

# SMITHSONIAN

## MISCELLANEOUS COLLECTIONS

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### SEVENTY NEW MALAYAN MAMMALS

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Dr. W. L. Abbott has presented to the United States National Museum four large collections of Malayan mammals of which it has been found impracticable to publish detailed accounts. The first was made on the islands of the Mergui Archipelago, off the west coast of Tenasserim, during the winter of 1900-01; it contains about four hundred specimens, and is noteworthy for its richness in slightly differentiated insular forms of rats and squirrels. The second collection, of about two hundred and seventy specimens, forms part of the results of explorations among the islands of the South China Sea not previously visited,<sup>1</sup> and on the neighboring east coast of Johore. Peculiar insular species of porcupine and flying lemur, both from Pulo Aor, may be regarded as the most interesting of the new mammals found during this expedition. The third was obtained in the Rhio Archipelago, off the southern extremity of the Malay Peninsula, in August and September, 1902, and numbers about one hundred and seventy-five specimens. Two of the new mammals which it includes, a monkey and a treeshrew, show an unexpected likeness to species occurring in the Anamba and Natuna Islands. The last and most valuable of the four collections was made with the assistance of Mr. C. B. Kloss during the winter of 1902-03 on the Pagi Islands, the Batu Islands, and Pulo Nias, islands of the chain lying parallel to the west coast of Sumatra.<sup>2</sup> It contains about three hundred specimens, among

<sup>1</sup> For an account of the mammals obtained during Dr. Abbott's first and second cruise in the South China Sea, see Miller, *Proc. Washington Acad. Sci.*, II, pp. 203-246, August 20, 1900, and III, pp. 111-138, March 26, 1901.

<sup>2</sup> For an account of the mammals obtained by Dr. Abbott on the more northerly islands of this archipelago, see Miller, *Proc. U. S. Nat. Mus.*, xxvi, pp. 437-484, February 3, 1902.

which are represented more than thirty hitherto undescribed species. Five of these are monkeys, two of which, a dwarf siamang and a member of a new genus *Simias*, differ from their known relatives by very remarkable characters. Study of these collections has led to the reexamination of much of Dr. Abbott's material that has been previously reported on. The seventy new mammals here described have been found in the course of this work.

**TRAGULUS BATUANUS** sp. nov.

*Type*.—Adult female (skin and skull), No. 121,697, United States National Museum. Collected on Tana Bala, Batu Islands, Sumatra, February 5, 1903, by Dr. W. L. Abbott. Original number, 2226.

*Characters*.—A large member of the *Tragulus napu* group with wholly black neck and black throat stripes. The black of neck extends forward over face and cheeks more than in any other species except *Tragulus annæ*, *T. jugularis*, and *T. bunguranensis*. From all of these the Batu animal is distinguished by the normal pattern of the throat markings.

*Color*.—Type: back ochraceous heavily shaded by the black hair-tips, neither color distinctly in excess of the other. On sides the ochraceous fades to buff and the black shading becomes slightly less heavy than on back. Muzzle, loral stripe, face, except dull ochraceous line 4 mm. wide bordering loral stripe, crown, ears, entire neck to outer white throat stripes, and cheeks to level of posterior canthus of eye, glossy black. Cheek from muzzle to posterior canthus of eye dull grizzled ochraceous. On close inspection dull ochraceous annulations may be detected on the black portion of the cheeks and on the neck, particularly at sides. These are nowhere sufficiently numerous to break the clear black effect, except at front of shoulders, where they rapidly increase in number, producing a rather abrupt transition to the color of the back. Underparts and light throat stripes white. A brownish stripe 60 mm. long and 4 mm. wide on middle of chest. Dark throat stripes clear black; collar black, noticeably speckled with dull ochraceous. The throat pattern is in every way normal, though the black stripes are perhaps narrower than usual. At anterior termination these stripes are about 10 mm. apart, and there is no brown wash on the white in front of them. Legs like back externally, the inner surface white. On hind legs the white disappears at about middle of tarsus; below this point the legs and feet are sprinkled with dull ochraceous hairs. Tail like back above, but ochraceous not as bright, white below and at tip.

*Skull and teeth.*—The skull is very large and the nasals are unusually long, but otherwise I do not detect any tangible cranial characters. Teeth large, particularly the upper premolars.

*Measurements.*—External measurements of type: total length, 680; head and body, 595; tail vertebræ, 85; hind foot, 145 (130); ear from meatus, 36.6; ear from crown, 30; width of ear, 24.

Cranial measurements of type: greatest length, 120 (116);<sup>1</sup> basal length, 112 (108); basilar length, 105 (102); occipito-nasal length, 110 (105); length of nasals, 40 (36); greatest breadth of both nasals together, 13 (13); diastema, 15 (12.4); zygomatic breadth, 54 (48); least interorbital breadth, 32 (30.4); mandible, 95 (91); maxillary toothrow (alveoli), 41 (39); maxillary premolars (crowns), 22 (20.4); mandibular toothrow (alveoli), 47 (45); mandibular premolars (crowns), 23.4 (20).

*Specimens examined.*—Four, all from the Batu Islands, one from Tana Masa, the rest from Tana Bala.

*Remarks.*—Unfortunately the type is the only adult in the collection. The immature individuals differ from it in the presence of a grayish buff wash on middle of belly, a character which is probably individual rather than due to the difference in age. The species is easily recognizable by the forward extension of the black neck area, combined with the normal throat pattern.

#### TRAGULUS RUSSULUS sp. nov.

*Type.*—Adult male (skin and skull), No. 121,701, United States National Museum. Collected on Tana Bala, Batu Islands, Sumatra, February 8, 1903, by Dr. W. L. Abbott. Original number, 2249.

*Characters.*—A member of the *kanchil* group similar to *Tragulus russeus* of the Banjak Islands, but upper parts not as dark, belly with less extensive yellowish suffusion, and throat pattern always normal. Skull and teeth not so large as in *Tragulus russeus*.

*Color.*—Type: general color above orange-ochraceous darker than that of Ridgway, the neck and outer surface of limbs brighter than body. The hairs of the back are tipped with black, forming a slight, uniform, dark clouding, much less pronounced than in *Tragulus russeus*. On shoulders this shading deepens abruptly into the black, slightly grizzled neck stripe. Crown a grizzle of dusky brown and buff. Cheeks dull buff. A faintly indicated buffy stripe borders upper margin of very ill-defined dark loreal stripe. Ears blackish. <sup>4</sup>Throat pattern normal, the dark stripes and collar orange-

<sup>1</sup> Measurements in parenthesis are those of an adult female paratype (No. 113,120) of *Tragulus nigricollis*.

ochraceous, the latter clear, the former slightly grizzled by dark brown hair-tips. The dark stripes meet anteriorly. From collar a dull orange-ochraceous stripe about 5 mm. in width extends back over middle of chest to join the pale orange-buff area 80 mm. long by 40 mm. wide which occupies middle of belly. With these exceptions the entire under surface of body is white. Tail white below and at tip, like back above but not as bright, and much less grizzled.

*Skull and teeth.*—The skull and teeth closely resemble those of *Tragulus russeus* but are not as large.

*Measurements.*—External measurements of type: total length, 535; head and body, 470; tail vertebræ, 65; hind foot, 122 (109); ear from meatus, 32; ear from head, 20; width of ear, 18. External measurements of adult female from the type locality (No. 121,697): total length 550; head and body, 485; tail vertebræ, 65; hind foot, 109 (98).

Cranial measurements of type: greatest length, 98; basal length, 92; basilar length, 86; occipito-nasal length, 87; length of nasals, 31.4; greatest breadth of both nasals together, 15; diastema, 8.8; zygomatic breadth, 44; least interorbital breadth, 28; mandible, 79; maxillary toothrow (alveoli), 33.6; maxillary premolars (crowns), 16.8; mandibular toothrow (alveoli), 37.6; mandibular premolars (crowns), 16.

*Specimens examined.*—Nine, all from the Batu Islands, 6 from Tana Bala, 1 from Tana Masa, and 2 from Pulo Pinie.

*Remarks.*—The orange-buff wash on the belly is occasionally more extensive than in the type, but never conspicuously so. The throat pattern is invariably normal, and the dark stripes always come together anteriorly. In the two skins from Pulo Pinie the general color of the back, sides, and neck is lighter and more buff than in those from the other islands.

#### RATUFA INSIGNIS sp. nov.

*Type.*—Adult male (skin and skull), No. 115,531, United States National Museum. Collected on Pulo Sugi, Rhio Archipelago, August 26, 1902, by Dr. W. L. Abbott. Original number, 1960.

*Characters.*—Externally similar to *Ratufa notabilis* Miller<sup>1</sup> of Linga Island, but size not as great. Skull noticeably smaller than that of *R. notabilis*, and front root of zygoma less abruptly flaring.

*Color.*—The color so closely resembles that of *Ratufa notabilis* as to need no detailed description. In the type the upperparts are

<sup>1</sup> *Proc. Acad. Nat. Sci. Philadelphia*, 1902, p. 150, June 11, 1902.

burnt-umber slightly darker than in the type of *R. notabilis*. Along middle of back there is a faint drab gloss, and the light annulations of the hairs are smaller and more sharply defined than in the related species. Back without the sprinkling of whitish hairs present in the type of *notabilis*. Underparts and inner surface of limbs cream-buff, tinged with brownish yellow, particularly on front legs. The cream-buff area on the legs is narrower than in the type of *Ratufa notabilis*. The pale area of underparts and legs is everywhere separated from the dark adjoining regions by a distinct edging of light tawny-ochraceous. This is present in the type of *R. notabilis*, but much less distinct. In both species the pale flank spot is indicated by an interruption of this edging. Cheeks, feet, and muzzle whitish. Tail concolor with back above, at sides, and tip, dull whitish gray along middle beneath. The four specimens are very uniform in color characters except for the usual effects of bleaching, which are noticeable in two of the skins.

*Skull and teeth*.—The skull and teeth are readily distinguishable from those of *Ratufa notabilis* by their smaller size. The general form of the skull is throughout less broad and robust than in the related species, but this difference is most noticeable in the region of the anterior zygomatic roots, which flare much less abruptly and widely than in the larger animal.

*Measurements*.—External measurements of type: total length, 780; head and body, 360; tail vertebræ, 420; hind foot, 76 (70); ear from meatus, 26.6; ear from crown, 16.

Cranial measurements of type: greatest length, 64.4 (68);<sup>1</sup> basal length, 55 (58); basilar length, 51.4 (55); length of nasals, 21.4 (22); diastema, 15 (14.6); least interorbital breadth, 25.4 (27.4); breadth of braincase above roots of zygomatics, 28 (29.4); zygomatic breadth, 39 (44); mandible, 41 (45); maxillary toothrow (alveoli), 12 (13); mandibular toothrow (alveoli), 12.6 (15).

*Specimens examined*.—Four, all from the type locality.

#### RATUFA CONSPICUA sp. nov.

*Type*.—Adult male (skin and skull), No. 115,528, United States National Museum. Collected on Pulo Bintang, Rhio Archipelago, August 19, 1902, by Dr. W. L. Abbott. Original number, 1900.

*Characters*.—In general similar to *Ratufa notabilis* and *R. insignis*, but skull not so large as in either of these, and pale color of underparts abruptly contrasted with dark brown of sides.

<sup>1</sup> Measurements in parenthesis are those of the type of *Ratufa notabilis*, a young adult male.



*Color*.—Upperparts of type exactly as in *Ratufa insignis* except that the neck and shoulders are more conspicuously speckled by the light annulations of the hairs. Underparts and inner surface of legs cream-buff not tinged with yellow. This color is everywhere sharply defined against the brown. There is a faint trace of the tawny edging between the two colors on hind legs, but to a much less extent than in either of the other species.

The skins show practically no variation in color beyond that due to bleaching.

*Skull and teeth*.—In form the skull is similar to that of *Ratufa insignis*, but in size it is not as large. Teeth as in the related species.

*Measurements*.—External measurements of type: total length, 705; head and body, 330; tail vertebræ, 375; hind foot, 77 (72); ear from meatus, 25.6; ear from crown, 13.

Cranial measurements of type: greatest length, 63; basal length, 54; basilar length, 50; length of nasals, 20.4; diastema, 14; least interorbital breadth, 24; breadth of braincase above roots of zygomata, 27.4; zygomatic breadth, 39; mandible, 38.8; maxillary toothrow (alveoli), 12.8; mandibular toothrow (alveoli), 12.8.

*Specimens examined*.—Seven, all from Pulo Bintang.

#### RATUFA BALÆ sp. nov.

*Type*.—Adult male (skin and skull), No. 121,715, United States National Museum. Collected on Tana Bala, Batu Islands, Sumatra, February 5, 1903, by Dr. W. L. Abbott. Original number, 2224.

*Characters*.—Similar to *Ratufa femoralis* but much darker; back darker than belly; tail blackish. Crown and forehead not noticeably lighter than back. Femoral spot large and conspicuous.

*Color*.—Type: upperparts wood-brown faintly washed with vandyke-brown along middle of back, and showing strong drab reflections in certain lights. On sides the brown brightens to a brownish buff and the shorter hairs show distinct light annulations. The speckling thus produced is inconspicuous. Crown and forehead like sides but not quite as dark. Cheeks slightly tinged with gray. Ears and indistinct eye ring blackish. Whiskers black, their bases surrounded by a whitish patch. Outer surface of legs like sides but strongly tinged with ochraceous-rufous. This is particularly noticeable on front legs between shoulder and wrist, where a clear band is formed between colors of outer and inner surfaces. Feet blackish. Underparts and inner surface of legs clear orange-buff, darker along median line, paler in axillary region. Chin dark grayish. Femoral spot whitish, large and well defined. Entire tail

very dark, blackish vandyke-brown, the hairs fading to a light drabby buff below middle. This color appears faintly at surface along under side, but scarcely more than enough to throw the dark median line of short hairs into contrast.

*Skull and teeth.*—The skull is slightly larger than that of *Ratufa femoralis*, the interpterygoid space is wider and the nasal bones and audital bullæ are longer. Teeth as in the related species.

*Measurements.*—External measurements of type: total length, 725; head and body, 340; tail vertebræ, 385; hind foot, 74 (70).

Cranial measurements of type: greatest length, 65; basal length, 54; basilar length, 50; length of nasals, 21; greatest breadth of both nasals together, 12; least interorbital breadth, 26; zygomatic breadth, 38; mandible, 39.6; maxillary toothrow (alveoli), 12.8; mandibular toothrow (alveoli), 13.6.

*Specimens examined.*—Eight, all from Tana Bala.

*Remarks.*—This squirrel is readily distinguishable from all other known members of the genus except those occurring on Tana Masa and Pulo Pinie by its rich coloration, blackish tail, and conspicuous femoral spot. The tail is nearly as dark as that of *Ratufa nigrescens*, but in the Mansalar animal the back also is blackish, and the femoral spot is obsolete. In *Ratufa femoralis* the back is distinctly lighter than the belly, while the opposite is true of the Batu species.

#### RATUFA MASÆ sp. nov.

*Type.*—Adult male (skin and skull), No. 121,818, United States National Museum. Collected on Tana Masa, Batu Islands, February 21, 1903, by Dr. W. L. Abbott. Original number, 2330.

*Characters.*—Like *Ratufa balæ*, but entire head grayish, in distinct contrast with back. Femoral spot large and well defined.

*Color.*—The color so closely resembles that of *Ratufa balæ* that no detailed account is required. The whole crown and forehead, however, are a grizzled yellowish gray, noticeably lighter than rest of upperparts. In the grizzled area the hairs are slaty at base, then yellowish brown, followed by a conspicuous whitish cream-buff annulation and a dark tip. Cheeks clear grizzled gray, the general effect between the hair-brown and smoke-gray of Ridgway, the same color extending as a broad band across throat and chin. Femoral spot large and conspicuous, whitish cream-buff.

*Measurements.*—Measurements of type: total length, 730; head and body, 340; tail vertebræ, 390; hind foot, 72 (69); skull, greatest length, 62; basal length, 52; length of nasals, 20; interorbital constriction, 25; zygomatic breadth, 39.

*Specimens examined.*—Four, all from Tana Masa.

**RATUFA PINIENSIS** sp. nov.

*Type*.—Adult male (skin and skull), No. 121,840, United States National Museum. Collected on Pulo Pinie, Batu Islands, March 1, 1903, by Dr. W. L. Abbott. Original number, 2343.

*Characters*.—Like *Ratufa masæ* but darker throughout, particularly on the ventral surface. Head grayish in strong contrast with back. Femoral spot less well developed than in the two related forms.

*Color*.—In general the color is like that of the two other Batu members of the group, but the vandyke-brown wash on the back is heavier, particularly in lumbar region, and the underparts are darkened nearly to ochraceous-rufous. The inguinal and axillary regions are not as dark as the rest of the ventral surface. Crown even lighter and clearer gray than in *Ratufa masæ*, scarcely yellower than cheeks. Femoral spot not as large as in the related forms, and so heavily grizzled by dark yellowish brown annulations as to be less conspicuous than in any of the Sumatran members of the group except *Ratufa nigrescens*.

*Skull and teeth*.—The skull and teeth do not differ tangibly from those of *Ratufa balæ*.

*Measurements*.—Measurements of type: head and body, 325; tail imperfect; hind foot, 73 (69); skull, greatest length, 62; basal length, 52; basilar length, 48.4; length of nasals, 11; greatest breadth of both nasals together, 12; least interorbital breadth, 26; zygomatic breadth, 38; mandible, 39; maxillary tooththrow (alveoli), 12; mandibular tooththrow (alveoli), 13.

*Specimens examined*.—Six, all from Pulo Pinie.

**SCIURUS BILIMITATUS** sp. nov.

*Type*.—Adult female (skin and skull), No. 105,072, United States National Museum. Collected at Tanjong Laboha, Tringanu, Malay Peninsula, September 29, 1900, by C. B. Kloss. Original number (Dr. W. L. Abbott), 671.

*Characters*.—Similar to the Javan *Sciurus nigrovittatus* Horsfield, but tail longer, back more distinctly grizzled, gray of underparts paler, and outer lateral stripe conspicuous and sharply defined.

