are covered with hair."

Gray's "Variety" is apparently the typical Sumatran form while his *leucocephalus* is based on Bornean animals. Sumatran specimens before us have distinctly whitish-tipped tails: Bornean and Malayan are either much less particolored or are practically concolorous. Larger series from the various localities may show that this difference is not material, but for the present we regard the Bornean and Malayan animals as a sub-species bearing Gray's name.

Lutra cinerea Illiger.

Lutra cinerea, Illiger, Abh. Ak. Berlin, 1811, 1815, p. 99: type locality near Batavia, Java.

Aonyx cinerea, Lyon, Proc. U. S. Nat. Mus., 36, 1909, p. 485, pl. 39; op. cit., 40, 1911, p. 119.

Bettotan 6 ♂, 3 ♀.

Some specimens are paler on the throat than others and occasionally there are irregular white patches on the chin. In museums the dark sepia colour of this otter soon fades to a paler, more yellowish, brown. Animals from the Malay Peninsula and Borneo seem inseparable.

Hose records the species as very rare in Borneo but it was very common at Bettotan and a much larger series could have been obtained with ease.

(For measurements *see* page 52).

UNGULATA

Tragulus javanicus borneanus Miller.

Tragulus borneanus, Miller, Proc. Biol. Soc. Wash., 15. 1902, p. 174 (British North Borneo); Lyon, Proc. U. S. Nat. Mus., XXXIII, 1907, p. 550.

Tragulus napu borneanus, Lyon, op. cit., 40, 1911, p. 64.

Tragulus javanicus borneanus, Kloss, Journ. Fed. Malay States Mus., VII, 1918, p. 248; Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 51.

Bettotan and Rayoh: 4 ♂, 4 ♀.

No Sumatran topotypes of *napu* are now available but these skins have been compared with a fair number from the Malay Peninsula and they are hard to separate. In some cases it would be difficult, if not impossible, to identify individuals on colour and the distinction on size is rather fine. There are average colour differences which are just acceptable: at the same time we agree with Lyon's implication that *borneanus* is a very thin race when compared with *napu*. Series for series the two races cannot be separated on the colour of the throat markings: both forms are very variable in this respect and the range is about the same. The width of the collar is a very weak character and would require very

large series to substantiate it as a racial distinction. On the upperparts the nape stripe is less noticeable in *borneanus* although it is by no means conspicuous in continental specimens. But in North Borneo occur animals in which the upperparts are considerably blackened and in this phase, which is leading to the form next to be described, *borneanus* is quite different from any mouse-deer we have seen from the Malay Peninsula. Some skins of *napu* from South Tenasserim are paler than any skin we have from Borneo.

(For measurements *see* page 54).

Tragulus javanicus banguei subsp. nov.

Type.—Adult male (skin and skull), collected on Banguey Island, North Borneo, on 2nd September, 1926. Raffles Museum, No. 3373.

Diagnosis.—Like *T. j. borneanus* Miller, of North Borneo but darker and smaller: very near to *nigricans*[1] of Balabac, Philippine Islands but the throat markings different.

Colour.—Top of the head and nape as in *borneanus* but more rufous; nape stripe obsolete. Remainder of upperparts and flanks black irregularly grizzled with orange-buff, the black predominating. On the back the hairs are pale grey at the base, then orange-buff, and finally broadly tipped with black: on the flanks the orange-buff zone is less evident, or absent. Thighs with the usual orange-rufous patch.

Throat markings very distinct with the pattern exactly as in the more regular examples of *borneanus*. The longitudinal dark stripes almost black in one, mixed black and rufous in another: horizontal throat band mixed rufous and black, the former predominating. Underparts variable.

Skull and teeth.—Essentially as in *borneanus*.

Measurements.—*See* page 54.

Specimens examined.—Three, all from the type locality.

Remarks.—On the upperparts the least blackened of the Banguey specimens is perhaps not separable from an exceptionally dark example of *borneanus* from Rayoh, but all the skins from Banguey are at once separable from those from the mainland by their very dark longitudinal throat stripes.

The series, though small, shows the wide range of variation in detail common to most races of mouse-deer. In one of the females the chest and abdomen are silky white with the dark flanks very sharply demarcated: there is an isolated, narrow, almost black median streak. In the type there is a broad band of orange-rufous across the chest and a thin line of the same colour bounds the flanks and the dark median streak, broadening out as a patch on the abdomen.

1. *Tragulus nigricans* Thomas, Ann. Mag. Nat. Hist. (6), IX, 1892, p. 254.

In practice it is sometimes difficult to allocate mouse-deer to a species. Where the two species are found together the *javanicus* form is of course always larger and heavier than the *kanchil* race and it usually has the lateral white stripes on the throat at least partially broken by a branch sent off by the grizzled area of the neck, but the sizes of the two species overlap and occasional examples of *kanchil* have the white throat stripes deflected as described above. On the mainland of north Borneo doubtful examples can usually be identified by the skull, for in most *borneanus* the posterior end of the combined nasals is more completely embraced by prolongations of the frontals than in the majority of the representative race of *kanchil* found in the same area. We have placed *banguei* as a race of *javanicus* on account of its throat pattern as differentiation by means of the skulls fails.

Tragulus kanchil longipes Lyon.

Tragulus hosei, Lyon (nec Bonhote), Proc. U. S. Nat. Mus., 33. 1907, p. 549.

Tragulus kanchil longipes, Lyon, Proc. U. S. Nat. Mus., 34, 1908, p. 628; op. cit. 40, 1911, p. 66 (Eastern Sumatra).

Tragulus kanchil hosei (nec Bonhote), Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 53.

Samawang and Bettotan: 3 ♂, 6 ♀.

Two specimens from South and North Sarawak (Samarahan and Baram) are very near to *fulviventer* (Gray) of the Malay Peninsula, yet are sufficiently differentiated by their longer feet to stand as *hosei* Bonhote. But the series from North Borneo is quite distinct, differing from the forms found in the Malay Peninsula, *fulviventer* and *ravus*, by large size and from both these races and *hosei* of Sarawak by generally paler, duller colour: the available material of typical *kanchil* is not good enough for a comparison to be made.

The difference in colour is best expressed by saying that the Bettotan and Samawang skins lack the rich fulvous element in the pelage, this being replaced by a yellower, buffy colour: such a distinction is of course most marked on the pure coloured or less grizzled areas, such as the forelimbs, sides of the neck, nape, thighs and especially on the coloured tracts of the underparts.

A further important distinction is that whereas the upperparts of the continental forms are very finely grizzled those of the animals before us (and herein the two examples of *hosei* agree) are coarsely grizzled as in the forms of *T. javanicus*.

Until a comparison of topotypes can be made it is best to regard the north Bornean animals as *longipes*, described by Lyon from the lowlands of eastern Sumatra and later considered by that author to occur in western, south-western and south-eastern Borneo: on the description we can make no separation. In detail our series is extremely variable in the colour of the underparts: one has the

flanks grey without any trace of a buffy colour. Some have the chest and abdomen largely white and in others these parts are largely coloured. No two skins are even approximately alike. In one male the white triangle on the centre of the throat is reduced to two small spots. As a series the nape stripe is less blackened and conspicuous than in *ravus, fulviventer* and *hosei*.

(For measurements *see* page 55).

Cervus unicolor brookei Hose.

Russa equina, Jentink, Notes Leyd. Mus., XIX, 1897, p. 63.

Cervus brookei, Hose, Ann. Mag. Nat. Hist. (6), 12, 1893, p. 206 (Mt. Dulit, N. Sarawak).

Rusa brookei, Lyon, Proc. U. S. Nat. Mus., XXXIII, 1907, p. 550; id., op. cit., 40, 1911, p. 69.

Cervus unicolor brookei, Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 50.

Banguey Island: 5 pairs of antlers with frontlets, two skulls with horns, one antler. Kinabatangan River: one incomplete adult female skin.

The antlers from Banguey are small and the skin from the Kinabatangan River, like another from Sarawak, is darker than a few continental animals (*C. u. equinus*) with which it has been compared. The hairs of the Bornean skin are palest at the base but they are not annulated. In Kudat we examined a pair of antlers, almost certainly of a local animal, in which the hind tine was longer than the front tine: this is unusual in the Bornean Sambar.

This deer also occurs on Balambangan Island.

Muntiacus muntjak rubidus Lyon.

Muntiacus pleiharicus, Lyon (nec Kohlbrugge), Proc. U. S. Nat. Mus., XXXIII, 1907, p. 550.

Muntiacus rubidus, Lyon, Proc. U. S. Nat. Mus., 40, 1911, p. 72 (Pamukang Bay, S. E. Borneo).

Muntiacus muntjak rubidus, Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 49.

Rayoh: 1 ♀ (adult).

Head and body 915; tail 135; hind-foot 280; ear 78.

Skull.—Condylo-basal length 175; maxillary toothrow 53; zygomatic width 87 mm.

RODENTIA

Petinomys setosus (Temm. and Schleg.) subsp.

Bettotan: 1 ♂.

P. setosus came from the west coast of Sumatra (Fauna Japon., 1847, Mamm., p. 49): we have neither the original description nor topotypes for comparison but the Bettotan specimen seems to agree with Jentink's account and figures of the species.[1]

All the small flying squirrels with flattened bullae seem very nearly related: *vordermanni*[2] from Billiton and *phipsoni*[3] from Tenasserim seem extremely close (Kloss has already suggested that they are races of one species)[4] and specimens from the Malay Peninsula identified by Thomas as *phipsoni* are perhaps not separable from a small series from Pulau Gallang in the Rhio Archipelago. These latter we once thought to be *vordermanni*.[5] The example from North Borneo differs from all the Gallang skins and our examples of *phipsoni* in its rather smaller skull and tooth-row; in the colour, which is much darker and without any trace of rufous or bright brown, even on the cheeks; and in having the tail distichous both above and below and not merely on the undersurface.

Upperparts black, the hairs narrowly tipped with silvery grey on the forehead, shoulders, sides of the back and thighs and with dull brownish-buff on the crown, nape, centre of the back and rump. Thighs black, forelimbs almost so: feet thinly clad with brownish hairs. Edge of the membrane, above and below black. Cheeks and underparts white. Tail brownish black, the underside with distinct baso-lateral whitish areas.

Head and body 106; tail 96; hind-foot 22.5; ear 14 mm.

Skull measurements:—total length 29; condylo-basal length 25.2; basilar length 23; palatilar length 12; diastema 6; upper molar row 5.4; greatest length of nasals 6.7; least interorbital breadth 6.1; zygomatic breadth 17 mm.

Hylopetes thomasi (Hose).

Petaurista thomasi, Hose, Ann. Mag. Nat. Hist. (7), 5, 1900, p. 215 (North-eastern Sarawak).

Bettotan: 1 ♂.

The single example obtained is a juvenile (posterior molars just erupted) but it agrees perfectly with Hose's very complete description of this rare and little known species.

Dimensions in millimetres (the figures in brackets are those of the type, an adult female, as given by Hose):—Head and body 300 (350); tail 370 (340); hind-foot 65 (60 dry); ear 30 (c. 19: error?).

Skull: greatest length 53 (61); condylo-basilar 48 (basilar length 51); zygomatic breadth 37 (41); nasals 16.6 x 11 (16.5 x 10.5); interorbital breadth 12 (13.5); tip to tip of postorbital processes 30

1. Notes Leyden Mus., XII, 1890, p. 145.
2. Jentink, tom. cit., p. 150.
3. Thomas, Journ. Bomb. Nat. Hist. Soc., XXIV, 1916, p. 422.
4. Journ. Nat. Hist. Soc. Siam, II, 1917, p. 304.
5. Chasen, Journ. Malayan Br. Roy. Asiat. Soc. III, pt. 1, 1925, p. 94.

(33); palatilar length 24 (palate length 28.8). The length of the complete upper tooth-row is approximately 14.5 mm.

The middle line of the belly and the parachute are uniform with the flanks. There is an indistinct dark ring round the eyes. The vibrissæ are pale rufous in colour.

In 1918[1] Robinson and Kloss tentatively referred this species to their genus *Aeromys*[2] but we now find that in its essential cranial characters it is nearer to *Petaurista* and we therefore leave it in *Hylopètes* where it was placed by Thomas in 1908.[3]

Ratufa affinis sandakanensis Bonh.

Ratufa ephippium sandakanensis, Bonhote, Ann. Mag. Nat. Hist. (7), v, 1900, p. 497 (Sandakan, N. Borneo).

? *Ratufa ephippium baramensis*, Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 33.

Samawang River, Bettotan and Rayoh: 4 ♂, 6 ♀.

Although very variable owing to the factors of individuality and 'bleaching'' the giant squirrel of Sarawak and North Borneo is definitely divisible into two geographical races: Bonhote's *baramensis* and *sandakanensis* are both good forms and the presence of intermediates in intervening areas is no cause for the suppression of *sandakanensis*.[4]

Surveying the whole of our series from North Borneo and Sarawak we find that although the material is so variable that scarcely two examples can be matched, yet proceeding from north-east to south-west the specimens can roughly be grouped into five sections.

Firstly there is the Banguey Island form (described as new below). It represents the extreme development of the species in one direction and is the darkest of all the Bornean races: typically it is almost black on the back and flanks with an almost imperceptible grizzle on the flanks. The hands and feet are nearer to white than to cream colour and contrast with the dark forearms and thighs which are grizzled brown and black. The cheeks and sides of the neck are tawny-ochraceous: the tail black, very coarsely grizzled or with whitish annulations. The material representing this form consists of skins in good condition and containing no bleached examples.

1. Records of the Indian Museum, XV, 1918, p. 183.
2. Journ. Fed. Malay States Mus., VI, 1915, p. 23.
3. Ann. Mag. Nat. Hist. (8), 1908, p. 6.
4. Gyldenstolpe has cast doubts on the validity of this form but no appreciation of the complicated systematics and ranges of Bornean squirrels can be obtained without very complete and carefully collected series. Seasonal change, exclusive of the gradual replacement of worn pelage, has never been demonstrated in any Malaysian squirrel. The various phases of *S. prevosti* have been ascribed to seasonal influence but the claim has never been seriously supported and they can always be correlated with locality if a large-scale map is used.

The form found in the territory of British North Borneo (*sandakanensis* Bonh.) can be roughly split into two sections. Firstly there are animals like the Banguey form but with the upperparts nearer brown than black and the flanks much more obviously grizzled, thus restricting the dark dorsal area: and secondly there are those specimens in which the brown element in the flanks and outer sides of the limbs is replaced by a colder, greyer colour. In both these sections the pelage bleaches to a much paler colour but regarding the material as a whole a race, *sandakanensis*, may be diagnosed in unworn pelage as follows:—Upperparts extensively blackish brown without any tawny element: flanks especially cold or greyish. Outer side of forelimbs grizzled: tail coarsely grizzled.[1]

The fourth section (*baramensis* Bonh.) includes specimens from Baram and Dulit in the north-east of Sarawak south-west to the Saribas district. They are characterized by the presence of a tawny or rufous element in the colour of the upperparts this being especially marked on the flanks and thighs. The sides of the head are more richly coloured than in *sandakanensis*. The tail is sometimes faintly grizzled, but often uniform in colour. Individual variation conceals all but the broad characters outlined above. *R. ephippium dulitensis*[2] is a name given to one of the many phases which *baramensis* exhibits: we have exact topotypes of *dulitensis* before us and can match them by skins from other localities in Sarawak. One skin from Samarahan must also be placed in this section.

The fifth and last section is represented by specimens from Samarahan (except the one mentioned above) and Mt. Poi in southern Sarawak. In this the hands and feet, forearms and thighs are creamy white and concolorous with the underparts. The dark area on the upperparts is restricted to a fairly well defined and narrow zone along the middle line. One skin from Mt. Poi, however, is so like Müller and Schlegel's plate of typical *ephippium* of S. E. Borneo, that in the absence of other evidence we should not have cared to separate it: the others are rather less richly coloured and on description seem very near to *cothurnata* Lyon,[3] but lacking topotypes of that form we regard them as *baramensis* > *cothurnata*.

The width of the interpterygoid space is a variable feature of the skulls.

(For measurements *see* page 56).

1. *Ratufa ephippium lumholzi* Lonnberg, Ann. Mag. Nat. Hist. (9), xvi, 1925, p. 514, from Pipoh Boeloengan, N. E. Dutch Borneo, appears to be only *sandakanensis*.
2. Lonnberg and Mjöberg, Ann. Mag. Nat. Hist. (9), xvi, 1925, p. 514 Foot of Mt. Dulit, N. Sarawak.
3. Proc. U. S. Nat. Mus. 40, 1911, p. 93 (Sukadana, South-west Borneo).

At present, therefore, we recognise in Borneo the following races:—

i. *R. affinis sandakanensis*, Bonh., British North Borneo.

ii. *R. affinis baramensis*, Bonh., Sarawak and Dutch N. E. Borneo.

iii. *R. affinis cothurnata*, Lyon, S. W. Borneo.

iv. *R. affinis ephippium* (S. Müll.), S. E. Borneo.

Ratufa affinis banguei subsp. nov.

Type.—Adult male (skin and skull) collected on Banguey Island, North Borneo on 7th September, 1927. Raffles Museum No. 3437.

Diagnosis.—Like *R. a. sandakanensis* of the mainland of North Borneo but smaller and the upperparts darker.