*Color*.—Upperparts a fine grizzle of black and cream-buff, the latter rather in excess, and brightening to buff on shoulders, neck, and flanks. Cheeks, muzzle, chin, and throat buff, brighter and more rusty than that of Ridgway. Chest, belly, and inner surface of legs pale smoke-gray, the darker bases of the hairs appearing



irregularly at surface. Lateral stripes clear and sharply defined, the inner black, the outer buff. The width of each at middle is about 10 mm.

*Measurements*.—Measurements of type: total length, 485; head and body, 205; tail vertebrae, 180; hind foot, 46 (43).

*Specimens examined*.—Malay Peninsula; Tanjong Laboha, Tringanu, 1; no exact locality, 1; Tioman Island, 12.

*Remarks*.—As compared with a series of five skins of *Sciurus nigrovittatus* from western Java the characters of *Sciurus bilimitatus* are both pronounced and constant. There is no variation worthy of note, and the specimens from Tioman Island appear to agree in all respects with those from the mainland. In *Sciurus nigrovittatus* the pale lateral stripe is so ill defined that in some skins it would easily pass unnoticed. Horsfield, in fact, does not mention it.

#### SCIURUS PEMANGILENSIS sp. nov.

*Type*.—Adult female (skin and skull), No. 112,460, United States National Museum. Collected on Pulo Pemangil, off coast of Johore, June 12, 1901, by Dr. W. L. Abbott. Original number, 1062.

*Characters*.—A pallid member of the *Sciurus vittatus* group somewhat resembling *Sciurus lautensis* of the North Natuna Islands, but smaller and with upperparts a clearer, less yellowish gray.

*Color*.—Upperparts a fine inconspicuous grizzle of black and pale very dull buff (or light wood-brown), the two colors about evenly mixed on back, the buff slightly in excess on sides, the general effect throughout very near broccoli-brown. Cheeks and outer surface of legs light wood-brown. Entire upper surface of tail like back, but more coarsely grizzled. Under surface of tail nearly clear, pale, wood-brown (or cream-buff with a slight brownish tinge) except at edges and at tip, where it is grizzled. Underparts and inner surface of legs bright ochraceous-buff (considerably more yellow than that of Ridgway), fading to pale wood-brown on chin. Outer lateral stripe buffy white, well defined and about 7 mm. in width. Inner lateral stripe diffuse, about 10 mm. in breadth, its color like that of sides of body but slightly darker and overlaid by a thin wash of ochraceous-buff. Feet dull buffy gray, not noticeably paler than legs.

*Skull and teeth*.—The skull and teeth resemble those of *Sciurus lautensis* except that the rostrum appears to be somewhat broader and more robust.

*Measurements*.—Measurements of type: total length, 335; head and body, 185; tail vertebrae, 150; hind foot, 44 (41); skull, greatest length, 49; zygomatic breadth, 28.

*Specimens examined*.—Twelve, all from Pulo Pemangil.

*Remarks*.—Among the squirrels of the *Sciurus vittatus* group with which I am familiar this species is readily distinguishable by its uniform gray dorsal surface, in which the grizzle has become obsolete.

**SCIURUS AORIS** sp. nov.

*Type*.—Adult female (skin and skull), No. 112,418, United States National Museum. Collected on Pulo Aor, off coast of Johore, June 5, 1901, by Dr. W. L. Abbott. Original number, 1002.

*Characters*.—A pallid member of the *Sciurus vittatus* group, much like *S. pemangilensis* in general color, but back and sides sharply and distinctly grizzled, and red of underparts slightly less bright.

*Color*.—Type: The type so closely resembles that of *Sciurus pemangilensis* that no detailed description is necessary. On back and sides the elements of the grizzle are essentially the same in the two species, but in that from Pulo Aor the colors are so sharply contrasted as to produce the finely speckled appearance characteristic of most of the members of the group. Underparts essentially as in *S. pemangilensis* but the red not as bright.

*Skull and teeth*.—I can detect nothing to distinguish the skull and teeth from those of *Sciurus pemangilensis*.

*Measurements*.—Measurements of type: total length, 335; head and body, 185; tail vertebrae, 150; hind foot, 44 (41); skull, greatest length, 45; zygomatic breadth, 25.

*Specimens examined*.—Fifteen, all from Pulo Aor.

*Remarks*.—*Sciurus aoris* is readily distinguishable from *S. pemangilensis*, by its sharply speckled back. In general color it closely resembles *Sciurus lautensis*, but the flanks and thighs are uniform with the back and not tinged with fulvous as in the Natuna animal. The series shows no marked variations in color.

**SCIURUS PENINSULARIS** sp. nov.

*Type*.—Adult male (skin and skull), No. 112,511, United States National Museum. Collected on north bank of Endau River, Pahang, June 21, 1901, by Dr. W. L. Abbott. Original number, 1078.

*Characters*.—Like *Sciurus vittatus*, but red of underparts strongly tinged with ochraceous, and cheeks scarcely more yellow than sides of neck.

*Color*.—Type: upperparts and tail a fine grizzle of black and ochraceous-buff, the latter a little in excess on body, the former on tail. Underparts and inner surface of legs tawny, washed, particu-

larly on chest, with ochraceous. Lateral stripes as in *Sciurus vittatus*, the outer whitish cream-buff, about 6 mm. wide at middle, the inner black and about 10 mm. in width. Cheeks like back, but with a light wash of ochraceous-buff, this wash not distinct enough to produce a marked contrast with color of neck.

*Measurements.*—Measurements of type: total length, 390; head and body, 210; tail vertebræ, 180; hind foot, 50 (47); skull, greatest length, 49.4; zygomatic breadth, 28.

*Specimens examined.*—Nine, five from the banks of the Endau River, and four from Singapore.

*Remarks.*—The squirrel of the *vittatus* group inhabiting the southern end of the Malay Peninsula is distinguishable from the typical Sumatran animal by its more yellowish underparts and less yellowish cheeks. In true *Sciurus vittatus*, as represented by specimens from Tapanuli Bay, the red area of the body is very nearly the same as the orange rufous of Ridgway, and the cheeks are so heavily washed with buff as to contrast strongly with sides of neck.

#### SCIURUS PANNOVIANUS sp. nov.

*Type.*—Adult male (skin and skull), No. 112,351, United States National Museum. Collected on Pulo Pannow, Atas Islands, South China Sea, May 28, 1901, by Dr. W. L. Abbott. Original number, 952.

*Characters.*—Like *Sciurus peninsularis*, but size less, dark lateral stripes much broader and more diffuse, and tail with fairly well defined black pencil.

*Color.*—Type: The general color so closely resembles that of the type of *Sciurus peninsularis* as to need no detailed description. The dark lateral stripes are less sharply outlined than in the mainland animal, however, and their width at middle is at least 15 mm. Tail with blackish pencil distinctly visible both above and below.

*Skull and teeth.*—The skull and teeth are not so large as in *Sciurus peninsularis*, and the audital bullæ are smaller and less inflated, particularly in their posterior segment.

*Measurements.*—Measurements of type: total length, 380; head and body, 193; tail vertebræ, 185; hind foot, 48 (45); skull, greatest length, 47; zygomatic breadth, 26.4.

*Specimens examined.*—Ten, all from Pulo Pannow.

*Remarks.*—From *Sciurus abbottii* and *S. anambensis* the Pannow squirrel is distinguished by its darker upperparts, brighter under surface, and black-tipped tail. The series of ten specimens shows no color variations worthy of note.

## SCIURUS ICTERICUS sp. nov.

*Type*.—Adult female (skin and skull), No. 121,727, United States National Museum. Collected on Tana Bala, Batu Islands, February 4, 1903, by Dr. W. L. Abbott. Original number, 2223.

*Characters*.—In general appearance like *Sciurus vittatus*, but size greater, color above darker, lateral stripes less distinct, and cheeks bright, clear, yellowish buff.

*Color*.—Type: upperparts and outer surface of legs a uniform fine grizzle of black and buff, the former everywhere in excess. Underparts and inner surface of legs rufous. Cheeks clear buff-yellow in striking contrast with surrounding parts. This color extends from base of whiskers to level of anterior margin of ear, and is continuous with the clear buff-yellow eye ring. This ring is 3 mm. wide over middle of eye. Posteriorly the buff area extends upward onto basal half of ear, but in this region it becomes dull and grizzled. Behind mouth and chin it becomes mixed with the rufous of underparts. The lips and chin are, however, dark grizzled gray. Outer surface of ears blackish. Feet like legs, but tinged with gray. Pale lateral stripe dull, light smoke-gray, only 5 mm. wide at middle and reduced in extent at each end. Dark stripe blackish, about 7 mm. wide, slightly longer than pale stripe. Tail like back, but more coarsely grizzled, and light bands on hairs less yellow; pencil indistinctly blackish.

*Skull and teeth*.—The skull is similar to that of *Sciurus vittatus* but is much larger and the audital bullæ are broader and less elevated. Teeth similar to those of *Sciurus vittatus* but larger throughout.

*Measurements*.—Measurements of type: total length, 420; head and body, 225; tail vertebræ, 195; hind foot, 49 (46); skull, greatest length, 54 (51);<sup>1</sup> basal length, 46.6 (43.6); zygomatic breadth, 32.6 (30); least interorbital breadth, 20 (18); mandible, 34 (32); maxillary toothrow (alveoli), 10.2 (9.6).

*Specimens examined*.—Nine, from the following of the Batu Islands: Pulo Pinie, 1; Tana Bala, 7; Tana Masa, 1.

*Remarks*.—This strikingly characterized squirrel needs no special comparison with any of the members of the group to which it belongs. The specimens show no variation worthy of note except that the skin from Pulo Pinie has the light element in the tail less yellow than the others.

<sup>1</sup> Cranial measurements in parenthesis are those of an adult female *Sciurus vittatus* from Tapanuli Bay, Sumatra (No. 114,518).

**SCIURUS ATRATUS** sp. nov.

*Type*.—Adult female (skin and skull), No. 121,524, United States National Museum. Collected on North Pagi Island, Sumatra, November 22, 1902, by Dr. W. L. Abbott. Original number, 2087.

*Characters*.—A large member of the *Sciurus vittatus* group with clear black tail, blackish brown upperparts, and blackish gray belly. Lateral stripes nearly lost in the general darkening of the fur.

*Color*.—Type: upperparts and outer surface of hind legs an ill-defined grizzle of black and dull russet, the former everywhere much in excess, but particularly so on middle of posterior half of back, where the lighter color is scarcely noticeable except on close inspection. Outer surface of front legs black. Cheeks dull black. Feet and ears blackish hair-brown. Tail clear black throughout, the hairs with no indication of lighter bands except at extreme base of tail, and even here very inconspicuously. Underparts and inner surface of legs a mixture of black and smoke-gray, each hair wholly of one color or the other. The gray is slightly in excess on throat and front legs, the black on chin, chest, belly, and hind legs. Black lateral stripe about 10 mm. broad. While it extends from front leg to middle of thigh it is not noticeable at first sight, on account of its slight contrast with the surrounding parts. Pale lateral stripe dull russet, more reddish than that of Ridgway, about 10 mm. wide, but so ill defined and inconspicuous that it might readily pass unobserved. Throughout the body the hairs are unusually glossy, and along median line from crown to middle of back there is a faint sprinkling of entirely white hairs.

*Skull and teeth*.—The skull and teeth closely resemble those of *Sciurus ictericus*, but the braincase is less highly arched and the nasals are broader in proportion to their length.

*Measurements*.—Measurements of type: total length, 395; head and body, 230; tail vertebrae, 165; hind foot, 49 (46); skull, greatest length, 54; basal length, 46; zygomatic breadth, 32; least interorbital breadth, 18; mandible, 35; maxillary toothrow (alveoli), 10.

*Specimens examined*.—Twenty-one, from the following localities: North Pagi Island, 8; South Pagi Island, 13.

*Remarks*.—While the characters as a whole are very constant there are certain rather considerable variations. In most of the skins the gray hairs are in excess of the black on entire ventral surface, but in one (No. 121,613) the opposite is conspicuously the case. The whitish hairs on the dorsal surface are sometimes concentrated on head and neck so as to give this region a noticeably grayish cast.



The tail is invariably clear black, except at extreme base, a character which will serve to distinguish the animal from the Siporan *Sciurus melanogaster* at a glance, though the two species are of about the same color and size.

**SCIURUS PINIENSIS** sp. nov.

*Type*.—Adult female (skin and skull), No. 121,800, United States National Museum. Collected on Pulo Pinie, Batu Islands, Sumatra, March 1, 1903, by Dr. W. L. Abbott. Original number, 2344.

*Characters*.—In general appearance like *Sciurus natunensis* (Thomas), but size less, and skull with short, broad rostrum much as in *Sciurus tenuis*.

*Color*.—Upperparts a fine grizzle of black and dull light ochraceous, the latter everywhere a little in excess, but more particularly so on sides. Crown, feet, and outer surface of legs like back, but darker and more finely grizzled. Cheeks, eye ring, and ill-defined area about roots of whiskers nearly clear ochraceous. A wash of the same color on anterior inner surface of thigh. Underparts and inner surface of legs cream-buff, lighter than that of Ridgway anteriorly and on front legs, darkening posteriorly and on hind legs almost to buff. The light and dark areas of front leg are separated on outer side by an almost clear blackish line. Tail like back, but darker above and lighter below, everywhere more coarsely grizzled; pencil black.

*Skull and teeth*.—Skull smaller than that of *Sciurus natunensis* and without elongation of muzzle. In size and general form it closely resembles the skull of *Sciurus tenuis*, but is not as broad interorbitally, the audital bullæ are smaller, and the nasal bones are shorter. Teeth as in *Sciurus tenuis* and *S. natunensis* but much smaller.

*Measurements*.—External measurements of type: total length, 210; head and body, 134; tail vertebræ, 75; hind foot, 32 (29); ear from meatus, 12.6; ear from crown, 7; width of ear, 10; skull, greatest length, 35; basal length, 29.4; length of nasals, 9.4; zygomatic breadth, 20.4; interorbital breadth, 11.2; maxillary tooththrow (alveoli), 5.6.

*Specimens examined*.—One, the type.

**SCIURUS BALÆ** sp. nov.

*Type*.—Adult male (skin and skull), No. 121,799, United States National Museum. Collected on Tana Bala, Batu Islands, February 12, 1903, by Dr. W. L. Abbott. Original number, 2282.

*Characters*.—Similar to *Sciurus pinicensis* but slightly larger, and underparts almost white.

*Color*.—The color throughout is as in *Sciurus pinicensis* except that the light element of the grizzle on upperparts is paler (very nearly the buff of Ridgway), the dark line on outer side of front leg is less developed, and the underparts are nearly white anteriorly, very pale cream-buff posteriorly.

*Skull and teeth*.—The skull is slightly larger than that of *Sciurus pinicensis* and the teeth are relatively smaller, but otherwise I can detect no differences.

*Measurements*.—External measurements of type: head and body, 137; tail, — (broken); hind foot, 34 (31); ear from meatus, 13; ear from crown, 8.6; width of ear, 11; skull, greatest length, 36.6; basal length, 31; length of nasals, 10; zygomatic breadth, 22; inter-orbital breadth, 12.2; maxillary toothrow (alveoli), 5.6.

*Specimens examined*.—One, the type.

*Remarks*.—While this squirrel is very closely related to *Sciurus pinicensis* the characters shown by the single specimen are such that it is impossible to regard the animals from the two islands as identical.

#### SCIURUS PUMILUS sp. nov.

*Type*.—Adult female (skin and skull), No. 121,627, United States National Museum. Collected on South Pagi Island, Sumatra, November 27, 1902, by Dr. W. L. Abbott. Original number, 2098.

*Characters*.—Similar to *Sciurus tenuis* but much smaller and somewhat darker. Not as small as *Sciurus fraterculus*.

*Color*.—Type: back, sides, neck, head, and outer surface of legs a fine, uniform grizzle of black and buff, the latter everywhere a little in excess, but slightly more so on sides than elsewhere. Underparts and inner surface of legs cream-buff, dulled by the appearance at surface of the slaty underfur, this especially noticeable toward sides. Tail like back but more coarsely grizzled and slightly yellower. Feet dull buffy gray, not strongly contrasted with legs.

*Skull and teeth*.—The skull resembles that of the members of the *Sciurus tenuis* group, but is smaller than that of any hitherto known, *S. fraterculus* excepted. As compared with that of *Sciurus procerus*, the smallest that I have at hand, it is decidedly narrower and more elongate in general outline, and the zygomata are less abruptly flaring in front. Teeth relatively as well as actually smaller than those of *Sciurus procerus*.

*Measurements*.—External measurements of type: total length, 205; head and body, 125; tail vertebræ, 80; hind foot, 30 (28); ear from meatus, 11; ear from crown, 7; width of ear, 10.

Cranial measurements of type: greatest length, 34.6; basal length, 28.4 (28);<sup>1</sup> basilar length, 26.8; diastema, 8.4 (8); length of nasals, 10 (9.8); greatest breadth of both nasals together, 5 (5.3); interorbital breadth, 11.8 (12); zygomatic breadth, 19.6 (20.3); mandible, 21; maxillary toothrow (alveoli), 5.8; mandibular toothrow (alveoli), 6.

*Specimens examined*.—Six, all from the Pagi Islands.

*Remarks*.—Although closely related to the *Sciurus fraterculus* of Sipora Island, this squirrel is distinguishable by its less dwarf size and by the absence of rufous tints on sides and upperparts.

#### SCIURUS LANCAVENSIS sp. nov.

1900. *Sciurus concolor* MILLER, Proc. Biol. Soc. Washington, XIII, p. 191, December 21, 1900. Part, specimens from Pulo Lankawi. Not *S. concolor* BLYTH.

*Type*.—Adult male (skin and skull), No. 104,390, United States National Museum. Collected on Pulo Lankawi, off west coast of Malay Peninsula (about 75 miles north of Penang), December 1, 1899, by Dr. W. L. Abbott. Original number, 101.

*Characters*.—Like *Sciurus davisoni* (Bonhote) but smaller and with scarcely a trace of the reddish areas on neck and sides.