Colour.—Crown, nape, back and flanks black with a brown tone in certain lights: crown, shoulders and flanks almost imperceptibly grizzled with rufous-buff. Muzzle and sides of the head mixed rufous-buff and black: a tawny-ochraceous area behind the ears. Outer side of forelimb black coarsely grizzled with creamy-buff di tally and rufous-buff proximally. Hands and wrists creamy white. General effect of the outer side of the thigh dark brown: feet and ankles creamy white. Underparts whitish, chin and throat tawny-ochraceous. Tail black, coarsely grizzled with creamy-buff in the form of broad, irregular annulations; white in the centre line underneath.

Skull and teeth.—Not essentially different from those of *sandakanensis*.

Measurements.—*See* page 56.

Specimens examined.—Three males from the type locality.

Remarks.—The type is rather more deeply black on the upperparts than the others which furthermore differ in having the white of the foot not extending quite so far on to the ankle. No. 3374 has the tail lined with creamy-buff rather than annulated. The least dark of the three specimens is at once separable from any example of *sandakanensis* we have seen by its darker, more blackened upperparts.

No form of *Ratufa bicolor* has been met with in Borneo and no representative of the other Malaysian species, *R. affinis*, in Java.

Sciurus prevosti pluto (Gray).

Macroxus pluto, Gray, Ann. Mag. Nat. Hist., xx, 1867, p. 283 (Borneo, Sarawak).

Callosciurus prevosti pluto, Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 35.

Sciurus rufoniger pluto, Chas. and Kloss, Journ. Malay. Branch

Roy. Asiatic Soc., iii, 1925, p. 97.

Samawang, Bettotan and Rayoh: 12 ♂, 10 ♀.

When we wrote our short paper on the black-and-red forms of squirrels occurring in Sumatra and Borneo we hesitated to call them races of *prevosti* because, judging from published records, it seemed tolerably certain that in some places in Borneo black and red animals existed side by side with the more normally coloured forms. A recent stay on Mt. Kinabalu in North Borneo has convinced us that no form in any way resembling *baluensis* occurs on the lower levels of Kinabalu which is inhabited by *pluto*; and that although the two forms may be collected in one day on the mountain each has its restricted range (altitudinal). Without denying the possibility of the two races being sometimes found together where their ranges meet we now feel sure that *pluto*, *rufoniger*, *piceus* and *nyx* are forms of *prevosti*.

All of the series before us are *S. prevosti pluto* and confirm our previous conclusions concerning the points of difference between *pluto* of the mainland and *rufoniger* from Labuan Island. The material can be divided into four groups on details of colouration.

Nine skins (including a juvenile) are solely black and red: the wrists and ankles are narrowly black: there is no grizzling on any part of the body and the pale side stripe is either absent or only to be faintly discerned in certain lights. Group (ii) consisting of five skins, is similar but there is always a faint, narrow, grey side stripe. In the third group are four specimens: they have the cheeks and perhaps also a very small area behind the ears lightly grizzled: the side stripe is as in group (ii). We have only two skins of our fourth group: in them the grizzling of the head is rather more extensive and extends to the sides of the neck. The side stripe is white and broader than in groups (ii) and (iii): furthermore it widers on the hip and is lost in a thin grizzle on the upperpart of the thigh.

A point of interest is that groups (iii) and (iv) are entirely composed of specimens from Rayoh, the most southerly of our collecting stations in North Borneo.

In most of the skins the hair of the black parts is dark to the base, but in some a few buffy subterminal annulations can be seen if the pelage is disturbed on the lower back and flanks. In a rather worn female from Bettotan this grizzling is lightly indicated over the whole of the upper surface. This specimen has no side stripe and we regard it, not as a link with a non-black form of *prevosti*, but as a casual aberration.

In the east Gyldenstolpe records *pluto* from the Boeloengan River, but the specimens from Rayoh are the most southerly examples of typical *pluto* we have seen from the west and although the race was said to have come from Sarawak it is more than doubtful if it occurs in that State. Animals from the Merapok Hills in

the north-east of Brunei and the Pelagus Rapids, north of Kapit, on the Rejang River, Central Sarawak, are interesting intermediates, *pluto* > *caroli*. They have the sides of the face and neck strongly grizzled, the lateral stripe white and conspicuous and spreading out as a grizzled buffy area over the thighs. They are further removed from *pluto* than any of the Rayoh animals but are still nearer to *pluto* than to *caroli* Bonh.

Two recognizable forms of *prevosti* are found in the Baram district. The upper Baram area, including the mountains, is occupied by *griseicauda* Bonh.: in this we formerly included *baluensis* Bonh., as specimens answering to the description of that form occur both in the lowlands and on the mountains, but we now have reason to believe that the type and other skins we have seen are not correctly or exactly localized and *baluensis* is a good high-level race. From the lower Baram along the coast to Balingean *caroli* is found: the feet in *caroli* are red or dark and the shoulders are pale or dark.

At Belaga, on the upper Rejang River in Central Sarawak, *caroli* is very variable: one specimen has the feet mixed red and grey and this specimen is also perfectly intermediate on the shoulders. Coming down the coast, next to *caroli* we find a race which is *atricapillus* Schlegel, or very near to that form. We have a series from the Saribas River basin. Thirty skins answer tolerably well to *atricapillus*: another five are intermediates, one being distinctly nearer the next form mentioned below, *sarawakensis* Grey. Two specimens from the Kalaka River (Ulu Awik) are *atricapillus*.

S. p. atricapillus, Schlegel (type locality near Poetus Sibau on the upper Kapuas River, Dutch West Borneo) appears to have a very wide range. It extends from the Saribas district in South Sarawak to Balik Papan on the east coast, and thence perhaps westward along the south coast until it meet *S. p. sanggaus* Lyon. From Talisaian on the east coast (lat. 1° 50″ North) Miller has described a form *atrox* (Smiths. Misc. Collns, 61, No. 21, 1913, p. 23) "like *atricapillus* from southern Borneo, but dark area on face not extending behind eyes, and feet a grizzled blackish brown instead of clear black".

Specimens from Samarahan to Mt. Poi in south-west Sarawak are *sarawakensis* (Gray) (syn. *kuchingensis*) Bonh. and this is not improbably the same as the earlier described *borneonensis* Müller and Schlegel, which came from the country north of Pontianak.

Other forms occur in Dutch Borneo; and *suffusus* from the Tutong River between Baram and Brunei is unknown to us.

We can produce no evidence to support Hose's statement[1] that this squirrel has seasonal phases: the black races are certainly not dry season forms. All the Bornean races except *pluto* and *rufo-niger* are unstable, and show not only geographical intergradation

1. Mammals of Borneo, 1893, p. 45.

but sporadic inosculation and their ranges have yet to be worked out in detail.

(For measurements *see* page 57)

Sciurus prevosti caedis subsp. nov.

Type.—Adult male (skin and skull) collected on Balambangan Island, North Borneo, on 10th September, 1927. Raffles Museum No. 3478.

Diagnosis.—Like *S. prevosti pluto* of the mainland of north Borneo but smaller. Greatest length of skull 51 - 53 mm. against 54·5 - 57 mm.

Measurements.—*See* page 57.

Specimens examined.—Six males and nine females from Balambangan Island and nine males and two females from Banguey Island.

Remarks.—Some of the specimens are entirely black and red. Others, like the tvpe, have a lateral stripe indicated by a faint narrow grey line. Occasionally the lateral line is whitish and more distinct and the range of variation is in fact as in *pluto* excepting that the lateral stripe never spreads out over the thighs, a very small grizzled patch on the hip representing the maximum development of a pale area. There is the barest indication of grizzling behind the ear and on the cheeks in a few specimens.

One male from Banguey Island (No. 3414) differs from the remainder of the series in having the whole of the underparts paler and brighter: otherwise this race is exactly like *pluto* in the colour of the underparts which is near "morocco red" (Ridgway).

Sciurus notatus dilutus Miller.

Sciurus dulitensis, Lyon (part.), Proc. U. S. Nat. Mus., 40, 1911, p. 84.

Sciurus dulitensis dilutus, Miller, Smiths. Misc. Coll., 61, No. 21, 1913, p. 23 (Tanjong Batu, East coast Borneo, lat. 2° 15′ North).

Sciurus vittatus dulitensis, Gyldenstolpe, Kungl. Sv. Vet. Akademiens Handlingar, Band 60, No. 6, 1920, p. 36.

Sciurus notatus dilutus, Chas. and Kloss, Journ. Malayan Br. Roy. Asiat. Soc., vi, pt. 1, 1928, p. 41.

Kudat, Samawang, Bettotan and Rayoh: 21 ♂, 18 ♀.

We have before us about ninety skins of this species from various localities in Sarawak from Samarahan in the south to the Baram district in the north and they are so variable on the underparts that in this respect it is quite impossible to give precise subspecific characters for *dulitensis* which is the applicable name.[1]

1. *Sciurus vittatus dulitensis* Bonhote, Ann. Mag. Nat. Hist. (7), vii, 1901, p. 451, Mt. Dulit, 1,000 ft., N. Sarawak.

In other parts of Borneo the species seems to be equally variable. Lyon has noted its variability in south-west Borneo and Miller, Gyldenstolpe and ourselves in the eastern half of the island. Nevertheless, it is possible to recognize at least two races in Borneo, the characters of which are not entirely masked by the great variation in the colour of the underparts.

The great majority of *dulitensis* is brighter than most of the north Bornean skins and even when these last are compared with the palest *dulitensis* the subtle difference in colour, red towards orange in *dulitensis* against ochraceous in *dilutus* is apparent: Sarawak specimens are furthermore usually browner and less grey on the upperparts than *dilutus*.

We have therefore listed our material as *dilutus* although they may not be truly representative of that form. As a series they are less hoary below than the examples we have examined from the Mahakkam river south of the type locality (Chasen and Kloss, l. c. s.).

The palest-backed examples are from Kudat. With the single specimen from Rayoh agree nine skins collected at Jesselton in 1925: they are rather deeply coloured below and could be placed equally well in *dulitensis*.

(For measurements *see* page 58).

Sciurus notatus malawali subsp. nov.

Type.—Adult male (skin and skull), collected on Mallewallé Island, North Borneo, on 8th September, 1929. Raffles Museum, No. 3446.

Diagnosis.—Like *S. n. dilutus* of North Borneo but smaller: greatest length of the skull 47.5 – 48.5 mm. against 48 – 50.2 mm. in *dilutus*. Tail never with a warmer tip or brownish suffusion on the undersurface.

Skull and teeth.—As in *dilutus*.

Measurements.—*See* page 59.

Specimens examined.—Nine skins and ten skulls from the type locality, compared with many examples of *dilutus* from the typical representatives of *dilutus*, but even these have a warm flush mainland.

Remarks.—This island race should be compared with the paler, on the end and the underside of the tail although this is never pronounced enough to form a pencil.

Sciurus adamsi Kloss.

Sciurus adamsi, Kloss, Journ. Straits Branch Royal Asiatic Soc., 83, 1921, p. 151 (upper Baram River, N. E. Sarawak).

Bettotan and Rayoh: 1 ♂ , 2 ♀ .

The re-discovery of this squirrel, originally described from two specimens collected by Moulton is an interesting event.

S. adamsi is a good species, existing side by side with *S. notatus dulitensis* and *S. n. dilutus*, from which it is only to be distinguished by small size and buffy patches behind the ears.

There is an unfortunate error in the original description of *adamsi*: the length of the hind-foot of the type should read 38 *not* 48 mm.

We postpone further discussion of *S. adamsi* until a forthcoming paper on the mammals on Mt. Kinabalu, in the neighbourhood of which we have recently collected a larger series.

(For measurements *see* page 59).

Sciurus hippurus pryeri (Thos.).

Sciurus pryeri, Thomas, Ann. Mag. Nat. Hist. (6), x, 1892, p. 214 (Sandakan Bay, N. E. Borneo).

Samawang and Bettotan: 5 ♂ , 9 ♀ .

(For measurements *see* page 61).

Although to include the white-bellied *pryeri* and the red-bellied forms of *hippurus* in one species is to take a broad view it seems that nowhere do the ranges overlap and the greatest difference in colour, which is that of the underparts, is bridged by *inquinatus* Thos.,[1] from an intermediate locality, the Lawas River in Brunei.

S. h. hippurellus[2] which has red underparts, a dark tail and the forearm largely brown occurs in western Borneo at Batu Ampar on the Landak River and below Tyan on the Kapuas River. It seems, fide Thomas (l. c. s.), also to occur in the south-western Sarawak ("quite similar to Malaccan examples"): south Bornean specimens "are also of the usual red-bellied type".

S. h. borneensis (Gray), which also has red underparts and a dark tail but the outerside of the forearm grey, occurs in the remainder of Sarawak from which State we have specimens from Balingean, Baram and Mt. Dulit.[3] Gyldenstolpe has also recorded it in the Boeloengan District of Dutch East Borneo.[4]

1. *Sciurus pryeri inquinatus* Journ. Bombay Nat. Hist. Soc., xviii, 1908, p. 247. Lawas River, Brunei, N. W. Borneo.

2. *S. hippurellus* Lyon, Smiths. Misc. Coll., 50, pt. I, 1907, p. 27. Landak River, South-western Dutch Borneo.

3. We do not consider that *Macroxus rufogaster borneensis* Gray, 1867, is invalidated by *Sciurus borneoensis* Müll. and Schl., 1839—44. For those who hold a contrary opinion Bonhote, in 1901, renamed this form *Sciurus hippurus grayi*. Müller and Schlegel's squirrel is a form of *prevosti* which Thomas, and those who follow him, place in the genus *Callosciurus*, and for them, since they refer the *hippurus* forms to *Tomeutes*, the two names originally proposed do not clash.

North Sarawak may be taken as the type locality of *borneensis*.

4. *Tomeutes hippurus grayi*, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 38.

S. h. pryeri with white underparts, a grey tail, parti-coloured forearms and differing from all the other races in having the thighs concolorous with the back, has a very limited distribution. It seems only to be known from the vicinity of Sandakan and Paitan. Hose[1] says that Whitehead obtained it on Mt. Kinabalu but neither Thomas nor Whitehead mention the specimen in their accounts of the mammals of that mountain.

S. h. inquinatus is the interesting intermediate form: it is like *pryeri* but has the underparts pale rufous instead of white. It is only known from the Lawas River in Brunei, N. E. Borneo.

Normally the grey areas on the shoulders of *pryeri* extend further back than in *hippurus* and *borneensis*. The colour of the outside of the forelimb is variable: in one specimen it is almost entirely grey but in the others the outer edge is broadly brownish like the back. The tail is rather less distichous and the individual hairs are shorter. Some examples of *pryeri* have a very narrow greyish area on the outer edge of the thigh, thus providing a further link with the more typical coloured races of the species. One female has the underparts washed with buff, thus approaching *inquinatus*; but in all the others the underparts are white. A skin of *pryeri* in the British Museum, from Paitan (Everett coll.), is also washed with buff below. On its label Thomas has written "another specimen, same date and place, is the usual white below".

Sciurus lowii lowii (Thos.).

Sciurus lowii, Thomas, Ann. Mag. Nat. Hist. (6), 9, 1892, p. 253 (Lumbidan, Brunei and Baram, N. Sarawak); Lyon, Proc. U. S. Nat. Mus., 40, 1911, p. 91.

Sciurus lowii bangueyae, Thomas, Ann Mag. Nat. Hist. (8), 5, 1910, p. 386 (Banguey Id.).

Sciurus lowii lowii, Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 39; Chas. and Kloss, Journ. Malayan Br. Roy. Asiat. Soc., vi, pt. 1, 1928, p. 43.

Samawang, Bettotan, Kudat and Rayoh: 9 ♂ , 13 ♀ ; Banguey Island: 7 ♂ , 4 ♀ .

All the specimens listed above seem to belong to one race, the island examples being in our opinion inseparable from typical *lowii* of North Sarawak.

(For measurements *see* page 60).

Rhinosciurus laticaudatus laticaudatus (Müller and Schleg.).

Sciurus laticaudatus, Müller and Schleg., Verh. Nat. Gesch. Ned. Bezitt., 1839 - 44, Zool., p. 100, pl. XV, figs. 1, 2, 3 (Pontianak, West Borneo).

Bettotan and Benoni near Jesselton: 1 ♂ , 1 ♀ .

1. Mammals of Borneo, 1893, p. 45.

These two specimens are not unlike the animal figured by Müller and Schlegel. It is noticeable that all are washed with ochraceous-rufous on the underparts. Hose[1] has stated that "the under surface is nearly pure white in some, and rich orange-yellow in others" but the descriptions of this author are admittedly based on those of previous writers and often are not made from Bornean animals: in this case the description seems composite in character. This squirrel seems curiously rare in Borneo.

(For measurements *see* page 61).

Nannosciurus exilis sordidus Chas. and Kloss.

Nannosciurus exilis sordidus, Chas. and Kloss, Journ. Malayan Br., Roy. Asiat. Soc., VI, pt. 1928, p. 44 (Telen River, East Borneo).

Samawang, Bettotan and Gomantong: 9 ♂ , 4 ♀ .

Animals from North Borneo belong to this pale race recently described by us from Long Temelan in Middle East Borneo. They are very distinct from a series collected in the Saribas and Baram districts of Sarawak.

The cinnamon-rufous wash of the upperparts is strongest on the nape and forepart of the back and weakest on the flanks and lower back.

(For measurements *see* page 62).

Nannosciurus exilis retectus (Thos.).

Nannosciurus exilis retectus, Thomas, Ann. Mag. Nat. Hist. (8), V, 1910, p. 387 (Banguey Id.).

Banguey Island: 4 ♂ .

This form is very near to *sordidus* of the mainland but is a shade less richly coloured above and has the underparts rather more creamy in colour.

(For measurements *see* page 62).