*Color*.—Type: back and sides a uniform grizzle of black and a brown intermediate between the buff and cinnamon of Ridgway, the lighter color somewhat in excess. Face, legs, and feet a finely grizzled gray approaching in general effect the hair-brown of Ridgway and forming a distinct though not very striking contrast with color of back. Neck with a barely indicated reddish area behind and below ear. Ears slightly more gray than back. Underparts dull gray much like that of legs, but distinctly washed with broccoli-brown on middle of belly. Tail concolor with back above, slightly paler below, the grizzle everywhere more coarse and forming obscure cross-bars beyond middle; pencil clear black, equal to about one-sixth entire length of tail.

*Skull and teeth*.—As compared with that of *Sciurus davisoni* the skull of *S. lancavensis* is noticeably smaller and the rostrum is relatively shorter and broader. Teeth essentially as in *S. davisoni*.

*Measurements*.—Measurements of type: total length, 410; head and body, 210; tail vertebræ, 200; hind foot, 51 (47.5); skull,

<sup>1</sup> Measurements in parenthesis are those of one of the cotypes (adult male) of *Sciurus fraterculus*, taken from the original description.

greatest length, 53; zygomatic breadth, 29.4; median length of nasals, 15.6; greatest breadth of both nasals together, 7.6.<sup>1</sup>

*Specimens examined*.—Two, both from Pulo Lankawi.

**SCIURUS ADANGENSIS** sp. nov.

1900. *Sciurus concolor* MILLER, Proc. Biol. Soc. Washington, XIII, p. 191, December 21, 1900. Part, specimens from Pulo Adang. Not *Sciurus concolor* BLYTH.

*Type*.—Adult male (skin and skull), No. 104,389, United States National Museum. Collected on Pulo Adang, Butang Islands, December 14, 1899, by Dr. W. L. Abbott. Original number, 153.

*Characters*.—Like *Sciurus lancavensis* but smaller.

*Color*.—The color so closely resembles that of *Sciurus lancavensis* as to require no special description. The sides of the neck are almost exactly concolor with back, and I can detect no trace of a reddish area along sides of body.

*Skull and teeth*.—The skull is shorter and relatively broader than that of *Sciurus lancavensis*, but otherwise it does not differ appreciably in form. Teeth as in the related species.

*Measurements*.—Measurements of type: total length, 395; head and body, 210; tail vertebrae, 185; hind foot, 48 (45); skull, greatest length, 51; zygomatic breadth, 30; median length of nasals, 14.8; greatest breadth of both nasals together, 7.

*Specimens examined*.—Three, all from Pulo Adang.

**SCIURUS SULLIVANUS** sp. nov.

*Type*.—Adult female (skin and skull), No. 104,377, United States National Museum. Collected on Sullivan Island, Mergui Archipelago, February 1, 1900, by Dr. W. L. Abbott. Original number, 294.

*Characters*.—Similar to *Sciurus davisoni* (Bonhote) from southern Tenasserim, but smaller and darker.

*Color*.—Type: back a fine grizzle of black, buff, and raw-sienna, the last slightly in excess of either of the others. On sides of neck and along sides of body from axilla to inner surface of thigh the color deepens nearly to ochraceous-rufous which forms a very evident contrast with the surrounding parts. Ears, head, legs, and feet grizzled gray, somewhat resembling the mouse-gray of Ridgway but with a silvery gloss. Underparts dull smoke-gray,

<sup>1</sup> In an adult male *Sciurus davisoni* from Bok Pyin, Tenasserim (No. 104,392), the skull measures: greatest length, 57; zygomatic breadth, 32; median length of nasals, 17.4; greatest breadth of both nasals together, 7.6.

with an indistinct darker wash along median line. Tail like back, but more coarsely grizzled, its terminal black area occupying about one-fourth total length of tail.

*Skull and teeth.*—The skull closely resembles that of *Sciurus adangensis* in form, but in size it is distinctly larger. It is smaller and less elongate than the skull of *Sciurus davisoni*. The teeth show no peculiarities.

*Measurements.*—Measurements of type: total length, 490; head and body, 285; tail vertebræ, 205; hind foot, 51 (47); skull, greatest length, 55; zygomatic breadth, 33; median length of nasals, 16.8; greatest breadth of both nasals together, 7.8.

*Specimens examined.*—Five, all from Sullivan Island.

*Remarks.*—The series shows no variation worthy of note. The color pattern in this species is like that of the mainland animal, and the neck and side markings show no tendency to become obsolete.

#### SCIURUS DOMELICUS sp. nov.

*Type.*—Adult female (skin and skull), No. 104,381, United States National Museum. Collected on Domel Island, Mergui Archipelago, February 24, 1900, by Dr. W. L. Abbott. Original number, 322.

*Characters.*—Like *Sciurus sullivanus* but colors throughout slightly darker, reddish lateral areas spreading over whole ventral surface, black tip of tail longer, and skull with narrower, more elongate rostrum.

*Color.*—Type: The colors are essentially as in *Sciurus sullivanus* but are all a shade darker, the red of the sides and neck approaching cinnamon-rufous. Entire underparts heavily washed with dull cinnamon-rufous, a trace of grizzled gray, however, remaining on chest. Legs, feet, and face darker gray than in the related form, but rather lighter and producing a more decided contrast. Tail as in *Sciurus sullivanus* except that the black terminal area is noticeably longer.

*Skull and teeth.*—The skull differs from that of *Sciurus sullivanus* in its narrower general form, and in the greater elongation of the rostrum. Its resemblance to the skull of *Sciurus lancavensis* is very close.

*Measurements.*—Measurements of type: total length, 420; head and body, 210; tail vertebræ, 210; hind foot, 51 (48); skull, greatest length, 54; zygomatic breadth, 31; median length of nasals, 16.4; greatest breadth of both nasals together, 7.

*Specimens examined.*—Two, both from Domel Island.



**SCIURUS BENTINCANUS** sp. nov.

*Type*.—Adult female (skin and skull), No. 104,383, United States National Museum. Collected on Bentinck Island, Mergui Archipelago, March 11, 1900, by Dr. W. L. Abbott. Original number, 349.

*Characters*.—External appearance essentially as in *Sciurus davisoni* but size somewhat greater, and skull with larger, more inflated audital bullæ.

*Color*.—Type: The color so closely resembles that of *Sciurus davisoni* from southern Tenasserim that no detailed description is necessary. The reddish area on sides and neck is, however, slightly more intense, approaching the ferruginous of Ridgway. In the type specimen the posterior half of the back is in a dull worn pelage slightly contrasting with the fresh coat on other parts of the body. Chest and belly with a distinct reddish wash, but this is not sufficiently heavy to obscure the usual grizzled gray.

*Skull and teeth*.—In size and general outline the skull does not differ appreciably from that of *Sciurus davisoni*, but the audital bullæ are distinctly larger and more inflated, a character that is particularly noticeable when the skull is viewed from below. The width of the anterior half of the bullæ in this aspect is fully 1 mm. greater in the island species. The teeth show no peculiarities.

*Measurements*.—Measurements of type: total length, 465; head and body, 235; tail vertebræ, 230; hind foot, 57 (53); skull, greatest length, 58; zygomatic breadth, 33.

*Specimens examined*.—Three, all from Bentinck Island.

**SCIURUS MATTHÆUS** sp. nov.

*Type*.—Adult female (skin and skull), No. 111,920, United States National Museum. Collected on St. Matthew Island, Mergui Archipelago, December 11, 1900, by Dr. W. L. Abbott. Original number, 774.

*Characters*.—Similar to *Sciurus bentincanus* but not as large and with reddish areas on neck and sides less strongly marked.

*Color*.—Type: The color throughout is exactly similar to that of *Sciurus bentincanus* except that the reddish areas on neck and sides are slightly duller and less strongly contrasted with surrounding parts.

*Skull*.—The skull is similar to that of *Sciurus bentincanus* in form, though the size is much less. Notwithstanding the size of the skull the bullæ are fully as large as those of *Sciurus davisoni*. The teeth show no peculiarities.

*Measurements.*—Measurements of type: total length, 445; head and body, 220; tail vertebræ, 225; hind foot, 53 (50); skull, greatest length, 54; zygomatic breadth, 31.

*Specimens examined.*—Four, all from St. Matthew Island.

**SCIURUS LUCAS** sp. nov.

*Type.*—Adult female (skin and skull), No. 104,385, United States National Museum. Collected on St. Luke Island, Mergui Archipelago, January 20, 1900, by Dr. W. L. Abbott. Original number, 256.

*Characters.*—Similar to *Sciurus matthæus*, but ground color of upperparts and tail strongly suffused with fulvous.

*Color.*—Type: general color above dull, light tawny-ochraceous, grizzled by the black hair-tips and buff subterminal annulations. Sides of neck and of body ferruginous, lighter than that of Ridgway and forming no very marked contrast with color of back. The ferruginous of neck is a little brighter than that of body. Tail like back, but more coarsely grizzled, the black terminal pencil well developed.

*Skull and teeth.*—The skull and teeth exactly resemble those of *Sciurus matthæus*.

*Measurements.*—Measurements of type: total length, 430; head and body, 220; tail vertebræ, 210; hind foot, 54 (50); skull, greatest length, 54; zygomatic breadth, 31.

*Specimens examined.*—Two, both from St. Luke Island.

*Remarks.*—Little though it would be anticipated, the squirrel of St. Luke Island differs very noticeably from that of St. Matthew. The characters are perfectly constant so far as the rather small number of specimens is concerned, and from the known stability of the colors in other members of the group there is no reason to suppose that the differences are merely individual.

**SCIURUS CASENSIS** sp. nov.

*Type.*—Adult female (skin and skull), No. 104,370, United States National Museum. Collected on Chance Island, Mergui Archipelago, December 28, 1899, by Dr. W. L. Abbott. Original number, 185.

*Characters.*—Like *Sciurus davisoni* (Bonhote), but size larger, color, particularly that of tail, paler, and reddish areas of neck and sides brighter and more strongly contrasted with surrounding parts.

*Color.*—Type: back and crown a fine grizzle of black and light buff, the latter slightly in excess. On sides this becomes suffused

with dull ferruginous which increases rapidly in intensity to form an almost clear ferruginous lateral stripe. Neck patch bright ferruginous, strongly contrasted with surrounding parts. Hind legs like back except that inner posterior surface is heavily washed with clear ferruginous. Front legs a clear silvery grizzle of ecru-drab and whitish smoke-gray. Underparts dull buffy gray washed with pale ferruginous on chest. A large, clear, orange-rufous area at groin. Tail distinctly paler than back, the light annulations of the hairs whitish cream-buff on dorsal surface, pale buff below. Black pencil well developed.

*Skull and teeth.*—The skull closely resembles that of *Sciurus davisoni* but is slightly larger, the rostrum is broader and the audital bullæ are more inflated anteriorly. Teeth as in the related species.

*Measurements.*—Measurements of type: total length, 465; head and body, 250; tail vertebræ, 215; hind foot, 52 (48); skull, greatest length, 57; zygomatic breadth, 33.

*Specimens examined.*—Five, all from Chance Island.

*Remarks.*—Its large size, pale color, the contrast between the upper surface of the tail and the back, and the brightness and distinctness of the ferruginous markings make this species one of the most strongly characterized in the group. The series of skins shows no variations worthy of note.

#### SCIURUS ALTINSULARIS sp. nov.

*Type.*—Adult female (skin and skull), No. 111,975, United States National Museum. Collected on High Island, Mergui Archipelago, December 31, 1900, by Dr. W. L. Abbott. Original number, 810.

*Characters.*—General appearance as in *Sciurus casensis*, but size smaller, general color paler, upper surface of tail not lighter than back, and ferruginous markings replaced by ochraceous-buff.

*Color.*—Type: back, sides, head, and both surfaces of tail a fine grizzle of black and cream-buff, the latter everywhere in excess and palest on head, darkest on tail. Neck patch dull ochraceous-buff, slightly contrasted with color of surrounding parts. Sides strongly tinged with ochraceous-buff in region between axilla and groin. Underparts smoke-gray, grizzled with broccoli-brown along median line of chest. A small, clear ochraceous-buff area at axilla and another at groin. Inner surface of legs like belly, outer surface and feet somewhat darker. Tail with black pencil well developed.

*Skull and teeth.*—The skull resembles that of *Sciurus casensis* but is distinctly smaller. Teeth not peculiar.

*Measurements.*—Measurements of type: total length, 437; head

and body, 230; tail vertebræ, 207; hind foot, 50 (47); skull, greatest length, 54.6; zygomatic breadth, 31.

*Specimens examined*.—Five, all from High Island.

**SCIURUS RUBECULUS** sp. nov.

*Type*.—Adult male (skin and skull), No. 86,777, United States National Museum. Collected at Khow Sai Dow, Trong, Lower Siam, altitude 1000 feet, February 21, 1899, by Dr. W. L. Abbott.

*Characters*.—Similar to *Sciurus atrodorsalis* Gray, but much larger. No black-backed phase at present known.

*Color*.—Type: upperparts a clear fine grizzle of black and ochraceous, the latter somewhat in excess. On sides, legs, cheeks, throat, and along median line from chest to base of tail the ochraceous element of the grizzle is lighter and duller than on the back, approaching the ochraceous-buff of Ridgway. Underparts (except the grizzled area) and inner side of legs nearly to feet, bright orange-rufous, darker and more red than that of Ridgway. The red area is completely divided by the grizzled median line. This is about 10 mm. in width. Ears like back. Front feet concolor with legs, hind feet slightly darker. Whiskers black. Tail like back but more coarsely grizzled. On terminal half and pencil the tail is fringed with clear orange-rufous due to a subterminal annulation of this color on each hair. The extreme tips of the hairs forming the fringe are for the most part black, but this color is easily overlooked. On terminal third of tail there is a slight tendency toward the formation of black cross-bars, and on under side through same region two faint black bands may be traced parallel with edge.

*Skull and teeth*.—As compared with a skull of *Sciurus atrodorsalis* from Kokareet, Tenasserim, that of *S. rubeculus* is immediately distinguishable by its greater size, and by the relatively shorter broader rostrum. The audital bullæ on the other hand scarcely exceed those of the smaller animal in size, while in form they are less inflated. Frontals nearly flat anteriorly, not distinctly concave as in the allied form. Teeth as in *Sciurus atrodorsalis*.

*Measurements*.—Measurements of type: total length, 440; head and body, 230; tail, 210; hind foot, 51 (48); skull, greatest length, 55 (50);<sup>1</sup> basal length, 49 (42); zygomatic breadth, 33 (29.6); least interorbital breadth, 20.4 (17); median length of nasals, 14.8 (14.6); greatest breadth of both nasals together, 8 (7).

*Specimens examined*.—Five, from the following localities: Trong, one, the type; Tenasserim, Bok Pyin, 3, Sungei Balik, 1.

<sup>1</sup> Cranial measurements in parenthesis are those of an adult female *Sciurus atrodorsalis* from Kokareet, Tenasserim (No.  $\frac{37461}{27380}$ ).



1. *Sciuropterus mærens*, type. 2. *Funambulus obscurus*, type.





*Remarks.*—The United States National Museum contains specimens of two readily distinguishable squirrels identified as *Sciurus atrodorsalis* by Mr. Oldfield Thomas. The first is from Kokareet, Tenasserim, and is one of the series recorded in the "Annali del Museo Civico di Storia Naturale di Genova" for 1892 (vol. xxx, p. 929). The second is the type of *Sciurus rubeculus*, identified at my request. While there can be no question as to the close relationship and general superficial likeness of the two specimens, due allowance being made for the fact that the Tenasserim skin is in the black-backed pelage, the cranial differences are such as to make their separation necessary. It seems highly improbable that the Kokareet animal is the same as true *Sciurus atrodorsalis*, the type of which came from Bhotan, but the latter, as well as *Sciurus gordonii* Anderson and *S. hyperythrus* Blyth, appears to agree with it and to differ from *Sciurus rubeculus* in markedly smaller size.

**FUNAMBULUS OBSCURUS** sp. nov.

(PLATE I, FIGURE 2)

*Type.*—Adult female (skin and skull), No. 121,640, United States National Museum. Collected on South Pagi Island, Sumatra, November 22, 1902, by Dr. W. L. Abbott. Original number, 2086.

*Characters.*—About the size of *Funambulus insignis*, but tail much shorter. Color darker than in the Sumatran animal, dark lateral stripes obsolete, and underparts iron gray. Skull with unusually elongate rostrum.

*Color.*—Type: back and sides a uniform, very fine grizzle of black and light ochraceous, the latter slightly in excess. Outer surface of hind legs similar to back, but that of front legs slightly darker. Crown and cheeks a little darker than back, the cheeks perceptibly tinged with gray. Feet and ears blackish. Median black dorsal stripe about 3 mm. wide. It is well defined, and extends from about middle of neck to lumbar region. Lateral stripes reduced to mere dark shades too indistinct to be measured, or to have any definite color. They are about 10 mm. distant from the median stripe, and of approximately the same length as the latter. Underparts and inner surface of legs a grizzled iron gray. This is darker and less grizzled on legs and along sides of belly, much lighter and with a frosted appearance on throat and chest. The darker gray about matches the slate-gray of Ridgway, the lighter cannot be accurately described. Tail like back but very coarsely grizzled. Above the ochraceous predominates in the middle and the black forms a border 10 mm. wide. The extreme tips of the

hairs at the edge are black, but there is a noticeable ochraceous subterminal band. Pencil black. Beneath the black predominates uniformly.

*Skull and teeth.*—While the skull in a general way resembles that of *Funambulus insignis* the peculiarities of the latter as compared with true *Sciurus* are in it much exaggerated. The rostrum is greatly elongated, so much so that the skull would hardly at first glance be recognized as that of a squirrel. This elongation, however, does not approach that of the rostrum in *Rhinosciurus*. In *Funambulus insignis* the distance from anterior rim of orbit to tip of nasals is about equal to breadth of braincase above roots of zygomata, while in *F. obscurus* it is decidedly greater than this breadth, though not, as in *Rhinosciurus*, approximately the same as the zygomatic breadth. The nasals are strongly rounded from tip nearly to base, so much so that near middle they almost form a ridge. Only the extreme proximal end is flat. Zygomata decidedly heavier than in *Funambulus insignis*, but not peculiar in form. Teeth similar to those of the related species but larger throughout.

*Measurements.*—External measurements of type: total length, 303; head and body, 220; tail vertebræ, 83; hind foot, 44 (42); ear from meatus, 14; ear from crown, 7; width of ear, 11.6.