Rattus sabanus sabanus (Thos.).

Mus sabanus, Thomas, Ann. Mag. Nat. Hist. (5), XX, 1887, p. 270 (Kinabalu, North Borneo); Jentink, Notes Leyd., Mus., XIX, 1897, p. 61.

Rayoh and Bettotan: 3 ♂ , 5 ♀ .

It is doubtful whether there is any difference in colour between *sabanus* and *vociferans*.[2] We have very large series of the latter and they average rather duller than *sabanus* which is the reverse of the condition noted by Miller: the difference no doubt depends

1. Mammals of Borneo, 1893, p. 49.
2. *Mus vociferans*, Miller Proc. Biol. Soc. Wash. XIII, 1900, p. 138 (Trang, Peninsular Siam).

entirely on the age of the skins, the freshest skins being the brightest.

Most examples of *sabanus* have the tail entirely dark but some have the tip white for about fifteen millemetres. In *vociferans* the under-side of the tail is usually white: sometimes the tail is largely white and only bicolored at the base.

Mammæ $\frac{2-2}{2-2}$

(For measurements *see* page 63).

Rattus surifer bandahara Robinson.

Rattus bandahara, Robinson, Ann. Mag. Nat. Hist. (9), VII, 1921, p. 234 (Kinabalu, N. Borneo).

Rattus surifer bandahara, Chasen and Kloss, Journ. Malayan Branch Roy. Asiat. Soc., VI, part 1, 1928, p. 45.

Kudat and Rayoh: 6 ♂, 2 ♀.

Robinson has shown that *R. rajah* of authors is composite. It is therefore impossible to arrange the synonomy of *rajah* and *bandahara* from literature as until lately both were probably recorded under the former name. The brighter specimens from south-eastern Borneo referred to *rajah* by Lyon[1] are perhaps *bandahara*. In this paper we cannot record *rajah* and *bandahara* from the same locality and it is curious that, although we have both from Sarawak, collections from a given collecting station only contain one of the species. The type of *bandahara* came from the foothills of Mt. Kinabalu and the describer was not quite right in regarding it as the Borneo highland representative of *surifer*. The type of *rajah* is a specimen in bad condition collected at the base of Mt. Batu Song in the Baram district of Sarawak.

The characters given by Robinson for separating *bandahara* and *rajah* are not absolute and although typical specimens of either form are so distinct that we have no doubt as to their specific status, a number of the *rajah* series (never aged animals) have been identified on the balance of characters: some of these have the nasal bones exactly as in *bandahara*.

An unusually large skull from Sarawak measures 51 mm. in greatest length!

(For measurements *see* pages 64, 65).

? Rattus surifer panglima Robinson.

? *Rattus panglima*, Robinson, Ann. Mag. Nat. Hist. (9), VII. 1921, p. 234; Island of Palawan.

Banguey Island: 2 ♂; Balambangan Island: 1 ♀: Mallewallé Island: 1 ♂, 1 ♀.

1. Proc. U. S. Nat. Mus. 40, 1911, p. 107.

These rats are much darker and duller than *R. s. bandahara* from the mainland of North Borneo and they all have the tail shorter than the head and body, a condition only exceptionally obtaining in *bandahara*.

R. s. panglima is described (from a single specimen collected by A. H. Everett) as an extremely dull rat and although the type, which we have not seen, seems to differ in detail from the specimens before us the two forms are evidently very closely allied although purely on geographical grounds we have no doubt that they will eventually prove to be distinct.

In *panglima* a narrow line of white is said to join the underparts to the feet and when compared with typical *R. surifer* the nasals are stated to be very broad anteriorly and rapidly contracting. In only one of our series is the first character to be remarked and we cannot appreciate the cranial distinction. The length of the tail is not mentioned in the original description of *panglima*.

All the examples before us have the underfur grey, a coloured gorget and, excepting the one animal mentioned above, the inside of the lower thigh coloured. The skins from Balambangan and Mallawallé are alike in colour and very dark on the upperparts: they are very different from any skin we have seen from the mainland of Borneo. The two skins from Banguey are rather paler but they lack the rich colour of *bandahara*. They are however very worn and as they have comparatively short tails we place them with *panglima*.

There is so much variation in the skulls of *bandahara* that we can detect no difference in those of these rats from the small islands likely to be of racial value.

(For measurements *see* page 65).

Rattus rajah rajah (Thos.).

Mus rajah, Thomas, Ann. Mag. Nat. Hist. (6), XIV, 1894, pp. 451, 454 (Batu Song, Baram, N. Sarawak). Bettotan and Samawang 10 ♂, 13 ♀.

Skulls of *R. r. rajah* in the Raffles Museum run up to 47 mm. in greatest length, a maximum not attained by any individual in the present collection.

(For measurements *see* page 64).

Rattus cremoriventer kina (Bonhote).

Mus kina, Bonhote, Ann. Mag. Nat. Hist. (7), XI, 1903, p. 124 (Kinabalu, N. Borneo).

Epimys kina, Lyon, Proc. U. S. Nat. Mus., 40, 1911. p. 112.

Rattus kina. Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 42.

Rattus cremoriventer kina, Chas. and Kloss, Journ. Mal. Br. Royal Asiat. Soc., VI, pt. 1, 1928, p. 46.

Bettotan and Rayoh: 2 ♂ , 3 ♀ .

Lyon (l. c. s.) has quite justly remarked that this form differs but very slightly from typical *cremoriventer*. It certainly is not larger as Bonhote stated, for continental specimens have the skull length running up to 38 mm. in greatest length. The two races seem sufficiently differentiated by the nasal bones, those of *kina* tapering posteriorly in a more marked degree than in *c. cremoriventer* in which there is a tendency for those bones to be truncated.

(For measurements *see* page 66).

Rattus cremoriventer malawali subsp. nov.

Type.—Adult male (skin and skull), collected on Mallewallé Island, North Borneo, on 9th September, 1927. Raffles Museum No. 3455.

Characters.—Like *R. cremoriventer kina* (Bonh.) of the mainland of Borneo, but duller in colour and the tail pale beneath.

Skull and teeth.—Essentially as in *kina*.

Measurements.—*See* page 66.

Specimens examined.—One male (the type) and two females from Mallewallé Island, five males and three females from Banguey Island and two males from Balambangan Island.

Remarks.—Like *cremoriventer* of the Malay Peninsula the tail of *kina* is entirely dark, but in all the examples from the islands the tail is pale beneath, not definitely bicolored as in some spiny-backed rats, but merely fleshy in colour: this difference in the colour of the tail is equally noticeable in the skins. Compared with an equal series of *kina* the difference in colour between the two forms is very marked. The pelage of *malawali* is a fine grizzle of black and buff, with an admixture of ochraceous chiefly on the fore part of the body; the flanks are particularly dull, entirely lacking the bright element.

$$\text{Mammæ} \quad \frac{2-2}{2-2}$$

Rattus whiteheadi whiteheadi (Thos.).

Mus whiteheadi, Thomas, Ann. Mag. Nat. Hist. (6), XIV, 1894, pp. 452 and 457 (Mt. Kinabalu, N. Borneo).

Mus whiteheadi perlutus, Thomas, op. cit. (8) VII, 1911, p. 205 (Balingian, W. Sarawak).

Epinys whiteheadi, Lyon, Proc. U. S. Nat. Mus., 40, 1911, p. 106.

Rattus whiteheadi whiteheadi, Gyldenstolpe, Kungl. Sv. Vet. Akademiens Handlinger, Band 60, No. 6, 1920, p. 43.

Rattus whiteheadi, Chas. and Kloss, Mal. Br. Roy. Asiat. Soc., VI, pt. 1, 1928, p. 44.

Mainland (Bettotan and Rayoh): 9 ♂ , 1 ♀ ; Banguey Island: 5 ♂ , 2 ♀ ; Mallewallé Island: 2 ♂ , 2 ♀ ; Balambangan Island: 5 ♂ , 4 ♀ .

No. 3410 from Banguey Island has a long skull (greatest length 35.5 mm.) but similar specimens occur elsewhere throughout the range of *whiteheadi*.

The series from the three islands are all dull in colour and the specimens from Mallewallé are both above and below the darkest example of this species we have seen. Nevertheless, we can see no reason to separate any island form: in size and in cranial characters all seem alike.

The variation and the various synonyms of this rat have been discussed at length by Robinson and Kloss.[1]

Tail pale beneath.

(For measurements *see* pages 67, 68).

Rattus bæodon (Thos.).

Mus bæodon, Thomas, Ann. Mag. Nat. Hist. (6), XIV, 1894, pp. 452, 458 (Mt. Kinabalu, N. Borneo).

Bettotan: 1 ♂ , 1 ♀ ; Rayoh: 2 ♂ , 2 ♀ .

This species was first obtained by Everett's collectors on Mt. Kinabalu (probably on the foothills). The type is an adult female in alcohol and nothing seems to have been published about it since the original description appeared.

Our small series shows little variation in colour. The upperparts are very like those of the much larger *pellax* of the Malay Peninsula although a little brighter. Thomas' description of the colour is not very apt, when applied to the specimens before us and it was almost certainly drawn up from the alcoholic type:—"General colour rufous brown (browner on the head, more rufous on the rump), finely speckled with yellowish." The skins before us are clay colour, tinged with tawny-ochraceous, brightest on the cheeks, shoulders and flanks but not so bright as in *R. surifer bandahara*. Posterior upperparts washed with vandyke brown. Underparts buffy-white, sometimes entirely washed with tawny-ochraceous: in one specimen the throat is almost rufous. Tail pale beneath and sometimes a trifle longer than the head and body. On all parts of the body the spines are whitish at the base. The very scanty underfur is white on the underparts, greyish white on the darkened posterior area on the upperparts and whitish or grey tipped with ochraceous elsewhere.

1. Journ. Fed. Mal. States Mus., VIII, pt. 2, 1918, p. 49.

Other cranial measurements not included in the table are:— palatilar length 13; breadth of palate between alveoli of posterior molars 4.2; least breadth interpterygoid space 2.6; least inter-orbital width 7; breadth of braincase 14.6; lower molar row 4.4 mm. (No. 3312).

Unfortunately in most of the Rayoh specimens the tail is imperfect. This species is very like *whiteheadi* and easy to confuse with that species. There is very little difference in the size and proportions of the two animals. The main external distinctions are in the character and colour of the pelage. *R. whiteheadi* has the pelage less spiny and especially are the spines on the underparts weaker in character. The underfur is more plentiful and always dark grey at the base even on the underparts. There is never a contrasting darkened posterior zone on the upperparts.

But Thomas has pointed out that the chief distinction between the two forms lies in the shorter tooth row and smaller, more delicately constructed teeth of *bæodon*.

The skulls are much alike, but that of *bæodon* can usually be recognized by the narrower zygomatic plate, the anterior edge of which is straight and sloping backwards whereas in *whiteheadi* it is convex. The whiskers of *bæodon* are rather longer than those of *whiteheadi*.

We are unable to ally this rat with any other form known to us and cannot discuss its affinities further: for the present it must stand as an isolated full species.

(For measurements *see* page 69).

Rattus concolor ephippium (Jentink).

Mus ephippium, Jentink, Notes Leyden Mus., 2, 1880, p. 15 (Sumatra); Lyon, Proc. U. S. Nat. Mus. XXXIII, 1907, p. 558.

Epimys ephippium, Lyon, Proc. U. S. Nat. Mus., 40, 1911, p. 98.

Rattus concolor ephippium, Chas. and Kloss, Journ. Mal. Br. Roy. Asiat. Soc., VI, 1, 1928, p. 46.

Bettotan and Kudat: 10 ♂ . 6 ♀ ; Banguey Island 5 ♂.

The Banguey series is apparently inseparable from that of North Borneo. All the skins are very pale underneath and quite different from some from Sarawak and west Borneo in which the underparts are a much darker grey. Specimens from Tenasserim Town, together with the majority of specimens from the Malay Peninsula are also dark below, but in the Malay Peninsula examples like those from North Borneo are also common.

The greater breadth of the palate is the character on which *ephippium* can be maintained against *concolor* (*vide* Robinson and Kloss, Journ. Fed. Mal. States Mus., VIII, pt. 2, 1918, p. 56).

(For measurements *see* page 69).

Rattus rattus turbidus (Miller).

Epimys rattus turbidus, Miller, Smiths. Misc. Coll., Vol. 61, No. 21, 1913, p. 12 (Lower Mahakam River, East Borneo).

Rattus neglectus, Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 44.

Bettotan: 1 ♂.

It is evident that the field rat of the Bornean lowlands is divisible into races. Specimens from the south of the island, the west (including the small coastal islands) and Sarawak have whitish underparts: these are *jalorensis* Bonhote (*neglectus* auct.).

In the east and north of the island a rat with grey underparts occurs.[1] The type locality of *turbidus* is Tenggarong near the mouth of the Mahakam River and it is described as like "*neglectus* from southern Borneo but color of underparts a dull drabby gray, inconspicuously contrasted with that of the sides." A single example with whitish underparts from higher up the Mahakam River was recently listed by us as *neglectus*;[2] but judging from the description the specimens recorded by Gyldenstolpe from Boeloengan are evidently *turbidus*.

The single specimen before us from North Borneo has the upperparts rather darker than Bornean *jalorensis* and a series might therefore justify the separation of yet another race, intermediate between *turbidus* (in which only the underparts are darkened) and the extremely dark forms found in the North Borneo islands and apparently also on Maratua Island, eastern Borneo.[3]

(For measurements *see* page 70).

Rattus rattus banguei subsp. nov.

Type.—Adult male (skin and skull) collected on Banguey Island, North Borneo on 4th September, 1927. Raffles Museum No. 3399.

Characters.—Like *R. r. turbidus* (as represented by north Bornean material) but much blackened above and darker below The upperparts entirely lacking the warm element common to the more typical forms of *R. rattus*, the ochraceous or buff elements in the pelage being replaced by hair-brown. Underparts from chin to vent dark grey.

Skull and teeth.—Essentially as in *jalorensis* and *turbidus*, but the palatal foramina perhaps more open than in at least the former race.

Measurements.—*See* page 70.

1. In Journ. Malayan Br. Roy. Asiat. Soc., VI, pt. 1, 1928, p. 46 we suggested apparently without justification, that *turbidus* was the same as *diardi*.

2. l. c. s., where *neglectus* = *jalorensis*, but we now follow Dammerman in considering *neglectus* as a synonym of *diardi*.

3. *Epimys tua* Miller, Smiths. Misc. Coll., Vol. 61, No. 21, 1913, p. 12.

Specimens examined.—Five males and four females from Banguey Island; one male from Mallewallé Island.

Remarks.—On description this race seems near to *R. tua* (Miller) from Maratua Island but that is a larger rat, the type of *tua* (adult female) measuring head and body 185; tail 170; hind-foot 39; condylo-basal length of skull 40.1 and zygomatic breadth 19.8 mm. The single specimen from Mallawallé differs from the others in having the throat creamy white and the grey underparts washed with the same colour.

Mammæ $\frac{2 - 2}{3 - 3}$

Rattus rattus diardi (Jentink).

Mus diardi, Jentink, Notes Leyden Mus., 2, 1880, p. 13.

Rattus rattus diardi, Chas. and Kloss, Journ. Mal. Br. Roy. Asiat. Soc., VI, pt. 1, 1928, p. 46.

Kudat: 3 ♀ .

Near the port of Kudat was the only locality where we obtained these coarsely built house-rats.

(For measurements *see* page 70).

Rattus mulleri borneanus (Miller).

Mus mülleri, Jentink, Notes Leyd. Mus., 11, 1879, p. 16; id., op. cit. XIX. 1897, p. 62.

Rattus muelleri, Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 43.

Rattus infraluteus (nec Thomas), Gyldenstolpe, t. c. s., p. 44.

Epimys borneanus, Miller, Smiths. Misc. Coll., 61, 1913, p. 15 (Karang Tigau Bay, East Borneo).

Rattus muelleri borneanus, Chas. and Kloss, Journ. Malayan Br. Roy. Asiat. Soc. VI, pt. 1, 1928, p. 47.

Bettotan and Gomantong: 8 ♂ , 6 ♀ .

The variation in the colour of the underparts in this series is large and about equal to that exhibited by series from Sarawak and eastern Borneo.

R. m. borneanus is very like typical *mülleri* but it has a longer tail and the pale rufous or chamois colour of the underparts shewn by many Bornean examples is probably another racial character.

We have no topotypes of *integer*[1] from Sirhassen, South Natuna Islands, but on description this form and *borneanus* seem extremely close: an example from Bungurun is exactly like some *borneanus*

[1] *Mus integer* Miller, Proc. Wash. Acad. Sci., III, 1901, p. 119.

in colour and there is great variation in the breadth of the rostrum in the large number of *borneanus* before us. It is of course improbable that the two forms are identical, but at present the longer tail of *borneanus* seems the most satisfactory reason for separating them.

The skulls of this species are also unusually variable in shape and size and many skulls, apparently perfectly adult, are really much smaller than their racial maximum. This extreme degree of variation is well illustrated if the skull measurements of numbers 3293 and 3681 are compared. Both are males and adult with the teeth showing about the same amount of wear and although the larger skull has some of the cranial ridges very slightly heavier than in the other specimen there is, beyond its larger size, little justification for considering that it is older.

This species has been discussed at length in several recent publications[1] wherein it has been shown that *bullatus* and *mülleri* are distinct species, the latter with many sub-species including at least *firmus* and all the forms described as closely allied to it and *validus*.

Mammæ $\frac{2 - 2}{2 - 2}$

(For measurements *see* page 71).

Rattus mulleri subsp.

Banguey Island: 5 ♂ , 6 ♀ ; Balambangan Island: 3 ♂ , 2 ♀

These rats from the islands are very like *borneanus* of the mainland but they have rather shorter tails and probably represent a new race which we cannot describe in the absence of topotypes of *integer* Miller from Sirhassen Island, South Natuna Islands.

In colour they resemble *borneanus* and show almost the same variation although none is white on the underparts as are some *borneanus*; but in such a variable species much larger series would be required to substantiate this character as of racial value.

The skull and teeth are not appreciably different from those of *borneanus*: the zygomatic breadth averages smaller but the series is small and the difference therefore insignificant. There is sometimes a small anterior, outer cusp on the posterior molar in animals from both the mainland and the islands.

Mammæ $\frac{2 - 2}{2 - 2}$

(For measurements *see* page 71).

[1] Robinson and Kloss, Journ. Fed. Mal. States Mus., VIII, 1918, p. 51; op. cit. VII, 1919, pp. 278 and 315.

Hæromys margarettæ margarettæ (Thos.).

Mus margarettæ, Thomas, Ann. Mag. Nat. Hist. (6), XI, 1893, p. 346 (Penrisen Hills, S. W. Sarawak).

? Hæromys sp., Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 45.

Bettotan: 1 ♀.

In colour this specimen agrees fairly well with the description of *margarettæ* excepting that the throat is washed with the colour of the upperparts which is paler than "deep rufous chestnut" and nearer to the hazel or sayal brown of Ridgway.

The tail was noted in the field as black and the mammæ as $\frac{1-1}{2-2}$.

Dimensions in millimetres (the figures in brackets are those given by Thomas for the type of *margarettæ*):—Head and body 77 (76); tail 136 (144); hind-foot 18 (19.7).

Skull: greatest length 24.4 (25.5); condylo basilar length 20.7; palatilar length 10; zygomatic breadth 13 (13); length of nasals 8 (7.6); interorbital breadth 4 (4.1); diastema 6.4 (6.8); anterior palatine foramina 3 (3.6); length of upper molar series 3.5 mm.

The specimen before us is therefore rather smaller than the type but is too large for *pusillus* Thos., with which it has been compared. The type of *margarettæ* (hither apparantly unique) is preserved in alcohol in the British Museum.

In the flesh the ear was measured as 9 mm. but this seems to be an error for 14 mm. judging from the skin. Thirteen millimetres is the size given for the ear of the type.

Hystrix crassispinis crassispinis Günther.

Hystrix crassispinis, Günther, Proc. Zool. Soc., 1876, p. 736, figs. 1 (a, b, c) and pl. LXX (Borneo, opposite Labuan Id).

Thecurus, Lyon, Proc. U. S. Nat. Mus., XXII, 1907, pp. 576, 577, 582, pls. LIV—LVI (fig. 1), pl. LVII (figs. 2, 9, 10).

Bettotan: 1 ♂, 2 ♀.

The skins before us are not quite so reddish as the animal in Günther's plate. The adult male has a few white hairs on the nape, representing a crest and the hairs on the hands and feet are largely white. The small spines on the fore-part of the body are brown, on the flanks narrowly tipped with white. On the hinder part of the body the spines are white at the base, then black and finally tipped with white, but the extent of the zones is extremely variable. On the undersurface, the bristles are mostly brown tipped with white but entirely white bristles occur. There is an indistinct white gorget.

The female is like the male but is without the white hairs on the nape and has the hands and feet black.

The immature animal has the spines of the fore-part of the body tipped with white and also has the inner side of the limbs largely white.

(For measurements *see* page 72).

Trichys lipura lipura Günther.

Trichys lipura, Günther, Proc. Zool. Soc. Lond., 1876, p. 739, pl. LXXI (Borneo, opposite Labuan Id.), Lyon, Proc. U. S. Nat. Mus., XXXII, 1907, p. 590; id. op. cit. 40, 1911, p. 113; Gyldenstolpe, Kungl. Sv. Vet. Akademiens Handlingar, Band 60, No. 6, 1920, p. 46.

Trichys guentheri, Thomas, P. Z. S., 1889, p. 235.

Trichys fasciculata, Jentink, Notes Leyden Mus., XIX, 1897, p. 63.

Bettotan: 3 ♀.

In view of differences of opinion as to the application of *Hystrix fasciculata* Shaw, we use, for the present, as the species name the name under which the Bornean animal was first made known. The Sumatran form *Trichys macrotis* Miller (1903), seems to differ little, if at all, from the continental animal.

(For measurements *see* page 72).

INSECTIVORA

Tupaia glis longipes (Thos.).

Tupaia ferruginea longipes, Thomas, Ann. Mag. Nat. Hist. (6), XI, 1893, p. 343 (Borneo, opposite Labuan Id.).

Tupaia longipes longipes, Lyon, Proc. U. S. Nat. Mus., 45, 1913, p. 76.

Samawang, Bettotan and Rayoh: 7 ♂, 6 ♀.

Lyon has examined the type and associates with it skins from Kalulong in Sarawak north to Spitang in British North Borneo and also specimens collected by Doria and Beccari in "Sarawak".

A specimen from the Baram River is exactly like the animals before us. Some are changing their coats and in these the old portions of the pelage are distinctly ferruginous.

In the fresh pelage the whole of the upperparts is a fine grizzle of black and ochraceous-buff. There is no ferruginous element anywhere and not the slightest difference between anterior and posterior parts of the body. The centre of the underside of the tail is entirely buffy. The shoulder-stripe is orange rufous.

In the south-east of Borneo occurs a race, *salatana* Lyon,[1] in which the shoulders are rufescent, the anterior and posterior portions of the back contrasted and in which the toothrow is comparatively short: in the west of the island this race extends as far north as the Melawi, a tributary of the Kapuas River.[2] At present we prefer not to determine animals from the west of Sarawak. The few examples we have are all in worn pelage: they may represent yet another race.

Three pairs of mammæ.

(For measurements *see* page 73).

Tupaia minor minor Günther.

Tupaia minor, Lyon, Proc. U. S. Nat. Mus., XL, 1911, p. 123; Gyldenstolpe, Kungl. Sv. Vet. Akademiens Handlingar, Band 60, No. 6, 1920, p. 20.

Rayoh: 4 ♀ .

The type locality in Borneo, opposite Labuan Id.

(For measurements *see* page 76).

Tupaia minor caedis subsp. nov.

Tupaia minor minor, Lyon (part), Proc. U. S. Nat. Mus., XLV, 1913, p. 110.

Type.—Adult male, skin and skull, collected on Balambangan Island, British North Borneo on 10th October, 1927, Raffles Museum No. 3472.

Diagnosis.—Like *T. m. minor* but the upperparts without a brownish wash and the shoulder stripe narrower and pale buff in colour.

Skull and teeth.—As in the typical race.

Measurements.—*See* pages 75, 76.

Specimens examined.—Samawang, Bettotan and Kudat: 10 ♂ 10 ♀ ; Banguey Island: 2 ♂ , — ♀ ; Balambangan Island: 5 ♂ , 3 ♀

Remarks.—Although a series of fifty skins of T. minor from Sarawak and North Borneo shows a perfect gradation it is at once clear that the extremes cannot be placed under the same sub-specific name.

Animals from Samarahan and Saribas in southern Sarawak have the upperparts browner and the shoulder stripe wider and whiter than those from the islands and the extreme north of the mainland of Borneo, in some of which the upperparts are entirely without brownish or russet wash. One specimen from Samarahan is like the northern examples in colour but it has the shoulder stripe broad and white.

1. Proc. U. S. Nat. Mus. 45, 1913, p. 77 (Pangkalan R., S. E. Borneo).
2. *Vide* Chasen and Kloss, Journ. Malayan Br. Roy. Asiat. Soc. VI, pt. 1, 1928, p. 48.

To define the geographic limits of the two races is not easy firstly on account of the gradation in colour and secondly because the type locality of *minor minor*, which is the mainland opposite the island of Labuan, is in the intermediate area.

The specimens from Rayoh (between Beaufort and Tenom) may be taken as practically topotypes of *minor*: they have the upperparts, especially posteriorly, strongly washed with russet and three out of four have the shoulder stripe more conspicuous than in the island series. It therefore seems preferable to separate a northern race which is best typified by the Balambangan series, the Banguey skins being a shade darker above. Some examples from Kudat are exactly like topotypes of *caedis*: those from Bettotan and Samawang are definitely nearer *caedis* than *minor*. Typical *minor* also occurs at Melawi in west Borneo, Mt. Dulit in Sarawak, and on the Mahakam River in middle east Borneo.

The largest example of this species we have examined is a male from 3,400 feet on Mt. Dulit. It has the greatest length of the skull 38.5 mm. but it seems to be unusually large as smaller normal animals occur in the same place.

None of the topotypes could be confused with any Sarawak skin before us.

Two pairs of mammæ.

Tupaia gracilis gracilis (Thos.).

Tupaia gracilis, Thomas, Ann. Mag. Nat. Hist. (6), XII, 1893, p. 53 (Batu Song, Baram, N. Sarawak), Lyon, Proc. U. S. Nat Mus., 40, 1911, p. 123.

Tupaia gracilis gracilis, Lyon, Proc. U. S. Nat. Mus., 45, 1913, p. 117; Chas. and Kloss, Journ. Malayan Br. Roy. Asiat. Soc., VI, pt. 1, 1928, p. 49.

Samawang, Bettotan and Rayoh: 4 ♂ , 3 ♀ ; Banguey Island: 1 ♀ .

Some examples are rather more olive above than others. The shoulder stripe varies in colour from white to buffy and the normally white underparts are sometimes strongly washed with ochraceous-buff on the throat and fore part of the chest.

The varying colour of the tail is difficult to understand: sometimes, in accordance with Lyon's description, it is a fine grizzle of black and buff but occasionally it is quite grey, an effect produced by the individual hairs being black with three broad white bands: perhaps the grey tail is characteristic of the new pelage. The single example from Banguey seems exactly like some from the mainland.

Two pairs of mammæ.

(For measurements *see* page 74).

Tupaia tana paitana (Lyon).

Tana paitana, Lyon, Proc. U. S. Nat. Mus., 45, 1913, p. 150 (Paitan River, north-eastern Borneo).

Samawang River and Bettotan: 17 ♂ , 10 ♀ .

In the northern half of Borneo this species is very unstable and shows a marked tendency to break up into races. Very little is known about the confines of these.

Specimens from Sarawak and British North Borneo are very different from the dull typical form *T. tana tana* (of which we have Sumatran topotypes). Lyon extends the range to south Borneo, but from a casual inspection of material in the British Museum it seems likely that animals from this locality together with others from the Lampongs in south Sumatra should stand as *speciosus* Wagner.

T. t. utara, Lyon (t. c. s. p. 141), based on material from Mt. Dulit in North Sarawak, has been used to cover animals throughout the whole length of Sarawak; but those from at least the extreme southern part of the state are possibly separable from *utara* (as represented by specimens from Baram) on account of their generally brighter colour, especially the redder, less blackened upper side of the tail; darker nape and darker pale areas on either side of the dorsal stripe which is therefore less conspicuous than in typical *utara*. We have these brightly coloured animals from Mt. Penrissen and Samarhan.

Lyon has extended the range of *utara* northwards from Mt. Dulit as far as Sandakan Bay and within British North Borneo recognises the presence of two other "species," *T. chrysura* Günther, from the mainland opposite the island of Labuan and *T. paitana*.

The first of these is almost certainly only a local race of *T. tana* with a very limited distribution.

T. paitana is the name available for the northernmost Bornean race which the fair series before us from Samawang and Bettotan shows to be distinct from *utara*, although the character on which the race was founded is only the extreme expression of a rather variable phase. *T. t. paitana* differs from *utara* in the greater development of the pale areas on either side of the dorsal line.

The twenty-seven skins before us are extremely uniform on the underparts but show a fair range of variation above. All have a well marked dorsal stripe and the lower back extensively blackened. The extent of the grizzled area is the most variable feature. In the phase of its least development it lies entirely within an area bounded by an imaginary posterior prolongation of the shoulder stripes. The entire forelimb and the neck lateral and immediately adjacent to the shoulder stripe are, like the flanks, bright hazel or ferruginous. The opposite extreme is provided by a specimen in which the

grizzled area is broader on the back, extends over the base of the upperside of the forelimb and includes the shoulder stripe. It is impossible to believe that these two phases represent different species: furthermore they are confluent.

We cannot persuade ourselves to use *Tana* for these tupaias with relatively long snouts. The generic separation of *Tana* from *Tupaia* involves the splitting of a group characterised by a conspicuous and unique colour pattern within the family. The strikingly external resemblance shown by *T. picta* to the *T. tana* forms not improbably indicates a phylogenetic relationship quite as deeply seated as the characters used to diagnose *Tana*.

Two pairs of mammæ.

(For measurements *see* page 77).

Tupaia tana chrysura Günther.

Tupaia tana var. *chrysura*, Günther, Proc. Zool. Soc. London, 1876, p. 427, pl. 36: mainland of Borneo, opposite Labuan.

Rayoh: 1 ♀ , 2 juvenile ♂ , ♀ .

The female listed above seems to be fully adult although the skull is rather small. The adult and the two juveniles are very similar in colour and differ from all other specimens from north Borneo in having the underparts decidedly yellow and less ferruginous, the hazel element of the upperparts lighter, browner and less red and the lower back less blackened. The tail is a mixture of brownish hazel and blackish above but rather browner and less blackened, particularly at the base, than in *paitana*: on the underside the middle line is near orange-buff and much less red than in *paitana*. The pale grizzled area on the foreback is not extensive but on the shoulders it completely embraces the pale stripe which is white and not buffy as in all but two examples of *paitana*.

Because of these differences which are very marked when the skins are laid side by side we have placed the Rayoh animals with *chrysura* although this form has, typically, a sharply contrasted, uniformly buffy tail. Robinson and Kloss,[1] however, have already noted that a north Sumatran tree-shrew *Tupaia glis demissa* Thos., exists in a pale-tailed phase which is typical of *demissa* and a darker-tailed phase later differentiated sub-specifically, but we think without reason, as *phoenicura* Thos.

The seasonal changes of pelage in this genus are very imperfectly known and although in some species the colour is very constant throughout the year it is equally certain that in other forms the tail varies considerably in colour. In addition to *Tupaia demissa* mentioned above, *T. castanea* from Bintang Island in the Rhio Archipelago and *T. anambae* from the Anamba Islands can be mentioned.

1. Journ. Fed. Mal. States Mus., VII, pt. 2, 1923, p. 319.

A. H. Everett thought that *Tupaia chrysura* was confined to Lumbidan, a narrow peninsula on the north side of the Klias River opposite Labuan Island, isolated by a line of swamps and thus practically an island. This seems a reasonable explanation of the very limited distribution of a strongly marked form and it may of course eventually be proved that the animal occurring at Rayoh is really *T. tana chrysura* > *paitana* mostly resembling *chrysura* but not developing the very pale tail.

(For measurements *see* page 77).

Tupaia tana banguei subsp. nov.

Tana paitana (part), Lyon, Proc. U. S. Nat. Mus., 45, 1913, p. 150.

Type.—Adult male (skin and skull), collected on Banguey Island, North Borneo, on 7th September, 1924. Raffles Museum No. 3436.

Diagnosis.—Smaller than *T. tana paitana*. Grizzled areas of the upperparts darker and the dorsal stripe therefore rather less conspicuous. As a series the ground colour of the upperparts rather darker, more maroon than hazel: upperside of the tail not so bright, browner and less blackened; centre of the tail underneath only slightly paler than the sides, not conspicuously orange-rufous as in *paitana*.

Skull and teeth.—As in *T. t. paitana* but smaller.

Specimens examined.—Seven males and five females from the type locality.

Measurements.—*See* page 78.

Remarks.—As in *paitana* some specimens have the area immediately external to the shoulder stripe reddish whereas in others it is grizzled, but the proportion of the latter specimens is greater than in *paitana*.

Tupaia dorsalis Schlegel.

Tupaia dorsalis, Jentink, Notes Leyden Mus., xix, 1897, p. 47.

Tupaia dorsalis, Lyon, Proc. U. S. Nat. Mus., xxxiii, 1907, p. 562; op. cit. 40, 1911, p. 121; Chas. and Kloss, Journ. Mal. Br. Roy. Asiat. Soc., vi, pt. 1, 1928, p. 49.

Tana dorsalis, Lyon, Proc. U. S. Nat. Mus., 45, 1913, p. 152; Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 23.

Samawang and Bettotan: 3 ♂, 1 ♀.

There is very little variation in this small series except in the colour of the underparts, one specimen being more ochraceous, especially on the underside of the head and throat than the others and another being rather whiter below.

They are like the animals examined by us from Long Petak in central eastern Borneo (l. c. s.) and one from the Baram River. A second skin from the Baram River and two from Saribas in south Sarawak are more ferruginous on the posterior upper parts of the body than the skins from British North Borneo. Lyon describes this species as having the posterior parts of the body with the general effect of "burnt umber" and his specimens came from the lower Kapuas River in western Borneo (the type locality), throughout Sarawak to the Trusan River in Brunei and it may be that there is a second race, characterized by more yellowish, less ferruginous posterior upperparts, occupying north and east Borneo.

(For measurements *see* page 73).

Echinosorex gymnura alba (Giebel).

Gymnura alba, Giebel, Zeitschr. Ges. Naturw. XXII, 1863, p. 277, pls. i and ii (Borneo), Lyon, Proc. U. S. Nat. Mus., XXXVI, 1909, p. 453; Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920, p. 24.