Cranial measurements of type: greatest length, 53.6; basal length, 45; basilar length, 43; palatal length, 24; diastema, 14.4; distance from anterior rim of orbit to tip of nasals, 25; length of nasals, 18.4; greatest breadth of both nasals together, 6.2; least breadth of both nasals together, 4; least interorbital breadth, 14; zygomatic breadth, 30; breadth of braincase above roots of zygomata, 20; mandible, 34; maxillary toothrow (alveoli), 10; mandibular toothrow (alveoli), 10.

*Specimens examined.*—Seven, all from the Pagi Islands.

*Remarks.*—The skins are very uniform in color. Practically the only variation shown by the series is in the distinctness of the lateral dark stripes. In four of the specimens these are nearly as well developed as the median stripe, but in none of them is there any close resemblance to *Funambulus insignis*.

#### FUNAMBULUS ROSTRATUS sp. nov.

*Type.*—Adult female (skin and skull), No. 121,801, United States National Museum. Collected on Tana Bala, Batu Islands, February 12, 1903, by Dr. W. L. Abbott. Original number, 2281.

*Characters.*—Similar to *Funambulus insignis*, but color slightly darker, black dorsal stripes apparently broader, and skull with more elongate rostrum.

*Color.*—Dorsal surface a uniform, fine grizzle of black and buff, the latter in excess everywhere except on rump, shoulders, neck, and head. Black stripes well developed, about 7 mm. wide at middle of back, extending from middle of neck to lumbar region, the median faintly prolonged to crown. Region between stripes exactly similar to that outside, but appearing lighter by contrast with the black. Cheeks and outer surface of legs duller and more finely grizzled than back. Feet dark hair-brown. Hairs of tail annulated with black and orange-buff, the general effect a coarse grizzle of the two colors. Underparts and inner surface of legs cream-buff, slightly more yellow than that of Ridgway.

*Skull and teeth.*—The skull is larger than that of *Funambulus insignis*, the interorbital region is relatively broader, and the rostrum is more produced. In the last character there is a close approach to *Funambulus obscurus*, but the nasals are flat posteriorly, as in *F. insignis*. Teeth as in *Funambulus insignis*, but somewhat larger.

*Measurements.*—External measurements of type: total length, 265;<sup>1</sup> head and body, 197; tail vertebræ, 68;<sup>1</sup> hind foot, 45 (41); ear from meatus, 15.6; ear from crown, 9; width of ear, 13.

Cranial measurements of type: greatest length, 51.6 (49);<sup>2</sup> basal length, 43 (41); basilar length, 40 (38.8); palatal length, 22.8 (21.4); diastema, 14 (12.2); length of nasals, 17 (16); greatest breadth of both nasals together, 6.6 (6.4); interorbital breadth, 14 (12.4); distance between tips of postorbital processes, 22.4 (20); zygomatic breadth, 30 (26);<sup>3</sup> breadth of braincase above roots of zygomata, 22 (20.6);<sup>3</sup> greatest depth of braincase, 17 (16); mandible, 33 (30); maxillary toothrow (alveoli), 9.4 (9); mandibular toothrow (alveoli), 10 (9).

*Specimens examined.*—One, the type.

*Remarks.*—The Batu *Funambulus* is readily distinguishable from the Sumatran *F. insignis* by its darker color and larger skull. For the opportunity to examine two skins and a skull of the Sumatran animal I am indebted to the Academy of Natural Sciences of Philadelphia, through the kindness of Mr. Witmer Stone.

#### FUNAMBULUS PENINSULÆ sp. nov.

*Type.*—Adult male (skin and skull), No. 86,776, United States National Museum. Collected at Khow Sai Dow, Trong, Lower Siam, February 18, 1899, by Dr. W. L. Abbott.

<sup>1</sup>Tail apparently imperfect.

<sup>2</sup>Measurements in parenthesis are those of an adult male *Funambulus insignis* from Gunong Sugi, Lampong District, Sumatra (No. 6655, Academy of Natural Sciences of Philadelphia).

<sup>3</sup>Approximate.

*Characters*.—General color lighter and brighter than in *Funambulus insignis*. Skull larger than in the Sumatran animal, but similar to it in form.

*Color*.—The light element in the grizzle of the upperparts is brighter and more yellow than that in *Funambulus insignis* and *F. rostratus*. The exact tint is very close to the raw-sienna of Ridgway, except in the neighborhood of the black stripes, where it is diluted with cream-buff. Front feet hair-brown. Hind feet hair-brown grizzled with yellowish. The light bands on the hairs of the tail are dull raw-sienna, but the tips are grayish. Underparts cream-buff, fading almost to white on chest, and darkening to buff on inner surface of hind legs.

*Skull and teeth*.—The skull is distinctly larger than that of *Funambulus insignis* and the interorbital region is broader, but otherwise it shows no peculiarities. Teeth as in *Funambulus insignis*.

*Measurements*.—Measurements of type: total length, 295; head and body, 195; tail vertebræ, 100; hind foot, 44 (41); skull, greatest length, 50; length of nasals, 16; diastema, 12; interorbital breadth, 14.4; zygomatic breadth, 28; mandible, 30; maxillary toothrow (alveoli), 8.8; mandibular toothrow (alveoli), 9.

*Specimens examined*.—One, the type.

#### SCIUROPTERUS MÆRENS sp. nov.

(PLATE I, FIGURE I)

*Type*.—Adult female (skin and skull), No. 121,531, United States National Museum. Collected on North Pagi Island, Sumatra, January 14, 1902, by Dr. W. L. Abbott. Original number, 2206.

*Characters*.—Like *Sciuropterus lugens* Thomas, but ear much smaller and color not as dark.

*Color*.—Entire animal drab, the back and tail darker than Ridgway's plate III, fig. 18, the underparts lighter and more bluish, closely approaching ecru-drab. In certain lights the shoulders, neck, and head show a distinct wash of wood-brown or isabella-color. Throughout dorsal surface the underfur is bluish gray. Tail unicolor throughout, except at extreme base below, where it is like belly. Feet and lower portion of legs so thinly haired as not to conceal the skin, the hairs dull light drab. Ears and whiskers blackish. Claws light horn-color.

*Ears*.—The ears agree in form with those of *Sciuropterus lugens* as described by Thomas, except that the posterior border is very slightly concave. In size they are much smaller, measuring only





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1. *Petaurista nitida*, male, No. 104,622, Bunguran Island, North Natunas. 2. *Petaurista nitida*, male, No. 121,499, eastern Java. 3. *Petaurista batuanua*, male (type). 4. *Atherura zygomatica*, female (type). 5. *Atherura macroura*, female, No. 84,433, Trong, Lower Siam.

15.4 mm. from meatus, and 8 mm. from crown. The measurements given in the original description of *S. lugens* are 21.5 and 20 for an adult male and female respectively.

*Skull and teeth.*—So far as can be judged from the description the skull and teeth (pl. 1, fig. 1) agree with those of *Sciuropterus lugens*. Audital bullæ very broad and flat.

*Measurements.*—External measurements of type: total length, 485; head and body, 265; tail vertebrae, 220; hind foot, 49 (44); ear from meatus, 15.4; ear from crown, 8; width of ear, 7.6.

Cranial measurements of type: greatest length, 48.8; basal length, 41.4; basilar length, 38; median palatal length, 22; diastema, 10; length of nasals, 14.8; greatest breadth of both nasals together, 7.8; interorbital breadth, 11; distance between tips of postorbital processes, 23; zygomatic breadth, 29; breadth of braincase above roots of zygomata, 20.6; greatest depth of braincase, 16.4; occipital depth, 12; mandible, 29; maxillary toothrow (alveoli), 10; mandibular toothrow (alveoli), 10.

*Specimens examined.*—One, the type.

*Remarks.*—While this squirrel is evidently a near ally of the Siporan *Sciuropterus lugens*, it is readily distinguishable by its smaller ear and less dark color. It needs no comparison with any other species.

**PETAURISTA BATUANA sp. nov.**

(PLATE II, FIGURE 3)

*Type.*—Adult male (skin and skull), No. 121,742, United States National Museum. Collected on Tana Bala, Batu Islands, Sumatra, February 5, 1903, by Dr. W. L. Abbott. Original number, 2233.

*Characters.*—Like *Petaurista nitidula* of the Natuna Islands, but intermediate in size between this species and the large Javan *P. nitida*.

*Color.*—Type: upperparts deep rufous or ferruginous, a little darkened, particularly along median line, by blackish hair-tips. Upper side of membranes and outer surface of legs burnt-sienna, darkening to black on feet, wrists, ankles, and outer edge of forearm. Edge of interfemoral membrane blackish brown. Underparts and inner surface of thighs and upperarms pale ochraceous-rufous. Chin blackish. On cheeks and muzzle the rufous and ochraceous-buff are mixed together and slightly tinged with gray. Ears rufous internally, black externally. A small blackish area behind ear. Eye ring and area surrounding muzzle and base of whiskers black. Edge of flying membrane dull ochraceous-buff.

Tail intermediate between the ochraceous-buff of belly and the rufous of back, the tip black.

*Skull and teeth.*—The skull and teeth (pl. II, fig. 3) exactly resemble those of *Petaurista nitida* (pl. II, fig. 2) and *P. nitidula* (pl. II, fig. 1), but are intermediate in size, though perhaps most nearly approaching the Javan animal.

*Measurements.*—External measurements of type: total length, 825; head and body, 405; tail vertebræ, 420; hind foot, 75 (68); ear from meatus, 35; ear from crown, 24.6; width of ear, 16.

Cranial measurements of type: greatest length, 66.4 (72);<sup>1</sup> basal length, 60 (65); basilar length, 56 (60); length of nasals, 20 (22.4); greatest breadth of both nasals together, 11.8 (12.8); median palatal length, 32.6 (33.6); diastema, 15 (16); interorbital breadth, 15.4 (16); distance between tips of postorbital processes, 36 (36); zygomatic breadth, 46.4 (49); breadth of braincase above roots of zygomata, 28.6 (28); greatest depth of braincase, 22 (23.6); occipital depth, 17 (17.4); mandible, 44 (49.6); maxillary toothrow (alveoli), 16 (16); mandibular toothrow (alveoli), 16.2 (17).

*Specimens examined.*—Eight, all from the Batu Islands. Seven are from Tana Bala, the other from Tana Masa.

*Remarks.*—While *Petaurista batuana* is more like *P. nitida* in size, its color is much lighter than that of the large Javan animal. It is not quite as light, however, as the small *P. nitidula* of the Natunas, though in all respects except size it very closely resembles this form.

#### MUS STRIDENS sp. nov.

1900. *Mus vociferans* MILLER, Proc. Wash. Acad. Sci., II, p. 208, August 20, 1900. Tioman Island. Not *M. vociferans* MILLER, April 21, 1900.

*Type.*—Adult male (skin and skull), No. 104,992, United States National Museum. Collected on Tioman Island, off southeast coast of Malay Peninsula, October 10, 1900, by Dr. W. L. Abbott. Original number, 702.

*Characters.*—Similar to *Mus strepitans* of the Anamba Islands, but ears larger and color not as dark.

*Color.*—The color so closely resembles that of *Mus strepitans*<sup>2</sup> that no detailed description is necessary. The ochraceous-buff of back and sides is distinctly paler than in the Anamba animal, and the sprinkling of blackish hairs is less noticeable. Underparts and inner

<sup>1</sup> Measurements in parenthesis are those of an adult male *Petaurista nitida* from western Java (No. 121,499).

<sup>2</sup> See Proc. Wash. Acad. Sci., II, pp. 207–208, August 20, 1900.

surface of legs pale straw-yellow, not whitish as in *Mus vociferans*, the mainland form.

*Measurements.*—External measurements of type: total length, 570 (550);<sup>1</sup> head and body, 254 (229); tail vertebræ, 316 (318); hind foot, 46 (45.6); hind foot without claws, 44 (44); ear from meatus, 28 (23); ear from crown, 22 (18).

*Specimens examined.*—Nine, all from Tioman Island.

*Remarks.*—This rat is a well marked form of the *sabanus-vociferans* group. In most characters it is intermediate between the bright *Mus vociferans* of Lower Siam and the dull dark *M. strepitans* of the Anamba Islands, but it appears to differ from both in the large size of the ears.

#### MUS MATTHÆUS sp. nov.

*Type.*—Adult male (skin and skull), No. 104,159, United States National Museum. Collected on St. Matthew Island, Mergui Archipelago, January 18, 1900, by Dr. W. L. Abbott. Original number, 243.

*Characters.*—A large member of the *sabanus-vociferans* group, differing from *Mus vociferans* in the duller, more rusty color of the back and sides, and strongly yellowish underparts. Blackish hairs of upperparts not as dark as in the mainland form.

*Color.*—The color is essentially as in *Mus vociferans*<sup>2</sup> except that the ground color of back and sides is tawny instead of ochraceous or tawny-ochraceous, and the dark hairs with which the back is sprinkled are distinctly brownish, while in the related species they are nearly black. Underparts and inner surface of legs cream-buff.

*Measurements.*—Measurements of type: total length, 600; head and body, 248; tail vertebræ, 350; hind foot, 50 (48); ear from meatus, 27; ear from crown, 21; skull, greatest length, 56; zygomatic breadth, 25.

*Specimens examined.*—Twelve (one skull without skin), all from St. Matthew Island.

*Remarks.*—In its dark, rich color this rat is strikingly different from the other members of the *sabanus-vociferans* group occurring in the Mergui Archipelago, all of which, so far as known, are paler than the mainland form.

#### MUS STRIDULUS sp. nov.

*Type.*—Adult female (skin and skull), No. 104,196, United States National Museum. Collected on Bentinck Island, Mergui Archi-

<sup>1</sup>Measurements in parenthesis are those of an adult male *Mus strepitans* from Pulo Jimaja, Anamba Islands (No. 101,736).

<sup>2</sup>See *Proc. Biol. Soc. Washington*, XIII, p. 138, April 21, 1900.



pelago, March 12, 1900, by Dr. W. L. Abbott. Original number, 350.

*Characters.*—A light-colored member of the *sabanus-vociferans* group, with disproportionately small feet.

*Color.*—The ground color of back and sides is buff, rather darker and brighter than that of Ridgway, but scarcely approaching ochraceous. Back rather thickly sprinkled with dark brown hairs, sides much less so. Underparts cream-buff.

*Measurements.*—Measurements of type: total length, 514; head and body, 222; tail vertebræ, 292; hind foot, 41 (38.6); ear from meatus, 25.4; ear from crown, 20; skull, greatest length, 52; zygomatic breadth, 24. Hind foot in two other adult females, 41.4 (39.6) and 40 (38). Hind foot in two adult males, 42 (40) and 41.6 (39.4).

*Specimens examined.*—Six, all from Bentinck Island.

#### MUS LUCAS sp. nov.

*Type.*—Adult female (skin and skull), No. 104,190, United States National Museum. Collected on St. Luke Island, Mergui Archipelago, January 20, 1900, by Dr. W. L. Abbott. Original number, 253.

*Characters.*—Similar to *Mus stridulus* but with feet of normal size.

*Color.*—The color is almost exactly the same as that of *Mus stridulus* from Bentinck Island, though perhaps a trifle more yellowish. It is therefore strikingly different from that of the dark *Mus mattheus* of St. Matthew Island.

*Measurements.*—Measurements of type: total length, 525; head and body, 215; tail vertebræ, 309; hind foot, 46 (44); ear from meatus, 26; ear from crown, 22; skull, greatest length, 52.4; zygomatic breadth, 23.

*Specimens examined.*—Three, all from St. Luke Island.

*Remarks.*—While this species differs widely from its near geographical ally *Mus mattheus* it rather closely resembles the *Mus lancavensis* of Pulo Lancawi. It is distinguishable from the latter by the more reddish cast of the upperparts, and by the less conspicuous grizzle produced by the dark hairs of the back.

#### MUS SOCCATUS sp. nov.

*Type.*—Adult male (skin and skull), No. 121,549, United States National Museum. Collected on North Pagi Island, Sumatra, December 29, 1902, by Dr. W. L. Abbott. Original number, 2183.

*Characters.*—A large, very dark member of the *sabanus-vociferans*

group, closely similar to *Mus siporanus* Thomas, but with rufous of upperparts replaced by dull buff.

*Color.*—Type: back and sides a mixture of blackish brown and dull buff, the former predominating on neck, shoulders, and fore part of back, and completely excluding the buff on lumbar region, rump, and about base of tail, the latter predominating on sides of neck and body, particularly in region of shoulders. Throughout the dorsal surface the hairs are ecru-drab at base. Crown, muzzle, and cheeks to level of lower eyelid glossy brownish black, lower half of cheeks like sides of body but more finely grizzled and somewhat darker. Ears and whiskers black. Outer surface of legs like sides proximally, but soon darkening to blackish brown, a color which covers entire dorsal surface of feet. Underparts whitish cream-buff to base of hairs. A narrow hair-brown median streak 30 mm. in length on lower portion of throat. Chest slightly discolored by a brownish stain. The color of belly extends down inner side of front leg to foot, but on hind leg it is abruptly cut off a little above middle of tibia by the blackish brown of lower half of leg. Tail blackish brown above to middle, whitish throughout terminal half. The under side of the basal half is irregularly marbled with whitish and brown.

*Mammæ.*—Mammæ 8, four pectoral and four inguinal.

*Fur.*—The quality of the fur is as in *Mus vociferans*, *M. sabanus*, and their relatives. The flattened, grooved hairs are so numerous as to give the fur a coarse, harsh texture, but they do not resemble bristles. Rump and lumbar region without noticeably elongated hairs.

*Skull and teeth.*—The skull resembles that of the members of the *sabanus-vociferans* group, but is distinguishable by its large size, relatively short, wide, incisive foramina, and by the unusually broad, rounded, angular process of the mandible. Teeth as in *Mus vociferans*, but larger.

*Measurements.*—External measurements of type: total length, 592; head and body, 276; tail vertebræ, 316; hind foot, 53 (50); ear from meatus, 24; ear from crown, 18; width of ear, 16. External measurements of an adult female (No. 121,540) from the type locality: total length, 562; head and body, 267; tail vertebræ, 295; hind foot, 52 (49.6).

Cranial measurements of type: greatest length, 58; basal length, 50; basilar length, 47; diastema, 15; length of incisive foramen, 7.8; combined breadth of incisive foramina, 3.8; length of nasals, 23; least interorbital breadth, 10; zygomatic breadth, 27; mandible, 32.6; maxillary toothrow (alveoli), 10.2; mandibular toothrow (alveoli), 10.2.

*Specimens examined.*—Twenty-four (6 skulls without skins), all from the Pagi Islands.

*Remarks.*—This is the largest and most conspicuous member of the *sabanus-vociferans* group that has yet come to my notice. It is evidently a near relative of *Mus siporanus* of Sipora Island, but the color is without trace of rufous. The series presents little variation in the color of the upperparts, and such as there is consists chiefly in the greater or less extent of the black lumbar area. On the underparts the brown median chest line is better developed in some specimens than in others, though it is apparently never absent. In one skin (female, No. 121,539) it extends back to middle of belly. In most of the specimens there is a trace of the brown stain on the chest, and in four a bright yellow wash covers parts of the belly and even spreads to the posterior half of back. It is undoubtedly due to stain.

**MUS MASÆ sp. nov.**

*Type.*—Adult female (skin and skull), No. 121,822, United States National Museum. Collected on Tana Masa, Batu Islands, February 21, 1903, by Dr. W. L. Abbott. Original number, 2327.

*Characters.*—A small member of the *sabanus-vociferans* group, with dull ochraceous back and sides, whitish underparts, and wholly brown tail. Skull like that of *Mus soccatus*, but not as large. Mammæ, 8.

*Fur.*—The quality of the fur is as in the members of the *sabanus-vociferans* group, that is, the flattened, grooved hairs, while not stiff enough to form spines, are so numerous as to make the fur coarse and harsh. The hairs of the rump and lumbar region are elongated, but not conspicuously so.

*Mammæ.*—Mammæ 8, four pectoral and four inguinal.

*Color.*—Back and sides mixed blackish brown and pale dull ochraceous or yellowish buff, the exact shade of the lighter color not easily defined, but approaching the ochraceous of Ridgway on shoulders, and fading about to buff on sides. Along middle of back the blackish brown predominates, while on sides the buff becomes almost clear. Crown like back, but more finely grizzled, and slightly tinged with gray; cheeks like sides, but duller. Outer surface of legs like sides, but tinged distally with hair-brown. Feet dull indefinite light brown. Underparts and inner surface of legs white tinged with cream-buff. Ears and tail dark brown, the latter not as dark below as above, but in no way bicolor.

*Skull and teeth.*—Skull almost exactly like that of *Mus soccatus* except that it is not as large; the incisive foramina are relatively

longer and narrower, and the interpterygoid space is narrower throughout and less flaring anteriorly. Teeth as in *Mus soccatus* and the members of the *sabamus-vociferans* group.

*Measurements.*—External measurements of type: total length, 510; head and body, 235; tail vertebræ, 275; hind foot, 43 (41); ear from meatus, 22.4; ear from crown, 17; width of ear, 16.

Cranial measurements of type: greatest length, 54; basal length, 45.4; basilar length, 42.4; diastema, 14.8; length of incisive foramen, 7.8; combined breadth of incisive foramina, 3; length of nasals, 20; least interorbital breadth, 9; zygomatic breadth, 14.6; mandible, 35; maxillary toothrow (alveoli), 10; mandibular toothrow (alveoli), 11.

*Specimens examined.*—Six, all from Tana Masa, Batu Islands.

#### MUS BALÆ sp. nov.

*Type.*—Adult female (skin and skull), No. 121,781, United States National Museum. Collected on Tana Bala, Batu Islands, Sumatra, February 12, 1903, by Dr. W. L. Abbott. Original number, 2274.

*Characters.*—Like *Mus masæ* but not as large; skull with relatively broader rostrum.

*Color.*—The color so closely resembles that of *Mus masæ* as to need no special description.

*Skull and teeth.*—The skull is like that of *Mus masæ*, but the general size is rather less, and the rostrum is actually as well as relatively more robust. Interpterygoid space wider and more expanded anteriorly than in the related species.

*Measurements.*—External measurements of type: total length, 465; head and body, 227; tail vertebræ, 238; hind foot, 41 (38.6); ear from meatus, 23; ear from crown, 18; width of ear, 17.

Cranial measurements of type: greatest length, 52; basal length, 44; basilar length, 42; diastema, 14; length of incisive foramen, 8.2; combined breadth of incisive foramina, 3.4; length of nasals, 20; least interorbital breadth, 9; zygomatic breadth, 25.4; mandible, 32; maxillary toothrow (alveoli), 9.4; mandibular toothrow (alveoli), 9.8.

*Specimens examined.*—Two skins and five skulls, all from Tana Bala.

#### MUS LUGENS sp. nov.

*Type.*—Adult female (skin and skull), No. 121,533, United States National Museum. Collected on North Pagi Island, Sumatra, November 15, 1902, by Dr. W. L. Abbott. Original number, 2046.

*Characters.*—A very large member of the *Mus rattus* group, somewhat closely resembling the *Mus simalurensis* of Simalur Island, but

larger, darker, and less buffy. Skull with audital bullæ actually as well as relatively smaller than in the Simalur rat.

*Color*.—Type: upperparts from muzzle to base of tail bluish black, faintly grizzled with dull buff. On sides the black fades to hair-brown, and the dull buff slightly predominates. Outer surface of legs light hair-brown. Underparts and inner surface of legs smoke-gray, somewhat paler than that of Ridgway. Median line of chest with broccoli-brown streak. Feet dull broccoli-brown. Ears and tail blackish.

*Skull and teeth*.—The skull resembles that of *Mus simalurensis*, but is larger and relatively narrower. The audital bullæ are actually smaller than in *Mus simalurensis* and the groove below and in front of meatus is more strongly developed. Teeth as in *Mus simalurensis*.

*Measurements*.—External measurements of type: total length, 436; head and body, 226; tail vertebræ, 210; hind foot, 41 (38); skull, greatest length, 51.4 (47.4);<sup>1</sup> basal length, 45.4 (41.8);<sup>1</sup> zygomatic breadth, 23.4 (23);<sup>1</sup> interorbital constriction, 7 (7.4);<sup>1</sup> length of nasals, 20 (18).<sup>1</sup>

*Specimens examined*.—Eight, all from the Pagi Islands.

*Remarks*.—The only species with which this rat needs comparison is the *Mus simalurensis* of Simalur Island. It is slightly larger than the Simalur rat, and the underparts lack all trace of buff. The back is also decidedly darker and less distinctly grizzled.

#### MUS JULIANUS sp. nov.

*Type*.—Adult female (skin and skull), No. 112,393, United States National Museum. Collected on St. Julian Island, South China Sea, June 2, 1901, by Dr. W. L. Abbott. Original number, 987.

*Characters*.—A moderate sized, light colored member of the *Mus rattus* group, resembling *Mus siantanicus* of the Anamba Islands in general appearance, but readily distinguishable by the large, globular audital bullæ, short, deep rostrum, and the massive structure of the anterior zygomatic roots.

*Color*.—Upperparts dull yellowish wood-brown, the back darkened by a plentiful sprinkling of blackish and dark hair-brown hairs, the sides lightened by the appearance at surface of ecru-drab under fur. Muzzle and outer surface of legs ecru-drab, the latter faintly washed with wood-brown. Whiskers mixed blackish and whitish. Underparts and inner surface of legs cream-buff, clouded with ecru-drab

<sup>1</sup> Type of *Mus simalurensis*.



laterally and along median line of chest. Feet hair-brown. Ears and tail uniform blackish brown.

*Skull and teeth.*—While of about the same length as that of *Mus siantanicus* the skull differs from that of the Anamba rat, as well as all other members of the group, in its very heavily built rostrum and anterior zygomatic roots. The plate forming outer wall of infraorbital foramen is much wider than in any other species of approximately equal size, and its upper margin is so flaring that the foramen is a very conspicuous feature of the skull when viewed from above. Audital bullæ unusually large, subglobular in outline when skull is viewed from below. Teeth in no way peculiar.

*Measurements.*—Measurements of type: total length, 379; head and body, 190; tail vertebræ, 189; hind foot, 36 (34); ear from meatus, 19.6; ear from crown, 13; width of ear, 14; skull, greatest length, 41; basal length, 37.4; zygomatic breadth, 20.6; interorbital constriction, 7.

*Specimens examined.*—Six (three in alcohol), all from St. Julian Island.

*Remarks.*—This easily recognizable member of the *Mus rattus* group is very different from the large *Mus tambelanicus*, its nearest geographical ally. In size it closely agrees with *Mus siantanicus*, but the cranial characters of the two species are very different.

#### MUS GILBIVENTER sp. nov.

*Type.*—Adult male (skin and skull), No. 104,153, United States National Museum. Collected on Sullivan Island, Mergui Archipelago, February 2, 1900, by Dr. W. L. Abbott. Original number, 295.

*Characters.*—Similar to *Mus cremoriventer* but with coarse, spiny fur resembling in quality that of the members of the *surifer* group.

*Color.*—The elements of the color are exactly as in *Mus cremoriventer*,<sup>1</sup> except that the spines on the back and sides are strongly tinged with cream-buff. These spines everywhere appear conspicuously on the surface instead of being completely hidden by the softer elements of the fur as is the case in *Mus cremoriventer*. The effect on the general color is to produce a peculiar variegated grizzle of ochraceous, light yellowish horn-color, and blackish brown, noticeably different from the more uniform ochraceous of the related species, and suggesting some of the members of the *surifer* group. Cheeks and narrow line along sides bright, clear ochraceous. Belly and inner surface of legs cream-buff rather yellower than that of

<sup>1</sup> See *Proc. Biol. Soc. Washington*, XIII, p. 144, April 21, 1900.

*Mus cremoriventer*. Tail uniform brown throughout, the tip with distinct brown pencil. Neither the skin of the tail nor its hairs are as dark as in the related species. Feet dirty whitish, clouded with brown.

*Skull and teeth*.—The skull resembles that of *Mus cremoriventer*,<sup>1</sup> but is slightly larger; the rostrum is deeper, the incisive foramina are longer, and the audital bullæ are less globular. Mandible more robust than in the related species, and concavity between condyle and angular process not as deep. Teeth as in *Mus cremoriventer*, but slightly larger throughout.

*Measurements*.—Total length, 310 (317);<sup>2</sup> head and body, 125 (146); tail vertebræ, 185 (171); pencil, 5 (8); hind foot, 28.8 (30?); hind foot without claws, 27 (28.5?); ear from meatus, 17 (17); ear from crown, 13.6 (13); skull, greatest length, 35 (34); zygomatic breadth, 16 (15.4); length of nasals, 13 (11.8); depth of rostrum behind incisors, 7 (6); length of incisive foramen, 6.4 (5.6).

*Specimens examined*.—One, the type.

*Remarks*.—While the skull, teeth, and unicolor tail show that this rat is closely related to *Mus cremoriventer*, the conspicuous appearance at the surface of the spines in the fur of back and sides gives the animal a strong superficial resemblance to the members of the *surifer* group. That this peculiarity is not due to moult is shown by the fresh, unabraded condition of the fur. Not only are the soft hairs less abundant than in *Mus cremoriventer*, but the spines are distinctly larger. This difference is most noticeable on the back and sides, but is also apparent on the underparts, particularly in region between and just behind front legs.

#### MUS LUTEOLUS sp. nov.

*Type*.—Adult female (skin and skull), No. 104,276, United States National Museum. Collected on St. Matthew Island, Mergui Archipelago, January 15, 1900, by Dr. W. L. Abbott. Original number, 226.

*Characters*.—A small member of the *rajah-surifer* group, resembling *Mus flavidulus* of Pulo Lankawi, but with tawny element in color distinctly less yellow.

*Color*.—Ground color of back and sides buff, almost exactly similar to that of Ridgway, very uniform throughout, though a little more yellow on shoulders and neck. Back thickly sprinkled with black-tipped spines, but the black is nowhere in excess of the buff,

<sup>1</sup> *Proc. Biol. Soc. Washington*, XIII, pl. v, fig. 2, April 21, 1900.

<sup>2</sup> Measurements in parenthesis are those of the type of *Mus cremoriventer*.

nor is there any tendency toward the formation of a dark dorsal line. Laterally the dark tips become less and less abundant, their color at the same time fading through bluish gray nearly to white, so that near line of demarkation between color of sides and that of underparts the buff is essentially pure. Underparts and inner surface of legs white, distinctly tinged with cream-buff. A well defined whitish patch covers area on each side of muzzle from which whiskers spring. Eye surrounded by a well-defined dark ring.

*Measurements.*—Measurements of type: total length, 360; head and body, 190; tail, 170; hind foot, 37 (35); skull, greatest length, 45; zygomatic breadth, 19.

*Specimens examined.*—Twenty-three (four skulls without skins), all from St. Matthew Island.

*Remarks.*—The series of nineteen skins presents no variation in color worthy of special comment. One specimen has the tail longer than the head and body, but in all the rest the proportions are essentially as in the type.

#### MUS UMBRIDORSUM sp. nov.

*Type.*—Adult male (skin and skull), No. 104,227, United States National Museum. Collected on Loughborough Island, Mergui Archipelago, January 24, 1900, by Dr. W. L. Abbott. Original number, 269.

*Characters.*—Similar to *Mus luteolus*, but ground color above slightly more yellow, and black of back tending to concentrate into a noticeable dorsal streak.

*Color.*—The ground color of back and sides is intermediate between the buff and buff-yellow of Ridgway, though nearer the latter. Black-tipped spines slightly more abundant than in *Mus luteolus*, those of middle of back forming a distinct though not sharply outlined dorsal streak about 10 mm. wide, extending from nape to base of tail. Otherwise as in *Mus luteolus*.

*Measurements.*—Measurements of type: total length, 350; head and body, 180; tail vertebræ, 170; hind foot, 40 (38); skull, greatest length, 42; zygomatic breadth, 18.

*Specimens examined.*—Thirteen (five skulls without skins), all from Loughborough Island.

*Remarks.*—Specimens vary somewhat in the yellowness of the upperparts and in the distinctness of the dark dorsal area, but the series considered as a whole is easily distinguishable from those procured on other islands or on the mainland. In every individual the length of head and body exceeds that of tail.

**MUS BENTINCANUS** sp. nov.

*Type*.—Adult female (skin and skull), No. 104,269, United States National Museum. Collected on Bentinck Island, Mergui Archipelago, March 11, 1900, by Dr. W. L. Abbott. Original number, 348.

*Characters*.—A rather large member of the *rajah-surifer* group, much resembling *Mus butangensis*, but color of back less strongly suffused with yellow.

*Color*.—The color is so similar to that of *Mus umbridorsum* as to need no special description. The black of the back, however, shows very little tendency toward the formation of a dorsal stripe.

*Measurements*.—Measurements of type: total length, 385; head and body, 205; tail, 180; hind foot, 42 (40); skull, greatest length, 47; zygomatic breadth, 22.

*Specimens examined*.—Eight (two skulls without skins), all from Bentinck Island.

*Remarks*.—This race is distinguishable from *Mus butangensis* by its lighter color, and from its relatives of the Mergui Archipelago by its large size combined with the absence of a throat band.

**MUS CASENSIS** sp. nov.

*Type*.—Adult male (skin and skull), No. 104,249, United States National Museum. Collected on Chance Island, Mergui Archipelago, December 28, 1899, by Dr. W. L. Abbott. Original number, 188.

*Characters*.—Similar to *Mus butangensis*, but with well developed throat band.

*Color*.—The color so closely resembles that of *Mus butangensis* as to require no detailed description.<sup>1</sup> As in this form the ground tint above is a yellowish ochraceous-buff, noticeably brighter than that of *Mus bentincanus*. Underparts whitish cream-buff, the throat crossed by a yellowish ochraceous-buff stripe about 30 mm. in width.

*Measurements*.—Measurements of type: head and body, 200; tail imperfect; hind foot, 42 (40); skull, greatest length, 47; zygomatic breadth, 21.

*Specimens examined*.—Seven (two skulls without skins), all from Chance Island.

*Remarks*.—As in the other insular forms of the *Mus surifer* group the tail is shorter than the head and body.<sup>2</sup> In all five specimens

<sup>1</sup> See *Proc. Biol. Soc. Washington*, XIII, p. 190, December 21, 1900.

<sup>2</sup> In an adult male (No. 104,284), with head and body the same length as in the type, the tail measures 178 mm.

the throat band is well developed. One female (No. 104,250), has the belly strongly darkened with gray.

**MUS DOMELICUS** sp. nov.

*Type*.—Adult female (skin and skull), No. 104,257, United States National Museum. Collected on Domel Island, Mergui Archipelago, February 24, 1900, by Dr. W. L. Abbott. Original number, 320.

*Characters*.—Similar to *Mus casensis*, but ground color above not as bright, and throat band less distinct.

*Color*.—As in *Mus casensis* the ground color above is a yellowish ochraceous-buff, but it is so much lighter than in the related form that the difference is readily noticeable when series are compared. Underparts as in *Mus casensis*, except that the throat band is a dull, light ochraceous-buff, which produces no strong contrast with the surrounding parts.

*Measurements*.—Measurements of type: total length, 350; head and body, 200; tail vertebræ, 150; hind foot, 40 (38); skull, greatest length, 49.

*Specimens examined*.—Seven (one extra skull), all from Domel Island.

**MUS PAGENSIS** sp. nov.

*Type*.—Adult male (skin and skull), No. 121,629, United States National Museum. Collected on South Pagi Island, Sumatra, December 23, 1902, by Dr. W. L. Abbott. Original number, 2153.

*Characters*.—A large, dark member of the *rajah-surifer* group, somewhat resembling *Mus catellifer* of Pulo Mansalar, but size greater, tail relatively longer, and collar obsolete or absent.

*Color*.—Type: back and sides ochraceous, the former heavily overlaid with blackish horn-color, the latter nearly clear. The ochraceous area widens considerably at shoulder and extends over outer surface of legs to feet, and also across rump. On hind legs it is darkened by a brownish wash. Top of head like back. Cheeks dirty brownish buff. Feet whitish, shaded with dark brown. Tail distinctly but not conspicuously bicolor to tip, blackish above, whitish below. Underparts and inner surface of legs pale cream-buff.