Gymnura rafflesii var. *candida*, Günther, P. Z. S., 1876, p. 425 (Labuan, the mainland opposite Labuan and Sarawak).

Bettotan: 4 ♂, 3 ♀.

All these specimens are entirely white on the underparts but show a few black tipped-hairs on the dorsal surface although the position and number of these is variable.

In the three females the black hairs are very few and widely scattered: they are never present on the head. One male is immaculate except for a few black hairs on the hind neck. In another male there is a tendency for these to form a patch on the nape and in this skin they are also sprinkled generally over the upper parts. In the most heavily marked example the hairs are roughly grouped in two zones on the nape and the lower part of the back: even this animal is much whiter than either of two skins from Kuching and Baram in Sarawak. One of these has some black-tipped hairs on the underparts and in both the admixture of black on the upperparts is so much greater than in the north Bornean series that if the differences held in a larger number of Sarawak specimens we should not hesitate to recognise two forms. A series from the Sempang River, S. W. Borneo (*vide* Lyon, l. c. s.) is practically white like ours. Animals freely speckled with black may be confined to the Sarawak area and, if so, would be *candida* Günther, the rest of Borneo being perhaps occupied by *alba*. Fresh skins have both the long hairs and the shorter underfur quite white: the yellowish colour sometimes seen is due to staining or fading.

With Lyon we agree that the supposed differences between the skulls of *gymnura* and *alba* cannot be upheld[1] but it certainly does

1. c. f. Jentink, Notes Leyd. Mus., III, 1881, p. 166.

seem that *alba* has shorter hair and generally less profuse pelage than *gymnura*: however, the two Sarawak examples mentioned above seem to agree with *gymnura* in this last character. Jentink[1] also recorded a difference in the relative size of the claws on the fore-feet of the two forms but this we cannot appreciate.

Another point of difference is that in *alba* the tail is wholly white whereas in *gymnura* it is black with a lengthy terminal white portion.

"Ears pink; nose pink or fleshy; eyes black."

(For measurements *see* page 79).

Galeopterus variegatus borneanus Lyon.

Galeopithecus volans, Jentink, Notes Leyd. Mus., XIX, 1897, p. 41.

Galeopterus borneanus, Lyon, Proc. U. S. Nat. Mus., 40, 1911, p. 24 (Tjantung, S. E. Borneo); Gyldenstolpe, Kungl. Sv. Vet. Akad. Handl., Band 60, No. 6, 1920 p. 16.

Galeopterus lechei, Gyld. tom. cit., p. 17 (Toembang Maroewe, Central Borneo).

Galeopterus hantu, Cabrera, Bol. Real Soc. Espan. 24, 1924, p. 128 (North Sarawak).

Galeopterus variegatus borneanus, Chasen and Kloss, Bull. Raffles Mus., 2, 1929, p. 18.

Bettotan: 2 ♂, 1 ♀; Banguey Island: 2 ♂, 2 ♀.

We have already given our reasons for considering that only one race of *Galeopterus* inhabits the mainland of Borneo and that this race is doubtfully distinct from *natunae* Miller, described from the North Natuna Islands.

The three females listed above are in the usual grey pelage and in colour are similar to females of *peninsulae* from the Malay Peninsula. One ♂ from Bettotan is much more richly coloured than the two from Banguey and is almost identical with a specimen of *peninsulae* from Singapore. The other ♂ from Bettotan is in the peculiar rufous phase sometimes seen in both sexes of this animal. Since our remarks on *Galeopterus* were written (l. c. s.) we have seen similarly coloured specimens from Java and Sumatra. Both the females from Banguey have the interorbital space relatively broader than any of the large series before us with the exception of one or two individuals of the small races found on the islands off the coasts of the Malay Peninsula: in one specimen this measurement (22 mm.) is actually greater than in all but a few very broad skulls of ♀ *variegatus* and *peninsulae;* but we are so thoroughly sceptical of the value of any cranial character except size, unless it is confirmed by a large series of specimens, that we do not care to distinguish the Banguey animals.

(For measurements *see* page 80).

1. op. cit., XVII, 1895, p. 20.

CHIROPTERA

Pteropus vampyrus natunæ K. And.

Pteropus vampyrus natunæ, K. And., Ann. Mag. Nat. Hist. (8), ii, 1908, p. 369 (North Natunas and Sarawak).

Pteropus vampyrus, Lyon, Proc. U. S. Nat. Mus. 40, 1911, p. 127.

Balambangan Island: 1 ♀; Banguey: 3 ♂ juv., 3 ♀ juv.

The Balambangan specimen has a bright, sharply defined mantle. The forearm measures 188 mm.

Skull:—total length to gnathion 74 mm.; palation to incisive foramina 36.5 mm.; front of orbit to tip of nasals 26.5 mm.; zygomatic width 39.5 mm.; upper teeth $c - m^2$ 28.5 mm.

The teeth are a trifle larger than in three topotypes of *natunae*, especially p^4.

Lyon (l. c. s.) records "*vampyrus*" from south-eastern Borneo; but does not mention *natunae* described three years earlier. The measurements of the specimens obtained by Abbott indicate that the range of this small race can be extended across the island of Borneo, a point of considerable interest as it was quite likely that the south part of the island would prove to be inhabited by an animal approaching the larger typical *vampyrus* of Java.

All the Banguey Island examples are juveniles. Three (two males and a female) are melanistic, having the pelage black throughout. Anderson (t. c. s. pp. 345, 360) states that the earlier described *P. v. lanensis* Mearns. of the Philippines[1] is a melanistic race "similar in size to *natunae* from which it differs in the generally much darker colour of the mantle; but specimens occur which are indistinguishable in colour from *natunae*".

P. v. natunae is the Bornean form and we have therefore listed our series from its northern islands under that name since Hollister[2] records an example from Palawan, the fauna of which is Bornean rather than Philippine. *P. v. lanensis* is generally distributed throughout the Philippines proper.

The colour of topotypes of *P. v. natunae* as young as our Banguey animals has not been recorded: it may be that they also will be found to exhibit a wholly black pelage.

Rhinolophus trifoliatus trifoliatus Temm.

Rhinolophus trifoliatus, Anderson, Ann. Mag. Nat. Hist (7), xvi, 1905, p. 249; op. cit., 1918 (9) 2, p. 378; Lyon, Proc U. S. Nat. Mus., xxviii, 1907, p. 563; op. cit., 40, 1911, p. 131: Gyldenstolpe, Kungl. Sv. Vet. Akademiens Handlingar, Band 60, No. 6, 1920, p. 15.

1. Mearns, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 432 (Mindanao).
2. Philippine Journ. Sci., VII, 1912, p. 10.

Bettotan: 2 ♀, Rayoh: 2 ♂, Banguey Island: 1 ♂.

These specimens are in alcohol but in the flesh the fur was noted as brown, the knees and elbows yellow and the membranes bright brown. A juvenile (not listed) was dusky in colour, darker than the adults.

R. trifoliatus varies much in size, but both in external dimensions and those of the skull our series agrees very well with the measurements published by Anderson.

The specimen from Banguey Island is the smallest of the series but it is within the known range for the mainland of Borneo. Anderson (1905, p. 250) has commented on the rarity of the complete obliteration of p^3 in the lower jaw in the *trifoliatus* section of the *luctus* group: the tooth seems to be missing in one well preserved mandible before us. These bats are usually taken when they are resting by day in the shady jungle.

(For measurements *see* page 82).

Rhinolophus morio foetidus And.

Rhinolopus morio foetidus, Andersen, Ann. Mag. Nat. Hist. (9) 2, 1918, p. 378: Baram, Sarawak.

Bettotan: 1 ♂.

This adult bat has the forearm measuring 58.5 mm. and is therefore rather small for a form of *morio*, a species in which the forearm according to Andersen ranges from 63.5 to 75 mm. in length. The specimen however seems nearer to *morio* than to the much smaller *trifoliatus*.

This is a member of the *trifoliatus* section of the *luctus* group, that is to say the skull has the sagittal crest high in front and abruptly descending towards the post nasal depression: in the wing the fifth metacarpal is the longest.

The fur is darker than in our Bornean examples of *trifoliatus*, and the membranes are not the bright brown of *trifoliatus*. In the upper jaw p^2 is in the tooth-row: in the lower jaw p^3 is almost external.

(For measurements *see* page 81).

Rhinolophus borneensis Peters.

Rhinolophus borneensis, Lyon, Proc. U. S. Nat. Mus., 40, 1911, p. 131.

Rayoh: 1 ♂ (red phase).

(For measurements *see* page 81).

Rhinolophus acuminatus Peters.

Bettotan: 1 ♂.

No bat of Andersen's *acuminatus* section of the *pusillus* group has hitherto been recorded from Borneo.

The single specimen before us has the connecting process less prominent than in two Javan topotypes of *acuminatus*.

(For measurements *see* page 81).

Hipposideros diadema vicarius And.

Hipposideros diadema vicarius, K. Andersen, Ann. Mag. Nat. Hist. (7), XVI, 1905, p. 499 (Sarawak).

Bettotan: 1 ♂.

(For measurements *see* page 81).

Emballonura monticola monticola Temm.

Emballonura pusilla, Lyon, Proc. U. S. Nat Mus., 40, 1911, p. 132 (south-western Borneo).

Bettotan: 1 ♂, 1 ♀; 6 ♀ in alcohol.

None of these specimens answers to the description of *rivalis* Thomas,[1] which is therefore almost certain to be a separate species and not a form of *monticola*.

The measurements are in close agreement with those given by Lyon for his *pusilla*.

(For measurements *see* page 82).

EDENTATA

Manis javanica Desm.

Manis javanica, Jentink, Notes Leyd. Mus., XIX, 1897, p. 66, Lyon, Proc. U. S. Nat. Mus., XXXIII, 1907, p. 548; id., op. cit., 40, 1911, p. 63.

One adult: Bettotan

Greatest length of skull 107 mm.

1. *Emballonura monticola rivalis* Thomas, Ann. Mag. Nat. Hist. (8), XV, 1915, p. 140 (Sarawak and North Borneo). Specimens recorded by Jentink from Mt. Liang Agang in Central Borneo may also belong to *rivalis* (*vide* Notes Leyd. Mus., XIX, 1897, p. 55).

HYLOBATES MOLOCH FUNEREUS (P. 2). MACACA N. NEMESTRINA (P. 9). MACACA IRUS IRUS (P. 9).

Species and Locality	Sex	Head & body	Nose to toe	Span of arms	Hind foot	Skull: Greatest length	Skull: Basal length	Skull: Zygomatic breadth	Skull: Maxillary tooth-row with canine (alveoli)	Collector's No.	Remarks
Hylobates moloch funereus—											
Bettotan ...	♂	48.5	930	1000	142	98	70.5	73	32	3113	Adult
,, ...	♂	485	...	...	136	102.5	73	67	33.5	3266	,,
,, ...	♀ c. ♂	485	987	1500	147	100	77.5	70.5	34.5	3078	,,
,, ...	♀	490	940	1440	145	95	71.5	..	31	3248	,,
,, ...	♀	475	955	1380	145	100	75	67.5	34	3154	,,
Rayoh ...	♂	485	985	1410	148	103.5	73	63.5	32	3079	,,
,, ...	♀	471	...	...	135	104.5	82.5	72	33	3563	,,
,, ...	♀	430	...	...	130	102.5	70	71.5	31	3583	,,
		505	..	...	140	102	72	67	33	3572	,,
Macaca n. nemestrina—											
Bettotan ...	♂	580	210	...	185	156	69.5	100.5	51	3267	,,
,, ...	♂	590	245	...	182	156	68.5	97.5	51.5	3276	,, (aged)
Macaca i. irus—											
Bettotan ...	♂	420	633	...	133	111	79	76	37	3258	,,
Banguey Island ...	♂	525	620	...	137	124	89.5	86	42	3413	,, (aged)

PYGATHRIX R. RUBICUNDA (P. 3). P. HOSEI (P. 6). P. SABANA (P. 7)

Species and Locality	Sex	Head & body	Tail	Head to symph. pubes	Hind foot	Skull: Greatest length	Skull: Basal length	Skull: Zygomatic breadth	Skull: Maxillary tooth-row with canine (alveoli)	Collector's No.	Remarks
Pygathrix r. rubicunda											
Bettotan ...	♀	..	750	...	182	93	62.5	69	28.5	3040	Adult
,, ...	♂	490	660	500	172	91	56	69	28	3126	,,
,, ...	♀	530	710	545	180	91	62	70	29	3242	,,
,, ...	♀	480	770	540	170	90	62	68	28	3114	,,
,, ...	♀	490	740	525	170	90.5	60.5	67.5	28.5	3115	,,
,, ...	♀	515	720	540	170	87	70	67	28	3243	,,
,, ...	♀	...	...	...	176	89.5	61	68.5	28	3254	,,
Pygathrix hosei —											
Rayoh ...	♂	425	665	...	160*	86	56.5	64	28.5	3577	,,
,, ...	♂	440	710	...	160*	86.5	55	64	27	3597	,,
,, ...	♀	464	739	...	160*	90	60	68	29	3553	,,
,, ...	♀	495	750	...	170*	88	59.5	69.5	29.5	3575	,,
Pygathrix sabana—											
Bettotan ...	♀	515	815	...	180	92.5	66	70.5	30	3150	,,

* Native Collector's measurements.

LUTRA CINEREA (P. 15). MARTES FLAVIGULA SABA (P. 13).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	SKULL: Basal length	Condylo-basal length	Palatal length	Least breadth of interpiery goid space	Zygomatic breadth	Upper molar row (alveoli)	Collector's No.	Remarks
Lutra cinerea—													
Bettotan ...	♂	440	260	90	18	78.4	84.6	40.6	7.2	60	25	3067	Adult
,, ...	♂	440	270	87	18	77	84.5	38.2	7	58.6	24.9	3164	,,
,, ...	♂	395	255	93	17	77.5	84	40.6	7.5	56	25	3255	,,
,, ...	♂	360	240	88	17	75.1	82	40	7.5	55	26	3256	,,
,, ...	♂	415	225	89	16	75.5	82	39	7.6	57	24.2	3294	,,
,, ...	♂	385	225	85	16	74.5	80.5	38.5	6.9	54.2	25	3322	,,
,, ...	♀	440	270	90	19	...	...	...	...	...	...	3257	,,
,, ...	♀	440	265	89	19	75.5	82.9	38.5	7	57.2	25.1	3264	,,
Martes flavigula saba—													
Bettotan and Rayoh	♂	455	360	90	34	78	84.2	38.1	9.2	48.6	23	3271	Type adult
,, ...	♂	455	365	85	33	82.5	89.5	41	8.9	49.9	24	3592	Adult
,, ...	♀	415	375	82	31	72	79	35.9	8.6	44.6	21	3240	,,
,, ...	♀	403	342	81	28	70.6	77.5	33.9	8.5	46	21	3272	,,

HEMIGALUS DERBIANUS BOIEI (P. 11). HERPESTES BRACHYURUS RAJAH (P. 12).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	SKULL: Basal length	Condylo-basal length	Palatal length	Least breadth of interpiery goid space	Zygomatic breadth	Upper molar row (alveoli)	Collector's No.	Remarks
Hemigalus derbianus boiei—													
Bettotan ...	♂	625	255	78	37	98	103	55	6	46	36	3111	Adult
,, ...	♂	560	...	80	57	...	...	53.2	7	50	33	3112	,,
,, ...	♂	540	360	80	40	96	101.9	52	7	50.7	34.1	3176	,,
,, ...	♀	640	255	80	37	94.1	99.5	50	5.3	48.5	34	3190	,,
,, ...	♀	560	350	82	37	93.7	99	50	7.5	49.9	33.2	3231	,,
,, ...	♀	500	310	72	35	88.6	94	49.5	6	43	34	3269	,,
,, ...	♀	510	330	80	40	95.1	101	51	7	45.5	36	3282	,,
Herpestes brachyurus rajah—													
Samawang and Bettotan ...	♂	385	215	85	27	80.7	87.3	48.4	6	47.5	29.1	3281	,,
,, ...	♀	425	230	79	28	81	87.2	49	6.9	51.3	28.6	3034	Aged
,, ...	♀	380	205	75	27	76.5	92	45	5.2	47.5	27	3141	Adult

TRAGULUS JAVANICUS BORNEANUS (P. 15). T. JAVANICUS BANGUEI (P. 16).

Species and Locality	Sex	Head & body	Tail	Hind foot and hoof	Skull: Greatest length	Skull: Condylo-basal length	Skull: Palatal length	Skull: Diastema	Skull: Upper molar row	Skull: Median nasal length	Skull: Inter-orbital breadth	Skull: Zygomatic breadth	Collector's No.	Remarks
Tragulus javanicus borneanus—														
Bettotan & Rayoh	♂	595	70	150	116	109	66	10	42.5	36.5	30	49.5	3198	Adult
,, ...	♂	507	70	142	105	99	58	10	39.5	31	29	47.5	3247	,,
,, ...	♂	431	65	142	...	...	...	...	...	...	...	...	3529	Immature
,, ...	♂ ♀	528	85	145	110	105	61.5	10	40.3	33.8	28	48.5	3587	Adult
,, ...	♀	535	80	152	...	...	..	...	...	...	...	...	3197	Immature
,, ...	♀	515	85	143	...	...	...	...	...	...	...	...	3324	,,
,, ...	♀	560	90	145	114.5	106.5	62	13	40	37	28.6	47.7	3332	Adult
,, ...	♀	520	80	153	112.5	108	61.3	14	37.5	35	31	52.5	3593	,,
Tragulus javanicus banguei—														
Banguey Island ...	♂	515	...	132	107	98	58	10	37	35	29	48.5	3373	Type adult
,, ...	♀	510	70	128	98.5	92	54.8	9.5	38	31.3	27.5	46	3343	Adult
,, ...	♀	485	70	131	...	...	...	...	...	...	...	...	3372	Immature

TRAGULUS KANCHIL LONGIPES (P. 17).