*Skull and teeth*.—The skull and teeth are larger than those of *Mus catellifer*, but do not differ appreciably in form.

*Measurements*.—Measurements of type: total length, 406; head and body, 216; tail vertebræ, 190; hind foot, 46 (43.6); ear from meatus, 24; ear from crown, 17; width of ear, 15; skull, greatest length, 50.4; basal length, 40; length of nasals, 19; zygomatic breadth, 21; interorbital constriction, 8.



*Specimens examined*.—Eleven, all from the Pagi Islands.

*Remarks*.—While this species is as dark in general coloration as *Mus catellifer*, it is readily distinguishable by its greater size, and by the less development of the brown collar. In six of the specimens the throat is entirely pure white. The five others show traces of a collar, and in two the band is complete though much less noticeable than in the Mansalar rat.

**CHIROPDOMYS NIADIS** sp. nov.

*Type*.—Adult female (skin and skull), No. 121,867, United States National Museum. Collected at Lafau, Nias Island, Sumatra, March 30, 1903, by Dr. W. L. Abbott. Original number, 2413.

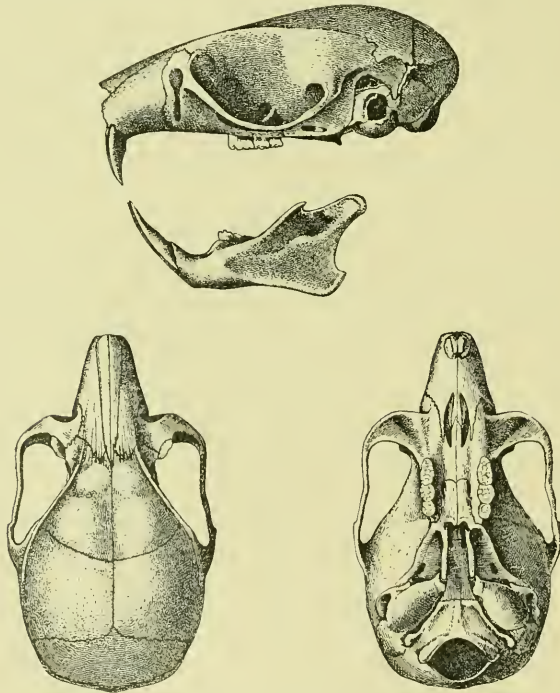


FIG. 1.—Skull of *Chiropodomys niadis* ( $\times 2$ ).

*Characters*.—Size as in *Chiropodomys glirioides*, but color not as dark, and skull with dorsal profile strongly convex.

*Color*.—Upperparts wood-brown, everywhere paler than that of Ridgway, and tinged, particularly on sides and flanks, with drab. On middle of back the blackish hair-tips produce a slight dusky cast.

Underparts white, faintly tinged with cream-buff. Line of demarcation sharp. Tail and ears uniform dark brown. Feet whitish, with dusky cloudings on metapodials. Whiskers black.

*Skull and teeth.*—The skull differs from that of *Chiropodomys glirioides* as described and figured by Sclater<sup>1</sup> in several important details. Most conspicuous among these is the convexity of the dorsal outline. From tip of nasals to middle of frontals the outline is essentially straight, distinctly less convex than in Sclater's figure. From middle of frontals back, however, the convexity is so strong that when the nasals are held in line with those of the figure the inion falls opposite the middle of occipital condyle. Viewed from below the skull differs from that of *C. glirioides* in the less broadened anterior palatine foramina, and narrower, parallel-margined, interpterygoid space. The width of the latter barely equals one-half the length of the anterior palatine foramina, while in *C. glirioides*, as both described and figured, it is considerably more than half. Mandible shorter and deeper than that of *C. glirioides*, the angular process wider and less distinctly marked off from main portion of jaw. Teeth, so far as can be judged from the description and figures, essentially as in *C. glirioides*.

*Measurements.*—Total length, 183; head and body, 81; tail vertebræ, 102; pencil, 4; hind foot, 19 (18); ear from meatus, 14.6; ear from crown, 12; width of ear, 10; skull, greatest length, 24; basal length, 20.4; basilar length, 18.6; zygomatic breadth, 14; least interorbital breadth, 4.8; greatest breadth of braincase above roots of zygomata, 12; diastema, 6.8; length of anterior palatine foramen, 3.6; breadth of both foramina together, 1.8; greatest width of interpterygoid space anteriorly, 1.6; mandible, 14; maxillary toothrow (alveoli), 3.6; mandibular toothrow (alveoli), 3.2.

*Specimens examined.*—One, the type.

*Remarks.*—This species was first recorded by Modigliani in 1889,<sup>2</sup> and has since been mentioned by Thomas.<sup>3</sup> Neither writer, however, appears to have examined the skull. Unless the figures published by Sclater are grossly inaccurate, and there is no reason to suppose that such is the case, the Nias animal is readily distinguishable from *Chiropodomys glirioides*. It needs no special comparison with the Bornean forms.

<sup>1</sup> *Proc. Zool. Soc. London*, 1890, p. 533, pl. XLV, figs. 6a and 6b.

<sup>2</sup> *Ann. Mus. Civ. di Storia Nat. di Genova*, 2d ser., VII, p. 244, 1889.

<sup>3</sup> *Ibid.*, x, p. 942, 1892.

## ATHERURA ZYGOMATICA sp. nov.

(PLATE II, FIGURE 4)

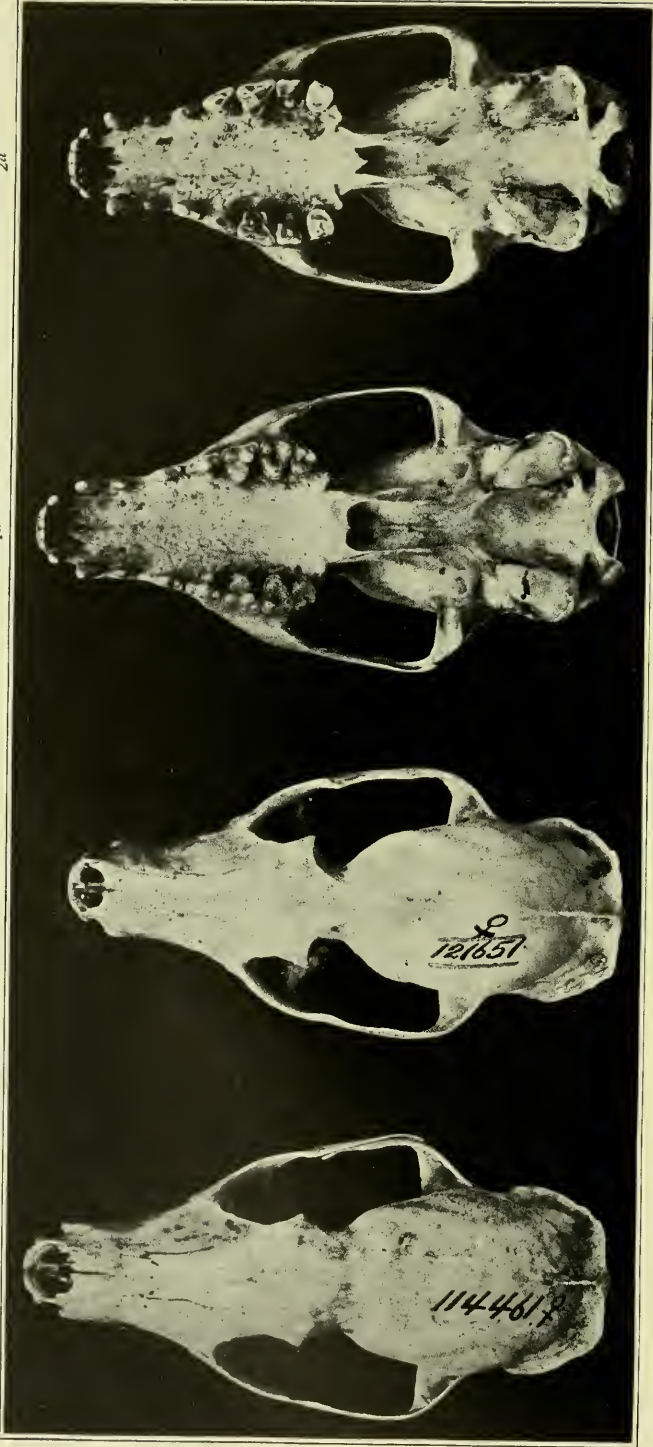
*Type*.—Adult female (skin and skull), No. 112,429, United States National Museum. Collected on Pulo Aor, off coast of Johore, June 6, 1901, by Dr. W. L. Abbott. Original number, 1009.

*Characters*.—Like *Atherura macroura*, from Trong, Lower Siam, but color darker and more bluish, and zygoma shorter and deeper.

*Color*.—*Type*: The elements of the color are essentially as in the mainland animal, that is, the quills are deep bluish horn-color, varied with whitish. But the horn-color is more blue and less brown than in the related form; and the whitish areas are less developed, so that the dark predominates everywhere, instead of only on back, head and legs. Underparts, except dull whitish area on chin and another in each axilla, dark drab horn-color, darker and clearer on inner side of hind legs, lighter and speckled with whitish along sides of body. Feet, and bristles on naked portion of tail, horny blackish. Ears and whiskers blackish. Tuft of bristles at end of tail dull whitish horn-color.

*Skull and teeth*.—In general appearance the skull (pl. II, fig. 4) resembles that of *Atherura macroura* (pl. II, fig. 5). Its size, however, is slightly less, and in the form of the lachrymal bone and of the zygoma it appears to differ constantly from the skull of the mainland animal. In *Atherura macroura* the lachrymal is fully 8 mm. in length below rim of orbit, while above it extends forward as a triangle of bone at least 5 mm. long, and is a noticeable feature of the dorsal aspect of the skull. In *A. zygomatica* its length below rim of orbit is usually about 5 mm. (in only one skull out of seven does it exceed 6 mm.), while the forward extension is often obsolete, and never large enough to be more than barely visible when the skull is viewed from above. Zygoma shorter than in *Atherura macroura*, the jugal deeper in proportion to its length, more abruptly concave above, and its lower contour invariably—even in a specimen so young that the posterior molar is not yet in place—broken by a strongly developed concavity beneath posterior jugal suture, this concavity terminating anteriorly on the posterior upper surface of a well-marked tooth-like projection. This character is present in all of the seven skulls of *Atherura zygomatica*, and is barely indicated in the three skulls of *A. macroura* that I have examined. Paroccipital processes broad and stout, not slender and elongate as in the related species. Posterior section of mandible shorter and deeper than in *A. macroura*.





1. *Hemigale haradovichii*, female, No. 114461, Tapanuli Bay, Sumatra. 2. *Hemigale minor*, female (type).



Teeth as in *Atherura macroura*. I can detect no peculiarities in the pattern of enamel folding.

*Measurements.*—External measurements of type: total length, 720; head and body, 520; tail vertebrae, 200; hind foot, 64 (61); ear from meatus, 34; ear from crown, 21; width of ear, 17.

Cranial measurements of type: greatest length, 93 (99);<sup>1</sup> basal length, 82 (87); basilar length, 77 (80); length of nasals, 26 (25); greatest breadth of both nasals together, 14 (15); diastema, 28 (28.4); zygomatic breadth, 45.4 (47.6); least interorbital breadth, 26 (28.6); length of zygoma from posterior rim of antorbital foramen, 29 (31); depth of zygoma at anterior jugal suture, 8.6 (8); mandible, 58 (61); maxillary tooththrow (alveoli), 17 (17.6); mandibular tooththrow (alveoli), 17.8 (19).

*Specimens examined.*—Seven, all from Pulo Aor.

#### HEMIGALE MINOR sp. nov.

(PLATE III, FIGURE 2)

*Type.*—Adult female (skin and skull), No. 121,651, United States National Museum. Collected on South Pagi Island, Sumatra, December 27, 1902, by Dr. W. L. Abbott. Original number, 2173.

*Characters.*—Like *Hemigale hardwickii* Gray, but smaller and darker.

*Color.*—Type: upperparts and outer surface of legs a buffy gray, much less yellow than that of *Hemigale hardwickii*. The exact shade is not easy to describe, but it is a mixture of broccoli-brown or pale isabella-color and grayish white, the former beneath the surface, the latter at the tips of the hairs. Dark markings clear black, exactly as in *Hemigale hardwickii* except that they are all wider and those of head and neck are ill-defined, owing to their tendency to spread over the intervening gray. Underparts light brownish buff, or pale, yellowish isabella-color, the tips of most of the hairs grayish white, these most noticeable on throat and forepart of chest. Inner surface of legs an indefinite yellowish gray. Feet broccoli-brown washed with buffy gray. Tail blackish brown except for two grayish rings at base and a grayish ventral area extending about to middle. Ears dusky brownish outside, dull buffy gray inside.

*Skull and teeth.*—Except for its smaller size the skull (pl. III, fig. 2) closely resembles that of *Hemigale hardwickii* (pl. III, fig. 1) in general appearance. The audital bullae are, however, less elevated above surface of basioccipital (when skull is held upside

<sup>1</sup> Measurements in parenthesis are those of an adult female *Atherura macroura* from Trong, Lower Siam (No. 84,433).

down) and the interpterygoid space is much narrower in proportion to its length. The constriction behind postorbital processes appears to be deeper and better defined than in the larger animal, but this character may not be constant. Teeth as in *Hemigale hardwickii* but smaller.

*Measurements.*—External measurements of type: total length, 760; head and body, 480; tail vertebræ, 280; hind foot, 67 (64); ear from meatus, 30; ear from crown, 26; width of ear, 19. External measurements of adult male (No. 121,650) from the type locality: total length, 715; head and body, 465; tail vertebræ, 250; hind foot, 65 (63).

Cranial measurements of type: greatest length, 95 (99);<sup>1</sup> basal length, 91.4 (96); basilar length, 87 (91); median palatal length, 50 (52); breadth of palate between anterior molars, 16.8 (16); length of interpterygoid space, 15.8 (15.4); width of interpterygoid space at middle, 6 (7.8); constriction in front of postorbital processes, 19 (18.4); constriction behind postorbital processes, 12.4 (17); zygomatic breadth, 45 (47); mastoid breadth, 31 (32); breadth of braincase above roots of zygomata, 29.8 (31); mandible, 66.4 (70); maxillary toothrow exclusive of incisors (alveoli), 37 (39); mandibular toothrow exclusive of incisors (alveoli), 40 (42).

*Specimens examined.*—Six, all from South Pagi Island.

*Remarks.*—This species is well characterized by the dark color of its head and the indistinctness of the black markings in this region. The pattern is exactly the same as that of *Hemigale hardwickii*, but the gray is so dull and the black so diffused that the longitudinal stripes are no longer a conspicuous feature of the animal's markings. The dark cross-bands on the back average wider than in the related species but their outlines are nearly as well defined. The series presents no variation worthy of note.

#### PARADOXURUS LIGNICOLOR sp. nov.

(PLATE IV, FIGURE 1, AND PLATE V, FIGURE 1)

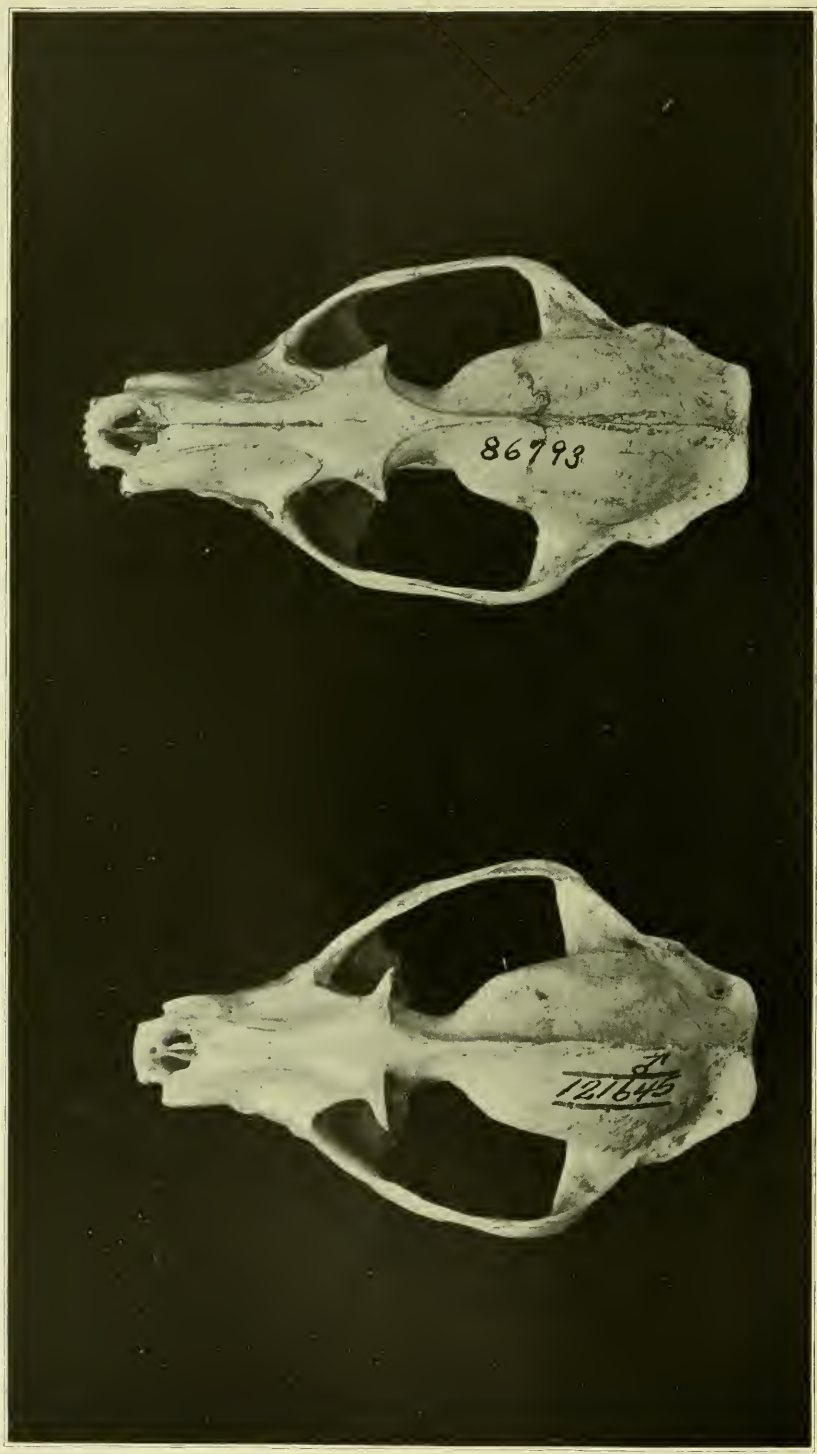
*Type.*—Adult male (skin and skull), No. 121,645, United States National Museum. Collected on North Pagi Island, Sumatra, November 19, 1902, by Dr. W. L. Abbott. Original number, 2068.

*Characters.*—Not as large as *Paradoxurus hermaphroditus*, but general form the same. Color yellowish brown with no dark markings; tail lighter than body. Teeth relatively larger than those of

<sup>1</sup> Measurements in parenthesis are those of an adult female *Hemigale hardwickii* (No. 114,461), not as old as the type of *H. minor*, from Tapanuli Bay, Sumatra.



2



1. *Paradoxurus lignicolor*, male (type). 2. *Paradoxurus hermaphroditus*, male, No. 86,793, Trong, Lower Siam.

*P. hermaphroditus*, but not essentially different in form. Nasals flat posteriorly.

*Color*.—Entire animal wood-brown, the belly and tail tinged with buff, the back somewhat lightened by the indistinct, grayish, sub-terminal annulations of the hairs. Dorsal line from crown to base of tail clouded by a wash of mummy-brown, most distinct on head and neck. Feet and outer surface of front legs tinged with broccoli-brown. The fur of the upperparts, chin, and throat is drab at base, that of belly and tail buffy throughout. Everywhere the hairs have a distinct silvery gloss, but this is especially noticeable on distal half of tail. Whiskers light wood-brown.

*Skull and teeth*.—The skull (pl. iv, fig. 1, and pl. v, fig. 1) closely resembles that of *Paradoxurus hermaphroditus* (pl. iv, fig. 2, and pl. v, fig. 2), but the interpterygoid space is narrower and there is scarcely a trace of the longitudinal groove involving the region between upper rims of maxillaries. Teeth essentially as in *P. hermaphroditus*, but inner lobe of upper sectorial longer, and set at a somewhat different angle, so that the width of the palate is considerably reduced.

*Measurements*.—External measurements of type: total length, 845; head and body, 485; tail vertebræ, 360; hind foot, 77 (75); ear from meatus, 33; ear from head, 19.6; width of ear, 25.

Cranial measurements of type: greatest length, 104 (112);<sup>1</sup> basal length, 99 (107); basilar length, 94.6 (102); median palatal length, 47 (50); breadth of palate between sectorials, 14 (18); breadth of palate between front molars, 19 (21); length of interpterygoid space, 20 (24); breadth of interpterygoid space at middle, 8.6 (10.2); constriction in front of postorbital processes, 17 (19); constriction behind postorbital processes, 10.4 (11); zygomatic breadth, 62 (58); mastoid breadth, 38 (38); breadth of braincase above roots of zygomata, 32 (33); mandible, 78 (81); maxillary tooththrow, exclusive of incisors (alveoli), 39 (41); greatest diameter of upper sectorial, 10.2 (10.2); mandibular tooththrow exclusive of incisors (alveoli), 44 (41).

*Specimens examined*.—Two, the type, and the skull of an adult female, the latter from South Pagi Island.

*Remarks*.—This well characterized species is probably most closely allied to *Paradoxurus hermaphroditus*, though in color it undoubtedly more nearly resembles *P. aureus*, an animal which I have not seen. It is apparently of about the same size as the Ceylonese musang.

<sup>1</sup> Measurements in parenthesis are those of an adult male *Paradoxurus hermaphroditus* from Trong, Lower Siam (No. 86,793).



and the teeth of the two animals, to judge by Blanford's description of *P. aureus*, have certain peculiarities in common. Dr. Abbott writes that the female exactly resembled the male in color.

**GALEOPITHECUS PUMILUS** sp. nov.

(PLATE VI, FIGURE 3)

1900. *Galeopithecus volans* MILLER, Proc. Biol. Soc. Washington, XIII, p. 193, December 21, 1900. Not *Lemur volans* Linnæus.

*Type*.—Adult male (skin and skull), No. 104,448, United States National Museum. Collected on Pulo Adang, Butang Islands, December 17, 1899, by Dr. W. L. Abbott. Original number, 165.

*Characters*.—Like *Galeopithecus volans* from the Malay Peninsula, but much smaller. Skull with relatively shorter rostrum and broader palate than in the mainland animal.

*Color*.—Type: entire dorsal surface an intimate blending of smoke-gray, blackish brown, and isabella-color, the gray clear and pale on back of neck and sides of head, tinged with isabella-color on posterior half of back, the brown predominating on legs, feet, and greater part of membranes, the isabella-color most noticeable on crown, along edge of principal membrane, and on distal half of uropatagium. Except for the nearly clear gray area on neck and cheeks the whole upper surface of the body is so mottled and clouded that the exact color is very difficult to describe. A few small flecks of nearly pure white may be detected on posterior edge of thigh. Underparts isabella-color, rather darker than that of Ridgway on throat, chest, and belly, fading toward ochraceous-buff on under side of membranes and limbs.

*Skull and teeth*.—As compared with the skull of an adult male *Galeopithecus volans* (pl. VII, fig. 2; pl. VIII, fig. 2, and pl. IX, fig. 2) from the Rumpin River, Pahang, that of *Galeopithecus pumilus* (pl. VI, fig. 3) is conspicuously smaller, the rostrum is relatively shorter and the palate broader. In the larger animal the least distance from orbit to anterior nares equals that between outer edges of anterior molars, while in *Galeopithecus pumilus* it is equal only to that from outer edge of one molar to inner edge of the opposite tooth. The supraorbital processes are less developed in the smaller animal, in which the greatest width of the process is scarcely more than one-half that of the narrowest flat portion of the interorbital region, instead of nearly equal to the entire width of this area as in the larger species. Braincase shorter than that of *Galeopithecus volans*, and occipital portion less distinctly outlined when skull is viewed from the side.



1



2



1. *Paradoxurus lignicolor*, male (type). 2. *Paradoxurus heru aphroditus*, male, No. 86,793. Trong, Lower Siam.

The teeth are essentially like those of *Galeopithecus volans*, due allowance being made for their smaller size.

*Measurements.*—External measurements of type: total length, 490 (585);<sup>1</sup> head and body, 305 (365); tail vertebræ, 185 (220); hind foot, 55 (69); hind foot without claws, 49 (62); front foot, 62 (77); front foot without claws, 55 (71); ear from meatus, 16 (16); ear from crown, 13 (13); width of ear, 13 (13.4).

Cranial measurements of type: greatest length, 61 (70); basal length, 58 (65); basilar length, 54 (61); lateral palatal length,<sup>2</sup> 27 (32); palatal width at front of first incisor, 11.6 (13.4); palatal width at space between canine and first premolar, 19 (18); distance between inner edge of posterior molars (alveoli), 14, (15.6); least distance from orbit to anterior nares, 19 (23.4); zygomatic breadth, 38.6 (39.6); greatest orbital breadth, 40 (45); least interorbital breadth, 16 (20); breadth of braincase above roots of zygomata, 24 (25); mastoid breadth, 29 (30); greatest depth of braincase, 17 (20); occipital depth, 13.8 (15); mandible, 43 (50); depth of mandible between canine and first premolar, 5.8 (5.6); depth of mandible through coronoid process, 19.6 (21); maxillary toothrow (alveoli), 29 (34); mandibular toothrow (alveoli), 30.2 (35).

*Specimens examined.*—Two, both from Pulo Adang.

*Remarks.*—This small *Galeopithecus* is so readily distinguishable from the peninsular animal, which for the present may be assumed to represent true *volans*, that no further comparison is necessary. From *Galeopithecus temminckii* as figured by Waterhouse it differs in its smaller size, less wide palate, and much smaller teeth.

#### GALEOPITHECUS AORIS sp. nov.

*Type.*—Adult female (skin and skull), No. 112,428, United States National Museum. Collected on Pulo Aor, off coast of Johore, June 8, 1901, by Dr. W. L. Abbott. Original number, 1028.

*Characters.*—Similar to *Galeopithecus pumilus* but not as small, palate relatively not as broad, and upper canine, lower canine, and first premolar much larger.

*Color.*—The type is similar to the type of *Galeopithecus pumilus* except that the wash of isabella-color is less distinct on feet and outer edge of membranes, and the entire back is tinged with whitish cream-buff. A pale buffy spot on each shoulder and hip. A

<sup>1</sup> Measurements in parenthesis are those of an adult male *Galeopithecus volans* from the Rumpin River, Pahang (No. 115,493).

<sup>2</sup> From tip of premaxillary to front of interpterygoid space.

young male (No. 112,427, June 5, 1901) almost exactly resembles the type of *Galeopithecus pumilus*.

*Skull and teeth.*—The skull of the female is about as large as that of the male of *Galeopithecus volans* from the mainland. In form it more closely resembles the skull of the peninsular animal than it does the short broad skull of *Galeopithecus pumilus*. Palate and rostrum rather wider than in *Galeopithecus volans*, but not as wide as in *G. pumilus*. Teeth essentially as in the related species, but canines, both above and below, and first lower premolar relatively larger, particularly in the male.

*Measurements.*—External measurements of type: total length, 625 (690);<sup>1</sup> head and body, 385 (405); tail vertebræ, 240 (285); hind foot, 60 (73); hind foot without claws, 54 (65); front foot, 70 (83); front foot without claws, 63 (75); ear from meatus, 16 (22); ear from crown, 13 (18); width of ear, 12 (17).

Cranial measurements of type: greatest length, 67 (77.6); basal length, 63 (72.4); basilar length, 58 (68); lateral palatal length, 30.4 (37); palatal width at front of first incisor, 12.4 (15); palatal width at space between canine and first premolar, 20.4 (23); distance between inner edge of posterior molars (alveoli), 15 (17); least distance from orbit to anterior nares, 23 (28); zygomatic breadth, 40 (47.6); depth of zygoma, 4 (6); greatest orbital length, 42 (50); least interorbital breadth, 17.4 (22.6); breadth of braincase above roots of zygomata, 25 (26); mastoid breadth, 30 (36.4); greatest depth of braincase, 17.8 (19); occipital depth, 15 (18); mandible, 50 (57); depth of mandible between canine and first premolar, 6.6 (7); depth of mandible through coronoid process, 20.4 (25.6); maxillary tooththrow (alveoli), 31.6 (37); mandibular tooththrow (alveoli), 33.4 (39).

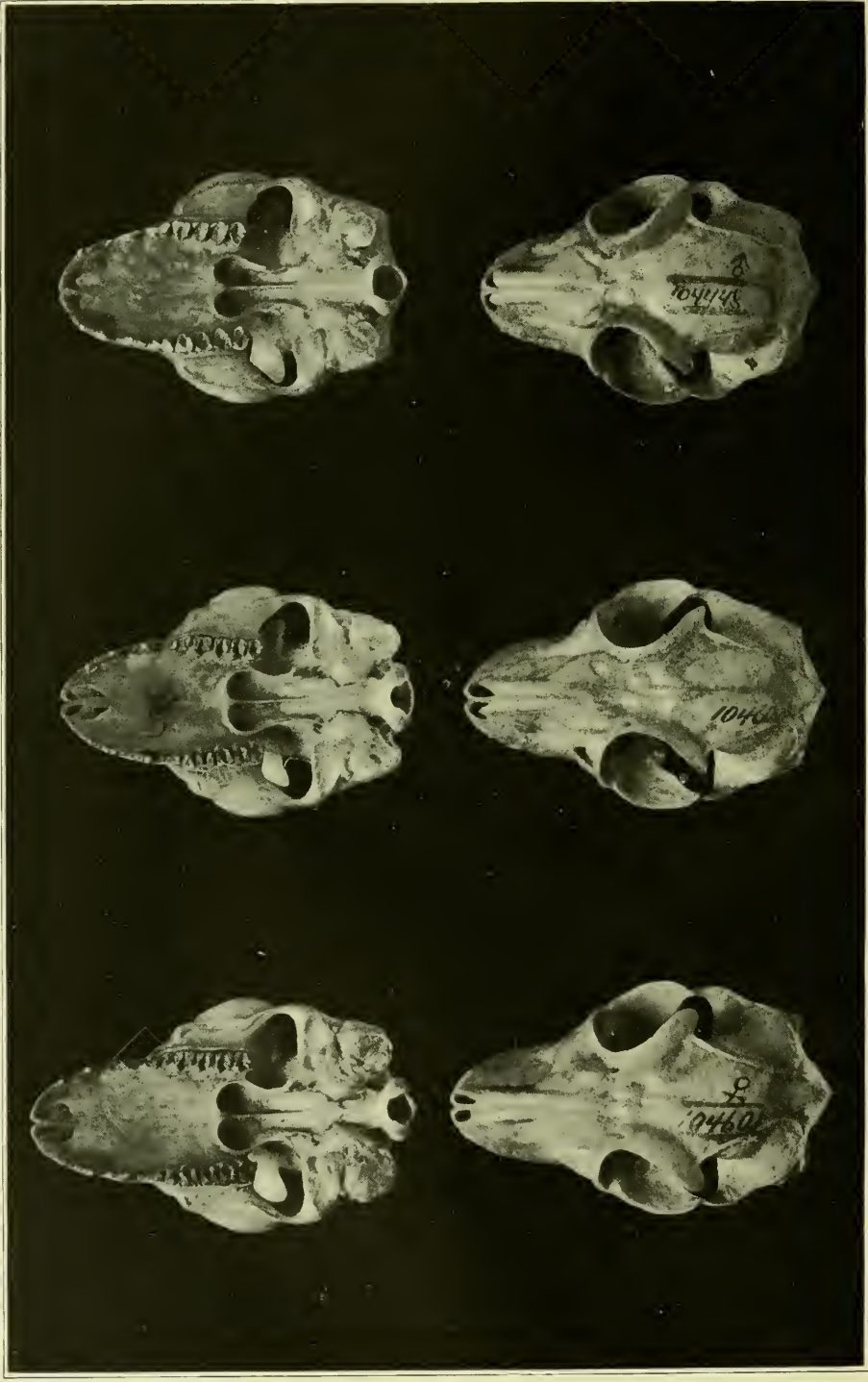
*Specimens examined.*—Two, both from Pulo Aor.

*Remarks.*—The type is the lightest colored *Galeopithecus* that I have seen, but whether this character is anything more than an individual peculiarity cannot now be determined. The male, so young that the permanent dentition is not fully in place, very closely resembles the type of *Galeopithecus pumilus*, but is not as small. Its measurements are: total length, 530; head and body, 340; tail vertebræ, 190; hind foot, 56 (50.4); front foot, 61 (56); skull, greatest length, 60; zygomatic breadth, 37.

<sup>1</sup> Measurements in parenthesis are those of an adult female *Galeopithecus volans* from Trong, Lower Siam (No. 84,420).







1. *Galeopithecus gracilis*, female (type). 2. *Galeopithecus gracilis*, male, No. 10460, Sirhassen Island, South Natunas. 3. *Galeopithecus pumilus*, male (type).

**GALEOPITHECUS GRACILIS** sp. nov.

(PLATE VI, FIGURE 2)

1901. *Galeopithecus volans* MILLER, Proc. Washington Acad. Sci., March 26, 1901. Part, specimens from Sirhassen Island. Not *Lemur volans* Linnaeus.

*Type*.—Adult female (skin and skull), No. 104,601, United States National Museum. Collected on Sirhassen Island, South Natunas, June 7, 1900, by Dr. W. L. Abbott. Original number, 461.

*Characters*.—Similar to *Galeopithecus pumilus* and *G. aoris* but not as small. Skull more elongate than in the related species, and with much narrower palate.

*Color*.—The color so closely resembles that of the related species as to require no detailed description. Both specimens are in the gray pelage.

*Skull and teeth*.—The skull (pl. VI, fig. 2) is slightly longer than that of *Galeopithecus aoris*, but the width is distinctly less. This is particularly noticeable in the rostral and lachrymal regions. On the other hand, the zygoma is shorter and broader (deeper) than in the related species. Palate narrower than in any other known member of the genus. The teeth are rather larger than those of *Galeopithecus aoris*, but I can detect no tangible peculiarities in form.

*Measurements*.—External measurements of type: total length, 605; head and body, 405; tail vertebræ, 200; hind foot, 62 (59); front foot, 73 (67); ear from meatus, 18; ear from crown, 14; width of ear, 14. External measurements of adult male from the type locality (No. 104,600): total length, 410; head and body, 300; tail vertebræ, 110; hind foot, 62.6 (56); front foot, 67 (60); ear from meatus, 14; ear from crown, 12.6; width of ear, 11.

Cranial measurements of type: greatest length, 68; basal length, 65; basilar length, 61; lateral palatal length, 32.4; palatal width at front of first incisor, 13; palatal width at space between canine and first premolar, 20; distance between inner edge of posterior molars (alveoli), 14.6; least distance from orbit to anterior nares, 24; zygomatic breadth, 38.4; depth of zygoma, 5; greatest orbital breadth, 40.2; least interorbital breadth, 17; breadth of braincase above roots of zygomata, 21.6; mastoid breadth, 31; greatest depth of braincase, 17; occipital depth, 13.4; mandible, 49.6; depth of mandible between canine and first premolar, 6; depth of mandible through coronoid process, 20.4; maxillary toothrow (alveoli), 33; mandibular toothrow (alveoli), 34.

Cranial measurements of adult male from the type locality (No. 104,600): greatest length, 64; basal length, 61; basilar length, 57;

lateral palatal length, 29.6; palatal width at space between canine and first premolar, 19.6; zygomatic breadth, 37; depth of zygoma, 5; mandible, 44.8; maxillary tooththrow (alveoli), 30.6; mandibular tooththrow (alveoli), 31.

*Specimens examined*.—Two, both from Sirhassen Island.