Species and Locality	Sex	Head & body	Tail	Hind foot and hoof	Skull: Greatest length	Skull: Condylo-basal length	Skull: Palatal length	Skull: Diastema	Skull: Upper molar row	Skull: Median nasal length	Skull: Inter-orbital breadth	Skull: Zygomatic breadth	Collector's No.	Remarks
Tragulus kanchil longipes—														
Samawang and Bettotan ...	♂	470	...	136	98	90.5	53	10	36.5	34.5	26	42.5	3010	Adult
,, ...	♂	487	73	138	103	95	55.5	10.5	36	33.5	27.5	44	3036	,,
,, ...	♂	478	72	130	100	92	53	9.5	33.8	30	27	44.5	3273	Aged
,, ...	♀	462	78	130	97	91	52.5	13	32.5	...	26	45	3037	Adult
,, ...	♀	493	87	138	104.5	97	56	11.2	37	...	28.5	44	3037	,,
,, ...	♀	465	70	131	...	...	...	...	...	...	...	...	3145	Immature
,, ...	♀	505	90	146	...	...	...	11.2	36.5	32	38.5	45.5	3205	Adult
,, ...	♀	420	70	125	...	...	...	...	...	...	...	...	3225	Immature
,, ...	♀	492	75	135	99	90.5	52	10.5	34	...	29	45	3261	Adult

RATUFA AFFINIS SANDAKANENSIS (P. 20). R. AFFINIS BANGUEI (P. 22).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Condylo-basilar length	Palatilar length	Diastema	Upper molar row (alveoli)	Median nasal length	Inter-orbital breadth	Zygomatic breadth	Collector's No.	Remarks
Ratufa affinis sandakanensis															
Samawang, Bettotan and Rayoh	♂	335	440	78	24	67	56	24.5	14.1	13.2	21	27	38.5	3148	Adult
,, ...	♂	333	437	78	22	67.5	57.5	27	16	13	22	26.2	40.5	3274	,,
,, ...	♂	345	435	79	24	66.3	56.2	25	14.9	13.5	21.9	27	42	3564	,,
,, ...	♂	319	395	78	28	67.8	58.1	27.2	15.1	13.3	21.5	27.9	41.3	3565	,,
,, ...	♀	338	450	79	21	68	58.5	27.2	15.9	13.2	22.7	28	42.2	3017	,,
,, ...	♀	345	450	81	23	67	56.6	26	14.9	13.2	21.5	28.9	42	3140	,,
,, ...	♀	325	445	75	27	67	56.9	26.9	15.1	13.9	20	27	42	3149	,,
,, ...	♀	353	410	79	20	67.4	57	26	15.1	13.5	21.2	27	41	3187	,,
,, ...	♀	337	423	70	23	66.2	57.8	25.8	15.6	12.9	23.9	25.2	41.9	3566	,,
	♀	339	445	80	25	66.1	57.8	27.2	15.3	13.8	21.2	25	42.1	3582	,,
Ratufa affinis banguei															
Banguey Island ...	♂	318	412	75	22	65.1	54.2	25.1	13.7	13.7	22.3	26	39.1	3437	Type: Adult
,, ...	♂	325	430	71	22	66.9	56	26	13.6	14.1	22.2	27.5	39.5	3342	Adult
,, ...	♂	315	385	68	22	63	54.6	25	14.1	13	19.5	27	41	3374	,,

SCIURUS PREVOSTI PLUTO (P. 22). S. PREVOSTI CAEDIS (P. 25).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Condylo-basilar length	Palatilar length	Diastema	Upper molar row (alveoli)	Median nasal length	Inter-orbital breadth	Zygomatic breadth	Collector's No.	Remarks
Sciurus prevosti pluto															
Mainland ...	♂	238	247	56	21	57	50	24.3	13.5	11.6	17.5	21.2	34.5	3039	Adult
,, ...	♂	248	252	55	19	55	48.5	23.5	13.3	10.5	16.7	21.8	33	3088	,,
,, ...	♂	251	222	56	19	56	49.2	24.9	13.9	10.6	18	23.1	34.5	3152	,,
,, ...	♂	245	255	56	20	55.3	47.6	23.3	12.9	10.2	17.1	22	34	3208	,,
,, ...	♂	223	250	55	20	54.6	46.6	23	12.4	11.3	16.5	22	32.6	3221	,,
,, ...	♀	232	233	57	18.5	...	48.5	23.9	13.5	11	...	22	35	3105	,,
,, ...	♀	235	250	54	19	55	48	23	12.9	11	16	23	33	3126	,,
,, ...	♀	226	234	50	20	54.5	46	23.3	13.1	10.6	16.1	21.8	33	3550	,,
,, ...	♀	230	258	51	20	56	49.9	24.9	14.4	10.6	17	23	36	3560	,,
,, ...	♀	231	227	50	19	55	48.1	23.9	14	10.9	18	21.5	34.9	3581	,,
Sciurus prevosti caedis															
Balambangan Island	♂	228	207	51	17.5	51.9	45.2	22.5	12.7	10.2	15	20.5	32	3478	,,
,, ...	♂	220	205	51	17.5	51	45	22	12.2	10.2	15.9	20.6	32	3507	,,
,, ...	♀	220	200	51	19	53	47	23	13.3	10.6	16	22	32.9	3480	,,
,, ...	♀	215	200	49	18	52	46	22.1	12.5	10.1	15	20.9	32	3481	,,
,, ...	♀	220	205	50	17	52.6	46.6	23	14	9.5	15.9	21.3	33	3508	,,
Banguey Island ...	♂	195	215	51	20	51.2	43.0	...	...	...	...	...	...	3226	Immature
,, ...	♂	220	205	52	18	52.1	45	22.9	12	10.1	15.5	20	32	3344	Adult
,, ...	♂	220	220	51	19	53	45.1	22	12 2	10.3	15	21	33	3414	,,
,, ...	♀	213	222	48	18	52.6	45.1	22.1	12	10.9	14.9	21	31.9	3351	,,
,, ...	♀	218	207	51.5	17	52.9	55	22	12	10.5	15	20	32	3499	,,

SCIURUS NOTATUS DILUTUS (P. 25).

Species and locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Skull: Condylo-basilar length	Skull: Palatilar length	Skull: Diastema	Skull: Upper molar row (alveoli)	Skull: Median nasal length	Skull: Inter-orbital breadth	Skull: Zygomatic breadth	Collector's No.	Remarks
Sciurus notatus dilutus															
Bettotan ...	♂	355	155	47	16.5	51	43.9	22.9	11.9	9.5	15	18.5	30	3001	Adult
,, ...	♂	402	204	47	15	50	43	21.5	11.4	9	14.5	18.5	30	3085	,,
,, ...	♂	380	190	45	16	49.5	42	21.1	11	9.1	16	18	29.1	3106	,,
,, ...	♂	395	193	46	16.5	49.5	42.5	21.5	11.7	9.1	...	17.9	29	3153	,,
,, ...	♂	390	187	45	16	50.2	42.5	21.6	11.5	9.3	14.4	18.9	30	3237	,,
,, ...	♀	393	205	46	16	49	42	21.2	11.1	9	13.2	17.5	29.2	3087	,,
,, ...	♀	415	205	48	15.5	48	42	21.1	11	9	14	19	29.2	3099	,,
,, ...	♀	385	195	45	16	50	43	21.9	12	9	15	17.2	30.2	3138	,,
,, ...	♀	385	192	46	15	48.5	42.5	22	11.2	9.2	13.5	18.5	30	3193	,,
,, ...	♀	407	202	47	17	50	44	22	11.4	9.5	15	17.5	29.1	3303	,,

SCIURUS NOTATUS MALAWALI (P. 26). SCIURUS ADAMSI (P. 26).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Skull: Condylo-basilar length	Skull: Palatilar length	Skull: Diastema	Skull: Upper molar row (alveoli)	Skull: Median nasal length	Skull: Inter-orbital breadth	Skull: Zygomatic breadth	Collector's No.	Remarks
Sciurus notatus malawali															
Mallewallé Island	♂	185	180	45	16	48	41.6	20.9	11	8.9	13.9	17.8	29	3446	Adult
,, ...	♂	196	174	47	17	48.5	42	21	11	9	13.2	18.5	29	3447	,,
,, ...	♂	190	180	45	16	47.5	41.2	21	11	9	13	17.2	29	3458	,,
,, ...	♂	195	182	46	16	...	42	21.9	11.1	9	...	17.7	...	3459	,,
,, ...	♂	192	185	45	17.5	48	41	21	10.8	9.1	13.2	17.6	28.9	3461	,,
,, ...	♀	200	...	47	17	47.5	41.5	21	11.1	9	13.2	17.5	29.1	3462	,,
,, ...	♀	192	180	45	16	...	...	...	...	...	...	...	...	3463	,,
,, ...	♀	197	178	46	15	48.2	42	21	11	9.1	13.1	18	29	3464	,,
,, ...	♀	190	180	46	16	...	...	...	...	...	...	...	...	3465	,,
Sciurus adamsi—															
Bettotan and Rayoh	♂	157	158	37	15	42.2	35.8	17.5	9.8	8	12	15.2	26	3601	,,
,, ...	♀	165	136	36	14	...	35.3	17.2	9.9	8	...	15.1	25	3172	,,
,, ...	♀	167	158	35	16	44	37.2	18.1	10	8	13	15.1	26.5	3529	,,

SCIURUS LOWII LOWII (P. 28).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Skull: Condylo-basilar length	Skull: Palatilar length	Skull: Diastema	Skull: Upper molar row (alveoli)	Skull: Median nasal length	Skull: Inter-orbital breadth	Skull: Zygomatic breadth	Collector's No.	Remarks
Sciurus lowii lowii—															
Mainland ...	♂	138	97	36	13	38.5	33	17	9.1	7.3	11.5	12	22.5	3181	Adult
,, ...	♂	138	93	35	13.5	38	32.5	16.5	9.4	6.9	10.9	12	22	3520	,,
,, ...	♀	147	108	36	14	39.9	34	17.5	9.9	7.6	12	12	23.3	3056	,,
,, ...	♀	140	85	34	13	39	33	17	9.5	7	12.1	11.5	22.3	3124	,,
,, ..	♀	134	90	34	13	39.5	33.7	17	9.3	7.2	11	12	22.9	3131	,,
Banguey Island ...	♂	147	90	34	13	39	34	18	10	7.2	11.9	11.9	22	3365	,,
,, ...	♂	142	93	32	13	38.5	33.5	17.1	10	7	10.1	11.9	22.5	3383	,,
,, ...	♂	144	100	35	13	...	33	17	9.5	7.5	...	11	21.9	3427	,,
,, ...	♀	138	67	32	12	37.3	32	17	9	7.9	10.9	11.5	21.7	3384	,,
,, ...	♀	135	90	34	13	38.8	33.5	17	9	7.9	12.2	...	21.5	3474	,,

SCIURUS HIPPURUS PRYERI (P. 27). RHINOSCIURUS L. LATICAUDATUS (P. 28).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Skull: Condylo-basilar length	Skull: Palatilar length	Skull: Diastema	Skull: Upper molar row (alveoli)	Skull: Median nasal length	Skull: Inter-orbital breadth	Skull: Zygomatic breadth	Collector's No.	Remarks
Sciurus hippurus pryeri															
Samawang and Bettotan ...	♂	225	225	55	18	56	48	25.2	14	10.1	16.5	18.9	34.1	3120	Adult
,, ...	♂	210	250	54	17	54.5	46.9	24.9	14.2	9.5	16	...	32.5	3166	,,
,, ...	♂	227	218	54	18	55.1	48	24.9	14	10	17.5	18.9	32.1	3167	,,
,, ...	♂	210	240	55	17	55	47.3	25	13.5	10.1	17.2	18.5	32.1	3018	,,
,, ...	♀	225	240	54	18	54.1	48	23.1	13	11	16	21.7	34	3098	,,
,, ...	♀	230	220	53	16	...	48	25.5	14.6	9.9	16	...	33.5	3143	,,
,, ...	♀	230	250	57	18	56.7	49	26	15	9.8	15.9	17.7	33	3175	,,
,, ...	♀	220	246	56	18	55.1	47	24	14	10	17.8	18.9	32.6	3210	,,
,, ...	♀	220	255	47	16	55	48	24.5	14	9.9	16	19.9	32.1	3249	,,
,, ...	♀	215	247	55	17.5	53.2	46.1	24	13	10	16	18.1	31	3275	,,
Rhinosciurus laticaudatus laticaudatus—															
Bettotan ...	♂	217	135	44	15	59	51.2	30.5	18	12.2	22.5	13	27.5	3178	,,
Benoni ...	♀	195	170	40	15	58.1	51.3	30	17.9	11.6	20	13.1	26.2	3531	,,

NANNOSCIURUS EXILIS SORDIDUS (P. 29). N. EXILIS RETECTUS (P. 29).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	SKULL: Greatest length	Condylo-basilar length	Palatilar length	Diastema	Upper molar row (alveoli)	Median nasal length	Inter-orbital breadth	Zygomatic breadth	Collector's No.	Remarks
Nannosciurus exilis sordidus—															
Samawang and Bettotan ..	♂	62	58	21	9	22.2	18.1	9	4.9	3.7	6	9.9	14.2	3003	Adult
,, ...	♂	70	45	...	8.5	22.9	18.7	9.2	5	3.7	6.1	9.2	...	3007	,,
,, ...	♂	73	50	22	7	23	19	9	5	3.8	7.5	9.7	...	3032	,,
,, ...	♂	68	56	20.5	9	23.3	19	9.1	5.1	3.9	6.8	10	15	3200	,,
,, ...	♂	66	54	21	9	22.9	19	9.2	5.1	3.1	5.9	9.3	...	3228	,,
,, ...	♂	68	52	22	8	23	18.6	9.2	5.1	3.5	6	10	...	3234	,,
,, ...	♀	66	57	22	9	22.6	18.7	9	5	3.7	7.1	9.1	...	3052	,,
,, ...	♀	72	55	22	9	...	...	...	...	3.5	...	9	14.1	3051	,,
,, ...	♀	65	52	19	8	22	18	9	5	3.6	6.7	9.2	...	3135	,,
,, ...	♀	64	37	23	8	23	19	9.3	5.1	3.2	6	10.1	15.2	3057	,,
Nannosciuris exilis retectus—															
Banguey Island ...	♂	70	56	21	8.5	23.3	19.3	9.7	5.1	3.6	7.1	9.9	14.9	3381	,,
,, ...	♂	74	53	21	9	...	...	...	...	...	...	...	...	3382	,,
,, ...	♂	73	57	21.5	9	22.9	19	9.1	5	3.7	6.1	9.5	...	3405	,,
,, ...	♂	62	55	22	9	21.2	17.1	8.5	4.5	3.7	5.5	9.9	...	3433	Subadult

RATTUS S. SABANUS (P. 29).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	SKULL: Greatest length	Condylo-basilar length	Diastema	Upper molar row	Length of palatal foramina	Median nasal length	Breadth of combined nasals	Zygomatic breadth	Collector's No.	Remarks
Rattus sabanus sabanus															
Bettotan and Rayoh	♂	264	300	46	...	57.8	50.1	16	11.1	8	22	7.5	27.6	3147	Aged
,, ...	♂	258	387	49	28	56.2	48.6	15.5	10	8.3	22	6.5	26.2	3219	Adult
,, ...	♂	249	376	47	28	...	...	...	...	...	...	...	...	3555	,,
,, ...	♀	253	407	48	...	56.6	48.2	15	10	7.5	22.5	7	26.7	3058	Aged
,, ...	♀	265	385	48	26	59.3	51.1	15.6	10.6	9	23	7.1	27.2	3118	Adult
,, ...	♀	256	410	48	26	56.1	49.5	16	10	8.5	22	7	26.5	3163	,,
,, ...	♀	258	382	48	28	58.2	50.9	16.7	10.6	7.9	23.9	7	27	3233	,,
,, ...	♀	222	346	43	28	55.5	47.1	14	10	8	22	6.6	...	3556	,,

RATTUS R. RAJAH (P. 31). R. SURIFER BANDAHARA (P. 30).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	SKULL: Greatest length	Condylo-basilar length	Diastema	Upper molar row (alveoli)	Length of palatal foramina	Median nasal length	Breadth of combined nasals	Zygomatic breadth	Collector's No.	Remarks
Rattus rajah rajah—															
Bettotan and Samawang	♂	167	198	38	22	42.2	36.3	12.1	7	6.2	16.1	4.9	20	3038	Adult
,, ...	♂	161	171	39	24	42	35.7	12	6.8	6	15.9	4.2	...	3183	,,
,, ...	♂	160	180	39	22	41.5	34.5	11.1	6.3	5.8	15.8	5	18.3	3230	,,
,, ...	♂	174	178	38	...	41.2	35.7	10.6	6.6	6	15	4.3	19	3208	,,
,, ...	♀	152	163	37	22	39.3	33	10.6	6.5	6	14.9	4	18	3024	,,
,, ...	♀	156	170	35	23	39	33.5	11	6.4	6.2	14.4	4.6	18.3	3033	,,
,, ...	♀	178	179	37	21	40.5	35.6	12	6.6	6.2	15	4.3	18.9	3082	,,
,, ...	♀	...	150	36	22	39.7	33	10.9	6.9	6	14.9	5	18	3144	,,
,, ...	♀	162	164	35	22	40	35	11.1	6.3	6	15.9	4.2	18	3191	,,
,, ...	♀	160	185	38	21	40.6	34.8	11.5	6.9	6	16	4.5	18	3195	,,
Rattus surifer bandahara—															
Bettotan and Samawang ...	♂	189	198	41	25	46.1	38.5	13	7	6.6	18.4	5	21	3737	,,
,, ...	♂	160	205	38	23	42.9	36.7	12.5	6.8	6.6	16.3	4.1	19.5	3540	,,
,, ...	♂	202	213	43	24	48	41	14	6.8	7	19	5.5	21.6	3541	,,

R. SURIFER BANDAHARA (P. 31). R. SURIFER PANGLIMA (P. 30).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	SKULL: Greatest length	Condylo-basilar length	Diastema	Upper molar row (alveoli)	Length of palatal foramina	Median nasal length	Breadth of combined nasals	Zygomatic breadth	Collector's No.	Remarks
Rattus surifer bandahara—															
Bettotan and Samawang	♂	165	190	40	24	43.6	37	12.7	6.6	6.1	16.9	5	19.5	3546	Adult
,, ...	♂	187	198	41	24	45	38	13	7	6.5	17.9	5	21	3547	,,
,, ...	♂	193	215	39	24	...	39	13	6.6	6	...	...	20.5	3598	,,
,, ...	♀	166	187	38	24	41	35	11	7	5.9	15	4	18.2	3521	,,
,, ...	♀	184	199	38	24	...	37	12	7	5.9	16.1	4.1	19	3534	,,
Rattus surifer panglima															
Banguey Island ...	♂	194	178	38	24	46	40	13.1	7	7	18.1	6	21.5	3442	,,
,, ...	♂	200	...	38	25	45.7	39.3	13	6.9	7	17.9	5.2	21	3443	,,
Balambangan Island	♂	187	...	38.5	21	...	37	12.3	6	6.8	...	5	19.3	3486	,,
,, ...	♀	185	165	36.5	21.5	42.8	36	12.2	6	7	17.1	4.9	19	3495	,,
Mallewallé Island ...	♂	181	173	38	22	43.5	36.8	12	6	6.5	17.2	5'	19.5	3448	,,
,, ...	♀	157	143	35	22	39	33	10.9	6	5.9	14.2	4.7	17.5	3449	Vix ad.

RATTUS CREMORIVENTER KINA (P. 31). R. CREMORIVENTER MALAWALI (P. 32).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Skull: Condylo-basilar length	Skull: Diastema	Skull: Upper molar row (alveoli)	Skull: Length of palatal foramina	Skull: Median nasal length	Skull: Breadth of combined nasals	Skull: Zygomatic breadth	Collector's No.	Remarks
Rattus cremoriventer kina—															
Bettotan and Rayoh	♂	140	195	26	19	36	31.5	10	6.2	6.3	13	5	17	3569	Adult
,, ...	♂	155	202	27	18	35.9	30.2	9.6	6.1	5.7	14	4.9	17.1	3596	,,
,, ...	♀	122	168	24	17	34.7	28	8.8	5.8	5	12.1	3.7	16	3570	,,
,, ...	♀	135	...	26	17	34	28	9	6.1	5	13	4.5	16.1	3590	,,
Rattus cremoriventer malawali—															
Mallewallé Island	♂	155	225	29.5	19	37.5	32	10	6.7	5.2	14.9	4.9	17.5	3455	,,
,, ...	♀	134	172	28	17	34.9	29.2	8.8	6.8	5	13 1	4.2	...	3456	,,
,, ...	♀	143	199	29	17.5	35	29.1	9	6	5	13	4.1	16	3457	,,
Banguey Island ...	♂	140	...	27	18	34	29	8 9	6	5	13.2	4	16	3398	,,
,, ...	♂	320	...	28	19	36.2	31	10	6	5.2	13.6	4.9	17	3386	,,
,, ...	♂	139	195	27	19.5	35	29.9	9.1	6.1	5	13.6	4.5	17	3444	,,
,, ...	♀	350	197	27	18	36	30.2	9.7	6.1	5.2	13.9	4	16.5	3352	,,
Balambangan Id	♂	130	200	29	18	35.4	29.1	9	6.1	5.9	12.9	4.2	16.2	3474	,,
,, ...	♂	153	230	29	...	36.5	30.6	9.1	6	5.8	13.5	4.1	17	3485	,,

RATTUS WHITEHEADI (P. 32).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Skull: Condylo-basilar length	Skull: Diastema	Skull: Upper molar row (alveoli)	Skull: Length of palatal foramina	Skull: Median nasal length	Skull: Breadth of combined nasals	Skull: Zygomatic breadth	Collector's No.	Remarks
Rattus whiteheadi—															
Bettotan and Rayoh	♂	111	...	27	19	...	...	...	...	...	...	...	...	3022	Adult
,, ...	♂	123	115	28	18	32.5	27.5	8	5.2	4.9	11.6	3.7	15	3313	,,
,, ...	♂	119	...	30	16	...	...	...	...	...	...	...	...	3530	,,
,, ...	♂	132	125	28	19	...	...	...	...	...	...	...	...	3542	,,
,, ...	♂	120	125	28	19	...	...	...	...	...	...	...	...	3548	,,
,, ...	♂	130	115	27	19	34.2	28.5	8.5	5.7	5	12.1	3.9	16	3578	,,
,, ...	♂	117	120	29	19	...	...	...	...	...	...	...	...	3586	,,
,, ...	♂	131	112	27	19	33	27.8	8.2	5.9	4.8	11	3.9	15	3588	,,
,, ...	♂	126	...	30	19	33.2	27.6	8.4	5.9	5.9	11.3	4	15.1	3599	,,
,, ...	♀	110	...	25	19	...	...	...	...	...	...	...	...	3538	,,
Banguey Island ...	♂	126	103	28	17.5	...	...	...	...	...	...	...	...	3339	,,
,, ...	♂	120	109	28	16.5	...	...	...	...	...	...	...	...	3340	,,
,, ...	♂	122	...	28	16	...	...	...	...	...	...	...	...	3353	,,
,, ...	♂	139	115	27.5	19	35.5	29	9	5.7	5.1	13.1	4	15.1	3410	,,
,, ...	♂	115	...	28	17	...	...	...	...	...	...	...	...	3445	,,
,, ...	♀	115	...	26	17	...	...	...	...	...	...	...	...	3369	,,
,, ...	♀	132	...	25.5	16	32 2	27	8.1	5.7	5.2	11	3.2	15	3379	,,

RATTUS WHITEHEADI (P. 32)—*Contd.*

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	SKULL								Collector's No.	Remarks
						Greatest length	Condylo-basilar length	Diastema	Upper molar row (alveoli)	Length of palatal foramina	Median nasal length	Breadth of combined nasals	Zygomatic breadth		
Rattus whiteheadi—continued.															
Mallewallé Island ...	♂	138	105	27	17.5	33.8	29	9	5.7	5.1	12	3.9	16	3451	Adult
,, ...	♂	146	120	29	17	34.7	29.9	9	5.8	6	13.2	4	16.1	3452	,,
,, ...	♀	146	..	...	18	34.6	29.2	9.5	5.5	5.1	13	4.2	16.1	3453	,,
,, ...	♀	123	104	29	17	...	...	...	...	...	...	...	...	3454	,,
Balambangan Island	♂	138	120	29	19	...	...	...	...	...	...	...	...	3476	,,
,, ...	♂	125	115	29	...	...	...	...	...	...	...	...	...	3477	,,
,, ...	♂	135	117	27	20	34.9	29.6	8.8	6	5.3	12.8	4.5	16	3502	,,
,, ...	♂	127	108	26	18	...	...	...	...	...	...	...	...	3503	,,
,, ...	♂	133	110	29.5	19	...	...	...	...	...	...	...	...	3504	,,
,, ..	♀	131	109	27	19	34.1	28.5	8	5.9	5	12.2	4	16.1	3468	,,
,, ...	♀	128	106	27	19	...	...	...	...	...	...	...	...	3484	,,
,, ...	♀	138	114	28	...	...	...	...	...	...	...	...	...	2500	,,
,, ...	♀	117	102	27.5	18	32.8	28.2	8.5	5.9	5	12.2	4	14.2	3505	,,

RATTUS CONCOLOR EPHIPPIUM (P. 34). R. BAEODON (P. 33).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	SKULL								Collector's No.	Remarks
						Greatest length	Condylo-basilar length	Diastema	Upper molar row (alveoli)	Length of palatal foramina	Median nasal length	Breadth of combined nasals	Zygomatic breadth		
Rattus concolor ephippium—															
Bettotan and Kudat	♂	130	143	26	17	34	29.7	9.3	5.1	6.8	13	3.9	15.2	3319	Adult
,, ...	♂	120	140	25	17	32.5	27.9	9	5	6	12	3.1	...	3327	,,
,, ...	♂	127	137	26	17	32.8	28.5	8.9	5.9	6.1	12.1	3.1	15	3516	,,
,, ...	♀	117	132	25	17	31.8	27.7	9	5	6	12	3.5	15	3290	,,
,, ...	♀	126	144	24	16	31.9	28	8.9	5.1	5.8	11.9	3.5	...	3317	,,
,, ...	♀	115	135	24	26	31.6	27.5	9	5.2	6	11.5	3.8	...	3335	,,
Banguey Island ...	♂	137	138	27.5	18	34	29.5	9	5.6	5.9	12.8	3	16	3358	,,
,, ...	♂	138	...	26	17	32.7	28.5	9	5.2	5.2	12	3.5	16	3359	,,
,, ...	♂	137	133	26	17	...	29	9	5.6	6	12	3.5	15.3	3363	,,
,, ...	♂	131	123	24	16.5	...	28	9	5	5.5	11.3	3.8	15.1	3412	,,
Ratius baeodon—															
Bettotan and Rayoh	♂	140	120	27.5	...	34.1	28.5	9.5	4.8	4.5	13	4	15.2	3312	,,
,, ...	♂	130	19	28	19	35.2	29	9.2	5	4.9	12.1	4	15.3	3533	,,
,, ...	♂	135	10	27	19	...	...	...	4.9	...	...	...	...	3570	,,
,, ...	♀	126	133	28	16.5	33.8	27.9	9	4.9	4.9	12.9	3.5	15	3224	,,
,, ...	♀	133	15	25	18	33.2	28	9	4.9	4.2	12.7	3.5	15.2	3543	,,
,, ...	♀	139	119	25	18	34.2	28.4	9.8	4.1	4.3	13	3.6	14.6	3571	,,

RATTUS RATTUS DIARDI (P. 36). R. RATTUS TURBIDUS (P. 35). R. RATTUS BANGUEI (P. 35).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Skull: Condylo-basilar length	Skull: Diastema	Skull: Upper molar row (alveoli)	Skull: Length of palatal foramina	Skull: Median nasal length	Skull: Breadth combined nasals	Skull: Zygomatic breadth	Collector's No.	Remarks
Rattus rattus diardi—															
Kudat	♀	182	188	36	22	42.1	37	11.7	7	9	15.5	4.3	20.2	3517	Adult
,, ...	♀	178	...	35	21	41.7	37.8	11.2	7	8	15	4.5	21.2	3518	,,
,, ...	♀	188	...	37	21	42.9	39	11.8	7.5	8.1	15.1	4.2	21	3519	,,
Rattus rattus turbidus															
Bettotan ...	♂	144	141	29	19	36.5	32.5	10.9	6	6.5	13	4	18	3326	,,
Rattus rattus banguei															
Banguey Island ...	♂	167	153	31.5	19	38.9	35	11	6.8	7.1	14.1	4.1	18.6	3390	,,
,, ...	♂	182	160	31.5	20	42.1	37.6	12	7	8.5	16	4.7	19.3	3399	,,
,, ...	♀	174	162	32	20	41	36.5	11.7	6.8	7	15	4.6	20	3341	,,
,, ...	♀	175	175	32	20.5	42	38	12.2	6.9	7.6	15	4.8	20	3354	,,
,, ...	♀	175	172	33	19.5	40.5	36.5	11.8	7	8	15	4.2	20	3419	,,
Mallewallé Island...	♂	170	160	34	20	40.9	36.3	11.5	7	7	15.5	5	18.5	3450	,,

RATTUS MULLERI BORNEANUS (P. 36). R. MULLERI SUBSP. (P. 37).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Skull: Condylo-basilar length	Skull: Diastema	Skull: Upper molar row (alveoli)	Skull: Length palatal foramina	Skull: Median nasal length	Skull: Breadth combined nasals	Skull: Zygomatic breadth	Collector's No.	Remarks
Rattus mulleri borneanus—															
Bettotan ...	♂	231	305	46	22	53.9	46.9	15	10	9	21	6.1	26.8	3325	Adult
,, ..	♂	222	278	45	22	...	46	14.6	9.1	9	...	6	25	3229	,,
,,	♂	...	...	...	...	52	46.1	14.4	9	9.1	20.5	6.7	28.1	3293	,,
,,	♂	227	288	45	23	53.6	46	14.5	9.6	9.6	20.6	6	26	3333	,,
,, ...	♂	215	260	43	22	51	44.7	13.9	9.2	9	20.4	6	26	3337	,,
,, ...	♂	...	...	...	...	58.7	50	16	9.3	9.2	23	7.1	29	3681	,,
,, ...	♀	232	293	44	24	53	47	15	9.5	9.1	21.7	6	...	3310	,,
,, ...	♀	210	278	43	21.5	50.8	43.9	14	8.9	8.8	20	5.6	...	3318	,,
Rattus mulleri subsp.															
Banguey Island ...	♂	230	260	44	24	54.6	45	14.8	9.1	9.2	22.4	6	25.2	3355	,,
,, ...	♂	208	242	45	24	51.2	43	13	10	8.2	20.2	5.9	24	3361	,,
,, ...	♂	220	240	44	24	52.1	44.9	13.9	10	9	21.2	6.7	25	3388	,,
,, ...	♂	233	282	46	...	54	...	15	9.2	9.5	23.4	6.5	...	3424	,,
,, ...	♀	206	231	42	23	49.5	42	12.9	9.9	8.5	20.5	5.9	23.5	3389	,,
,, ...	♀	222	250	44	22	50.9	43.5	13.9	9.4	9.9	20.1	6	24.3	3400	,,
,, ...	♀	225	255	42	22.5	50	44	14	9.9	8.3	20.5	6.1	25.2	3425	,,
Balambangan Island	♂	232	258	44	22	53	46.5	15	10	8.1	20.9	6.9	26.2	3473	,,
,, ...	♂	230	250	42	22	52.1	45.3	15.1	9	8.1	21.5	7	26	3487	,,

HYSTRIX C. CRASSISPINIS (P. 38). TRICHYS L. LIPURA (P. 39).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Skull: Condylo-basilar length	Skull: Palatilar length	Skull: Diastema	Skull: Upper molar row (alveoli)	Skull: Median nasal length	Skull: Zygomatic breadth	Collector's No.	Remarks
Hystrix c. crassispinis														
Bettotan ...	♂	665	135	90	35	124	110	53.5	33	23	37.2	63.7	3244	Adult
,, ...	♀	615	110	80	37	120.2	104.8	51	32.5	21	38.2	60	3199	,,
,, ...	♀	525	125	87	36	111	96.7	46	...	...	35	58	3270	Immature
Trichys lipura lipura														
Bettotan ...	♀	400	210	64	30	89	74	37.5	26	15	27	44.8	3226	Adult
,, ...	♀	435	235	64	31	91	78.5	38	24.9	17.5	29	44	3232	,,
,, ...	♀	440	...	66	30	90.5	77.9	38	25	16	31	45	3246	,,

TUPAIA DORSALIS (P. 44). T. GLIS LONGIPES (P. 39).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Skull: Basal length	Skull: Condylo-basal length	Skull: Palatal length	Skull: Upper molar row (alveoli)	Skull: Tip of premaxilla to lachrymal notch	Skull: Rostral breadth at diastema	Skull: Inter-orbital breadth	Skull: Zygomatic breadth	Collector's No.	Remarks
***Tupaia dorsalis*—**																
Samawang and Bettotan ...	♂	165	157	41	14	48.5	52.5	45.5	27	17.8	24	5.6	13	22	3004	Adult
,, ...	♂	166	147	42	13	48.5	...	...	27.2	17	23.5	5.5	14	23	3132	,,
,, ...	♂	170	152	41	13.5	49.5	53.5	46.5	28	17.5	25	5.5	13.6	22.9	3060	,,
,, ...	♀	167	150	39	12.5	48.5	52.5	45.5	27.5	17.2	24.2	5.5	13.6	22.5	3212	,,
Tupaia glis longipes																
Samawang, Bettotan and Rayoh	♂	183	182	50	14	52	45.6	49	28.2	20.4	22	7.1	14	25	3031	,,
,, ...	♂	207	195	49	15	52.5	46	49.5	29	20.1	23	7.4	14.9	27	3047	,,
,, ...	♂	195	198	49	16	52	...	49	29	19.5	23.8	7.1	...	25.5	3081	,,
,, ...	♂	202	168	48	14	52	44.5	48	28.2	19.5	22.9	8	15	26.5	3130	,,
,, ...	♂	197	215	51	15	54.5	48	51	30	21	23.5	8	15	26.5	3146	,,
,, ...	♂	202	215	50	15	53.5	47.5	50.5	30.3	20	24	8	15	27.5	3184	,,
,, ...	♂	208	192	48	15.5	52.5	46.5	49.5	29	20.1	23	7.5	14.9	28	3250	,,
,, ...	♀	195	185	50	14	53	46	49	28.5	20.9	23.2	7.3	14.6	25	3011	,,
,, ...	♀	213	205	50	15	54	46.8	50	30	20	23.9	7.2	15.5	27.5	3251	,,
,, ...	♀	188	185	45	15	51.5	45.2	48	28.5	20	23	7.1	15	26	3302	,,

TUPAIA G. GRACILIS (P. 41).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	SKULL: Greatest length	Basal length	Condylo-basal length	Palatal length	Upper molar row (alveoli)	Tip of premaxilla to lachrymal notch	Rostral breadth at diastema	Inter-orbital breadth	Zygomatic breadth	Collector's No.	Remarks
Tupaia g. gracilis—																
Mainland ...	♂	140	184	39	12.5	41	35	37.5	20.3	14	16	6.5	13.2	21.5	3019	Adult
,, ...	♂	129	196	40	13.5	40	35.1	37	20	13.6	15.7	6.5	13.2	21.5	3133	,,
,, ...	♂	145	165	40	13	41	34.5	37	20.1	14	15.2	6	13.3	...	3580	,,
,, ...	♀	135	167	38	13	...	...	...	...	13.7	15	6	12	...	3160	,,
,, ...	♀	132	170	36	11.5	38	32.5	35	18.1	13.5	13.9	6	11.5	20.5	3279	,,
,, ...	♀	134	161	38	13	...	...	...	...	14.2	16	6.5	...	...	3579	,,
Banguey Id.	♀	133	162	36	11	37.5	32.1	34.5	...	13	14.2	6	12	20	3347	,,

TUPAIA MINOR CAEDIS (P. 40).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	SKULL: Greatest length	Basal length	Condylo-basal length	Palatal length	Upper molar row (alveoli)	Tip of premaxilla to lachrymal notch	Rostral breadth at diastema	Inter-orbital breadth	Zygomatic breadth	Collector's No.	Remarks
Tupaia minor caedis—																
Balambangan Island ...	♂	121	147	33	11.5	37	31	34	18	12.9	13.1	6.1	11	18.7	3469	Adult
,, ...	♂	108	137	31	11.5	33.1	27.9	...	...	...	...	...	...	...	3497	Immature
,, ...	♂	105	147	32	12	36.5	30.8	33.8	...	12.2	13	...	11.3	...	3501	Adult
,, ...	♂♀	125	150	33	11.5	35.6	...	33.5	18	12.9	13	6	10.5	18.5	3470	,,
,, ...	♀	128	145	31.5	11.5	...	...	...	19	12.8	13.8	6	11.8	19.6	3471	,,
,, ...	♀	125	143	30.5	12	36.5	31.1	34	18	12.5	13.2	6	...	18.9	3472	Type
,, ...	♀	115	135	31.5	11.5	...	...	...	...	...	...	...	...	...	3490	Immature
,, ...	♀	118	142	31.5	12.5	36	30.5	34	18	12.2	13	6	11	18.5	3491	Adult
Banguey Id.	♂	123	142	30	12	35.1	...	...	...	12.1	...	...	11	19	3367	,,
,, ...	♂	122	160	32	11.5	37.9	31.5	35	18.5	12.8	13.7	6.1	11.8	20.5	3378	,,
,, ...	♀	125	145	27.5	10.5	35.5	30	33	17.9	12.2	13	5.7	11.1	19.1	3348	,,
,, ...	♀	118	135	29	10	35	...	32.2	17.4	12	13	...	11	19	3423	,,

TUPAIA MINOR CAEDIS (P. 40). TUPAIA MINOR MINOR (P. 40).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Basal length	Condylo-basal length	Palatal length	Upper molar row (alveoli)	Tip of premaxilla to lachrymal notch	Rostral breadth at dias-	Inter orbital breadth	Zygomatic breadth	Collector's No.	Remarks
Tupaia minor caedis—																
Mainland ...	♂	128	152	30	11	36.5	30.9	33.2	18.1	12.6	13.3	6	11.4	20.5	3009	Adult
,, ...	♂	130	153	32	11.5	36.5	30.8	33.5	17.9	12	13	5.9	11.4	19.2	3076	,,
,, ...	♂	125	160	32	9.5	36.7	31	34.1	18.1	12.5	13	5.5	11	19.1	3158	,,
,, ...	♂	123	163	32	11.5	36.3	30.5	33.6	18	12.2	13.1	5.7	11	19.6	3164	,,
,, ...	♂	120	142	31	10	35.9	30.5	33.2	18	12	13	6	11.5	19.5	3216	,,
,, ...	♂	128	142	31	10	35.9	30.5	33.6	17.6	12.4	13	5.6	12	20	3300	,,
,, ...	♂	128	170	34	11	36	30.9	34	18	12.5	13	5.3	10.5	18.5	3512	,,
,, ...	♂	127	165	33	12	36.1	31	34.1	19	13.1	13.5	...	10.6	18.5	3525	,,
,, ...	♀	121	156	29	11	36.5	30.9	33.5	18	12	12.9	5.5	10.5	19.1	3021	,,
Tupaia minor minor—																
Rayoh ...	♀	...	...	...	...	36.8	31.8	34.9	18.5	12.6	14.8	5.7	11.7	19.6	3544	,,
,, ...	♀	...	...	...	..	36.5	31	34	18	13	13.1	6	10.7	19.1	3558	,,

TUPAIA TANA PAITANA (P. 42). T. TANA CHRYSURA (P. 43).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Basal length	Palatal length	Upper molar row (alveoli)	Premaxilla to tip of lachrymal notch	Inter-orbital breadth	Zygomatic breadth	Collector's No.	Remarks
Tupaia tana paitana—														
Samawang and Bettotan ...	♂	206	174	46	16	60.1	57.3	34	18	30	16.9	27.3	3006	Adult
,, ...	♂	200	170	45	14	59.9	55.7	33.8	17.5	29.9	15.6	26.4	3026	,,
,, ...	♂	208	180	47	18	63.8	59	36	18	32	17	28.4	3042	,,
,, ...	♂	217	176	46	16	63.5	58.4	36	18.5	31.9	16.1	27.6	3094	,,
,, ...	♂	198	180	47	15.5	59.5	55.2	33	17.5	29.9	15.1	27	3128	,,
,, ...	♀	210	166	46	16	60.7	56.9	33.9	17.9	31	15.5	27	3027	,,
,, ...	♀	207	170	44	17	60	55.2	32.9	17.8	30	16	26.1	3030	,,
,, ...	♀	200	185	45	16	60	56.3	34	18.2	30	14.3	25	3048	,,
,, ...	♀	200	185	50	15	60.5	56.9	34	18.5	30	16	27	3061	,,
Tupaia tana chrysura	♀	208	180	47	16	62.5	57.9	35	17.9	32	16	27.2	3062	,,
Rayoh	♀	192	175	44	17	57	53.5	31.9	16.4	28.9	14	25.5	3545	,,

T. TANA BANGUEI (P. 44).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length	Basal length	Palatal length	Upper molar row (alveoli)	Premaxilla to tip of lachrymal notch	Inter orbital breadth	Zygomatic breadth	Collector's No.	Remarks
Tupaia tana banguei—														
Banguey Island ...	♂	190	150	41	14	54.1	50.1	30	16	27	14.6	27	3346	Adult
,, ...	♂	163	150	...	14	54.6	50	29.9	17	26	15.5	25	3377	,,
,, ...	♂	187	153	44	16	54	...	29.7	16	26.3	14.5	26	3392	,,
,, ...	♂	185	150	40	15.5	52	48.5	29.4	15.8	25	14.5	24.9	3408	,,
,, ...	♂	200	155	43	16	55	51.2	30.4	16	27	15.6	27	3416	,,
,, ...	♂	182	165	41	16	55	51	31	16.2	27.6	15	26	3436	,,
,, ...	♀	188	165	43	15	53.0	50	30	16	26	14.9	24.2	3350	,,
,, ...	♀	183	150	43	13.5	52.5	49.2	29.3	16.1	25	14.9	24	3396	,,
,, ...	♀	182	145	41.5	14	52.9	49.3	...	16	25	14.3	23	3417	,,
,, ...	♀	177	163	43.5	14	53.1	29.9	...	16	26	14.5	...	3422	,,

ECHINOSOREX GYMNURA ALBA (P. 45).

Species and Locality	Sex	Head & body	Tail	Hind foot	Ear	Skull: Greatest length*	Basal length	Palatal length	Upper tooth-row all teeth (alveoli)	Zygomatic breadth	Collector's No.	Remarks
Echinosorex gymnura alba—												
Bettotan ...	♂	370	230	64	27	82.6	77.5	50.3	46.3	41.6	3305	Adult
,, ...	♂	390	254	65	26	83.2	77.9	50	47	40	3331	,,
,, ...	♂	400	260	65	28	85	80	51.4	48	40	3239	,,
,, ...	♂	380	250	64	28	84.2	78.4	51.1	48	40.5	3265	,,
,, ...	♀	360	228	63	29	83	78	50	47	39.7	3156	,,
,, ...	♀	405	260	62	28	89.4	84	53	49.2	42	3209	Aged (teeth much worn)
,, ...	♀	355	245	53	28	83.7	78.9	50	47.5	...	3227	Adult

*Tip of premaxilla to condyle.

GALEOPTERUS VARIEGATUS BORNEANUS (P. 46).

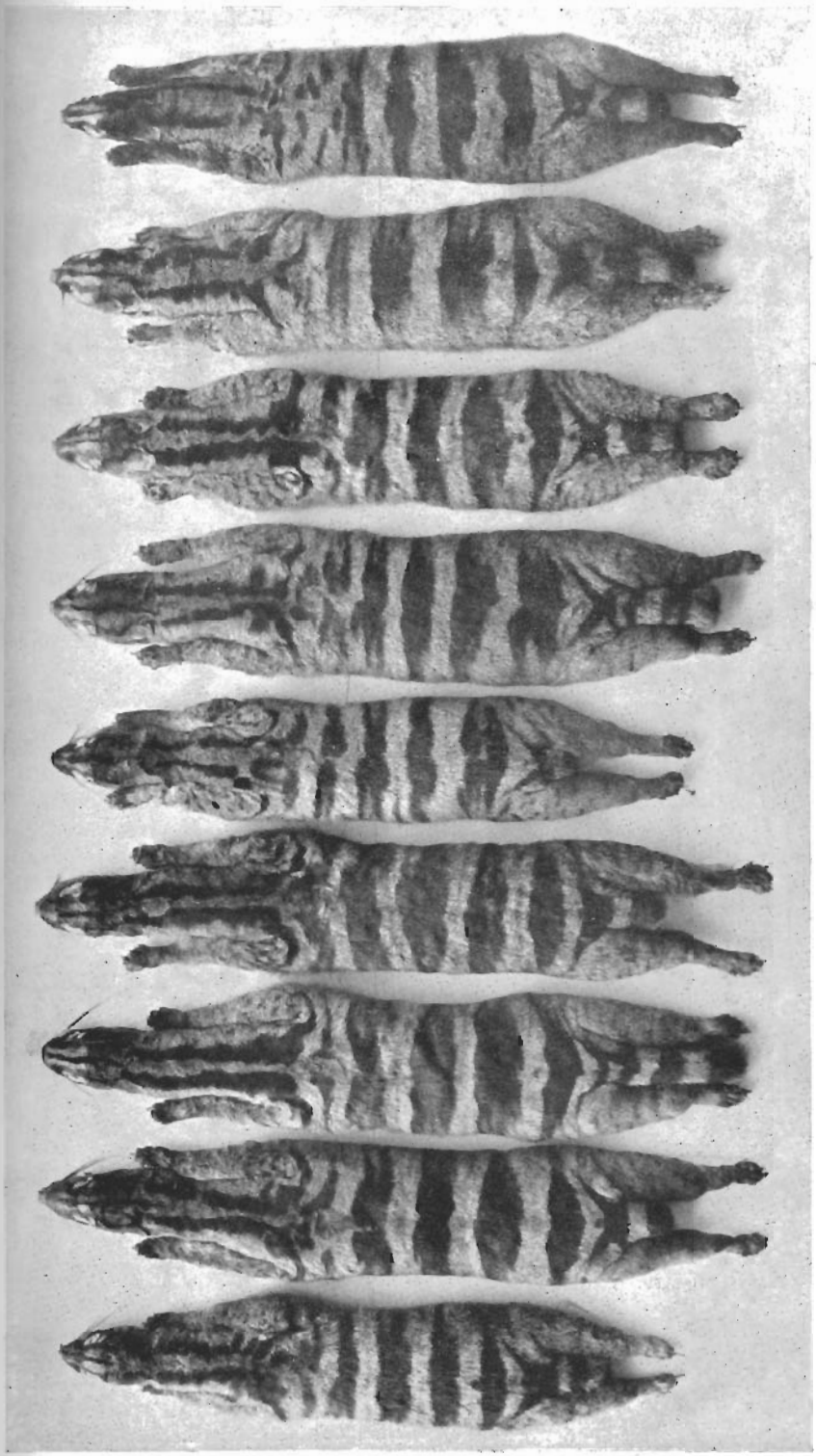
Localities	Sex	Head & body	Tail	Hind foot	Ear	SKULL: Greatest length	SKULL: Condylo-basal length	SKULL: Palatal length	SKULL: External biorbital breadth	SKULL: Least inter-orbital breadth	SKULL: Upper tooth-row (alveoli)	Collector's No.	Remarks
Galeopterus variegatus borneanus—													
Bettotan ...	♂	385	225	67	22	69	66.5	33	45	19.1	33.3	3218	Adult
" ...	♂	383	267	71	22	69.3	67	32.7	...	18.5	34	3141	" (rufous phase)
Samawang River ...	♀	415	255	66	20	72.3	68.5	33	46.2	18.1	36	3014	"
Banguey Island ...	♂	350	240	62	23	68	66	30.2	43	18.3	32.9	3430	"
" ...	♂	345	225	63	20	66.2	63	30	41.9	16.6	33	3431	Sub-adult
" ...	♀	390	250	66	23	70.2	65.9	31	47.9	20.9	33.9	2428	Adult
" ...	♀	405	265	70	24	74	70.1	33.5	47.1	22	35	3429	"

HIPPOSIDEROS DIADEMA VICARIUS (P. 49). RHINOLOPHUS ACUMINATUS (P. 48). R. BORNEENSIS (P. 48). R. MORIO FOETIDUS (P. 48).

Species and Locality	Sex	Forearm	Third meta-carpal	III¹	III² (chord)	Fourth meta-carpal	IV¹	IV²	Fifth meta-carpal	V¹	V²	Tibia	SKULL: Total length to canine	SKULL: Zygomatic breadth	SKULL: Upper teeth to front of canine	SKULL: Mandible	Collector's No.	Remarks
Hipposideros diadema vicarius—																		
Bettotan ...	♂	81	59.5	28	28.5	59.5	20	15	54.5	20	16	33	32.2	17.7	12.9	2.3	3672	Adult
Rhinolophus acuminatus—																		
Bettotan ...	♂	50.5	37.8	15	20.5	39	11.5	13	39	12	12.5	23	22	11.8	9	15	833	"
Rhinolophus borneensis—																		
Rayoh ...	♂	44	30.5	13	19	32	10	12	32	10	12.5	18	19.5	10	7.5	12.9	832	"
Rhinolophus morio foetidus																		
Bettotan ...	♂	58.5	39.7	23	32	45	13	19	47.5	13	20	28	27.5	13.5	11	19	3096	"

R. TRIFOLIATUS TRIFOLIATUS (P. 47). EMBALLONURA MONTICOLA (P. 49).

Species and Locality	Sex	Forearm	Third metacarpal	III¹	III² (chord)	Fourth metacarpal	IV¹	IV²	Fifth metacarpal	V¹	V²	Tibia	Skull: Total length to canine	Skull: Zygomatic breadth	Skull: Upper teeth to front of canine	Skull: Mandible	Collector's No.	Remarks
Rhinolophus t. trifoliatus—																		
Bettotan ...	♀	51	33	20	29	37	11.5	16	39	13	17	25.5	23.5	12	9	16	3069	Adult
,, ...	♀	...	34	19	28	39.5	11.5	19	42	12.5	20	26	23	12	8.9	15.5	3268	,,
Rayoh ...	♂	49.5	34	18.5	29	40	12	18	41	12	18	26	23.5	12	8.9	15.5	3660	,,
,, ...	♂	51.5	33.7	19	29	40	11	18.5	41	12	18	26	23.5	11.5	9.1	16	3661	,,
Banguey Id.	♂	47.5	32	17.5	27	36	10	15.5	38	11	15.5	24	21.5	11	8.4	14.2	3421	,,
Emballonura monticola—																		
Bettotan ...	♀	45	40.4	...	...	33	10.5	6	30	11.4	6.2	17.5	14	8.5	5.1	10	3065	,,
,, ...	♀	43	39	11.5	17.3	31	9	6	29	10.2	5.1	16.9	14	8.2	5	10	3072	,,
,, ...	♀	45.5	40	13.5	18	33	9.5	7	32	11	6	17	13.6	...	5.2	9.5	3673	,,
,, ...	♀	44.5	39	12.5	18	32	9.5	6.5	29.5	11	5	17.5	14.1	8.6	5.1	10.1	3089	,,



Hemigalus derbianus boiei (Müll.) from North Borneo.