**GALEOPITHECUS NATUNÆ** sp. nov.

1901. *Galeopithecus volans* MILLER, Proc. Washington Acad. Sci., III, p. 134, March 26, 1901. Part, specimen from Bunguran Island. Not *Lemur volans* Linnæus.

*Type*.—Adult female (skin and skull), No. 104,602, United States National Museum. Collected on Bunguran Island, North Natunas, July 16, 1900, by Dr. W. L. Abbott. Original number, 573.

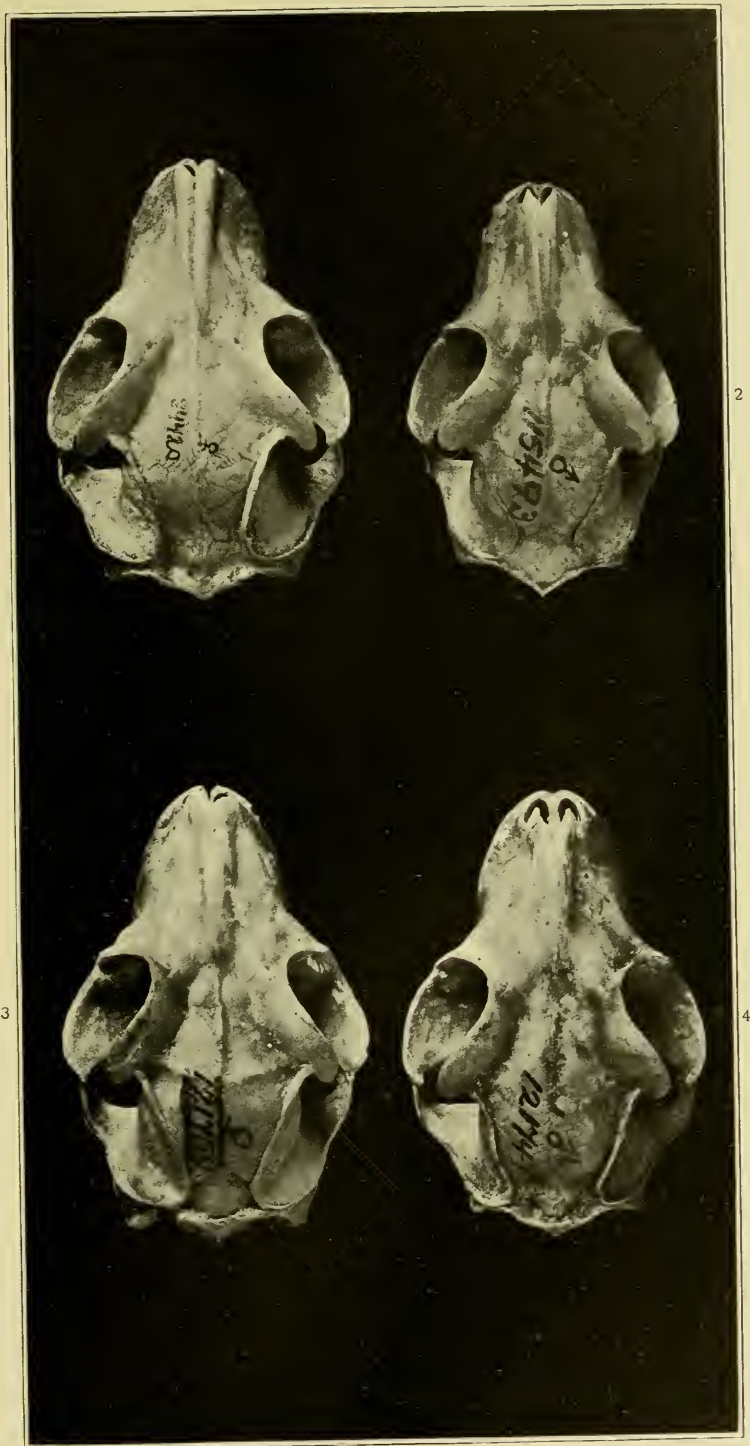
*Characters*.—Intermediate in size between the large and small members of the genus. Skull and teeth essentially as in *Galeopithecus volans* but distinctly smaller. Color as in the related species.

*Color*.—The color shows no tangible differences from that of the species just described. The specimen is in the gray phase.

*Skull and teeth*.—The skull and teeth are very similar to those of *Galeopithecus volans* from the Malay Peninsula, but are readily distinguishable by their smaller size. In the type the lachrymal region is considerably swollen so that the rostrum is less sharply marked off from the orbit than in *Galeopithecus volans*, a character which may prove to be individual. Palate slightly narrower than that of *Galeopithecus volans*, but not closely approaching the form characteristic of the Sirhassen animal. The teeth show no tangible peculiarities.

*Measurements*.—External measurements of type: total length, 660; head and body, 405; tail vertebræ, 255; hind foot, 70 (64); front foot, 83 (77); ear from meatus, 17; ear from crown, 16; width of ear, 12.6.

Cranial measurements of type: greatest length, 71; basal length, 67.6; basilar length, 63; lateral palatal length, 33; palatal width at front of first incisor, 14; palatal width at space between canine and first premolar, 22; distance between inner edge of posterior molars (alveoli), 14.8; least distance from orbit to anterior nares, 26.4; zygomatic breadth, 41.8; depth of zygoma, 5.4; greatest orbital breadth, 44.4; least interorbital breadth, 17.6; breadth of braincase above roots of zygomata, 25.4; mastoid breadth, 33.6; greatest depth of braincase, 19; occipital depth, 15.4; mandible, 51; depth of mandible between canine and first premolar, 6.8; depth of mandible through coronoid process, 22.6; maxillary tooththrow (alveoli), 34.6; mandibular tooththrow (alveoli), 36.



1. *Galeopithecus volans*, female, No. 84,420. Trong, Lower Siam. 2. *Galeopithecus volans*, male, No. 115,403, Rumpin River, Pahang. 3. *Galeopithecus saturatus*, female (type). 4. *Galeopithecus saturatus*, male, No. 121,747, Tana Bala, Batu Islands.





*Specimens examined*.—One, the type.

*Remarks*.—Although represented by one specimen only, this species is undoubtedly distinct from the *Galeopithecus volans* of the Malay Peninsula and from the form inhabiting Sirhassen Island. It appears to be more closely allied to the former, a fact in harmony with the relationship of other Bunguran mammals, notably the giant squirrels.

**GALEOPITHECUS SATURATUS** sp. nov.

(PLATE VII, FIGURES 3 AND 4; PLATE VIII, FIGURES 3 AND 4; PLATE IX, FIGURES 3 AND 4)

*Type*.—Adult female (skin and skull), No. 121,750, United States National Museum. Collected on Tana Bala, Batu Islands, Sumatra, February 12, 1903, by Dr. W. L. Abbott. Original number, 2278.

*Characters*.—Slightly larger than *Galeopithecus volans*, and sexual difference in size less noticeable than in the other known species. First upper incisor usually with four cusps. Color very dark, the light phase not unlike the dark phase of *Galeopithecus volans*.

*Color*.—*Light phase* (type specimen): dorsal surface mostly ochraceous-buff and seal-brown, the former predominating on body, hind legs, and interfemoral membrane, the latter nearly clear on forearms. Neck washed with gray, shoulders and back with cream-buff. Face suffused with dark brown. The colors are everywhere indescribably blended. On each hip there is a conspicuous buffy white spot, and two similar but smaller spots occur behind each shoulder. The feet and edges of the principal membranes are speckled with grayish white dots. Dark area of forearm intensified by about six conspicuous buffy white spots 3–8 mm. in length and about 2 mm. wide. Under surface of body drab washed with wood-brown. Under surface of legs and membranes tawny clay-color considerably lighter than that of Ridgway. *Dark phase* (adult male, No. 121,749); general color above seal-brown, faintly grizzled with russet on interfemoral membrane, lumbar region, and sides of back. On front legs and feet and over most of the membranes there is a noticeable sprinkling of whitish hairs, these most conspicuous on forearm. Neck dull, grizzled wood-brown. Head blackish, sprinkled with silvery white hairs. Hip spots indicated by a few tufts of creamy white. White spots on shoulders and forearms obsolete. Underparts as in the light phase, but wood-brown and drab rather darker, and interfemoral membrane heavily washed with an indefinite dark brown. *Red phase* (adult male, No. 121,853): entire upperparts bright cinnamon-rufous, the hairs fading to orange-buff beneath the surface of the fur. Neck slightly grizzled with wood-

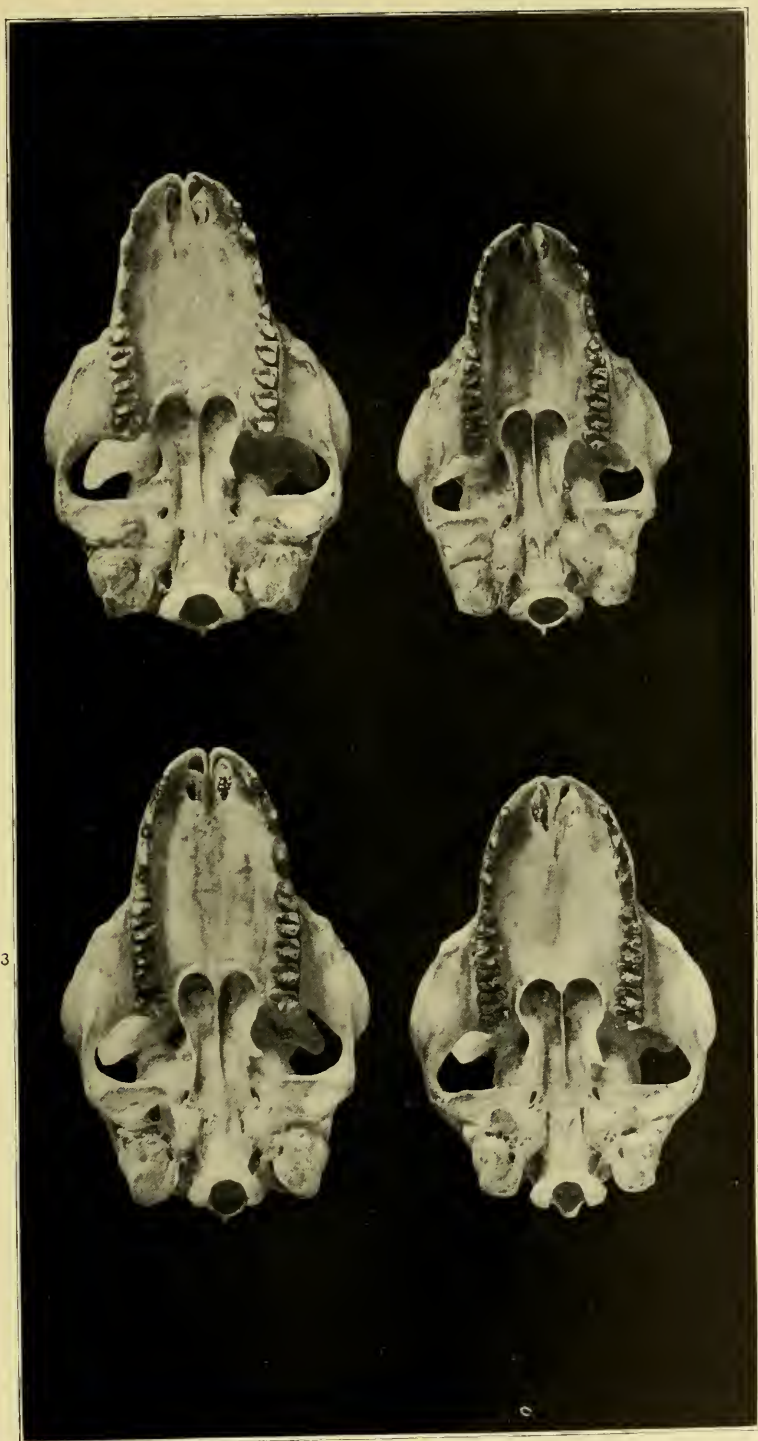
brown. A slight burnt-sienna wash on shoulders. Head, face, and chin burnt-sienna. Underparts essentially as in the other phases, but everywhere tinged with rufous.

*Skull and teeth.*—In general form the skull (pl. VII, figs. 3 and 4; pl. VIII, figs. 3 and 4; pl. IX, figs. 3 and 4) closely resembles that of *Galeopithecus volans* (pl. VII, figs. 1 and 2; pl. VIII, figs. 1 and 2; pl. IX, figs. 1 and 2). In fact, when skulls of females are compared the only tangible difference appears to be in the form of the basioccipital and foramen magnum. In *Galeopithecus saturatus* this bone is narrower than in the mainland animal, and the occipital condyles are set at a less distinct angle. Consequently the foramen magnum is more nearly of the same width above and below, and the whole bony structure surrounding it stands out as more noticeably tubular. This character is equally noticeable in the skull of the male, which is further distinguished by its considerably greater size (see measurements of *Galeopithecus volans* under *G. pumilus*, p. 47). The teeth resemble those of *Galeopithecus volans*, but are more robust, and the first upper incisor is conspicuously larger. In four of the five skulls this tooth has four well developed cusps, while three is the usual number in the other species.

*Measurements.*—External measurements of type: total length, 725; head and body, 459; tail vertebræ, 266; hind foot, 76 (68); front foot, 85 (77); ear from meatus, 20; ear from crown, 16; width of ear, 14. External measurements of adult male from the type locality (No. 121,747): total length, 653; head and body, 403; tail vertebræ, 250; hind foot, 70 (63); front foot, 83 (74).

Cranial measurements of type: greatest length, 78; basal length, 74; basilar length, 69; lateral palatal length, 36.8; palatal width at front of first incisor, 14.4; palatal width at space between canine and first premolar, 23.6; distance between inner edge of posterior molars (alveoli), 16.8; least distance from orbit to anterior nares, 28; zygomatic breadth, 45; greatest orbital breadth, 51; least inter-orbital breadth, 22; breadth of braincase above roots of zygomata, 27; mastoid breadth, 34.6; greatest depth of braincase, 20; occipital depth, 16.6; mandible, 54; depth of mandible between canine and first premolar, 6.6; depth of mandible through coronoid process, 23; maxillary toothrow (alveoli), 38; mandibular toothrow (alveoli), 37.

Cranial measurements of adult male (No. 121,747): greatest length, 73; basal length, 70; basilar length, 65.6; lateral palatal length, 34; palatal width at space between canine and first premolar, 23; zygomatic breadth, 46; mandible, 55; maxillary toothrow (alveoli), 37; mandibular toothrow (alveoli), 37.



1. *Galeopithecus volans*, female, No. 84,420, Trong, Lower Siam. 2. *Galeopithecus volans*, male, No. 115,493, Rumpin River, Pahang. 3. *Galeopithecus saturatus*, female (type). 4. *Galeopithecus saturatus*, male, No. 121,747, Tana Bala, Batu Islands.





*Specimens examined.*—Six, all but one from Tana Bala, the latter from Pulo Pinie.

*Remarks.*—Of the six skins two, both males, are in the dark pelage, one male is in the red phase, and the one female, the type, is in the gray coat. The two others, both males, are in a stage intermediate between the red and dark phases. Due allowance being made for the three phases, the species is not unusually variable in color. Specimens in the dark or red pelages are very different from *Galeopithecus volans*, but those in the gray phase might readily be mistaken for the mainland animal in dark coat. But whatever the characters of the skin, the species is always recognizable by the relatively slight difference in the size of the two sexes, and by the large anterior upper tooth.

#### GALEOPITHECUS TUANCUS sp. nov.

1901. *Galeopithecus volans* MILLER, Proc. U. S. Nat. Mus., xxvi, p. 471, February 3, 1903. Not *Lemur volans* Linnæus.

*Type.*—Adult female (skin and skull), No. 114,375, United States National Museum. Collected on Pulo Tuangku, Banjak Islands, Sumatra, January 22, 1902, by Dr. W. L. Abbott. Original number, 1454.

*Characters.*—Color essentially as in *Galeopithecus saturatus*, but gray phase apparently lighter. Size much less than that of the Batu animal.

*Color.*—*Light phase* (type specimen): The animal was evidently moulting when killed, as two pelages are represented; a thin, abraded, grayer coat on limbs, head, neck, and sides, and a fresh, more brown coat on back. The former closely resembles the ordinary gray phase of *Galeopithecus volans*, and calls for no special comment. The latter is essentially like the back in the type specimen of *Galeopithecus saturatus*, but the colors are not as bright and well contrasted. Underparts as in the type of *G. saturatus*. *Dark phase* (immature<sup>1</sup> male, No. 114,376): like corresponding pelage of *Galeopithecus saturatus*, except that the back is more suffused with russet, and the neck is distinctly tinged with gray.

*Skull and teeth.*—The skull is much smaller than that of *Galeopithecus saturatus*, that of the female closely corresponding with that of the female *G. aoris* in size. The skull of the male, however, is decidedly larger than in the male *G. aoris* of exactly comparable age. Teeth as in *Galeopithecus aoris*, except that the first

<sup>1</sup> Apparently full grown, but permanent dentition not fully in place.

upper incisor is larger and in the permanent dentition shows a distinct trace of a fourth cusp.

*Measurements.*—External measurements of type: total length, 640; head and body, 385; tail vertebræ, 235; hind foot, 65 (59); front foot, 78 (71); ear from meatus, 18; ear from crown, 16; width of ear, 13. External measurements of immature male (No. 114,376): total length, 550; head and body, 335; tail vertebræ, 215; hind foot, 63 (57); front foot, 68 (61).

Cranial measurements of type: greatest length, 69; basal length, 65.4; basilar length, 61; lateral palatal length, 32; palatal width at front of first incisor, 13; palatal width at space between canine and first premolar, 20.4; distance between inner edge of posterior molars (alveoli), 16; least distance from orbit to anterior nares, 24.2; zygomatic breadth, 41; greatest orbital breadth, 45; least interorbital breadth, 19.4; breadth of braincase above roots of zygomata, 24; mastoid breadth, 28.6; greatest depth of braincase, 19; occipital depth, 15; mandible, 49; depth of mandible between canine and first premolar, 6.6; depth of mandible through coronoid process, 21; maxillary toothrow (alveoli), 33; mandibular toothrow (alveoli), 33.6.

Cranial measurements of immature male (No. 114,376) from the type locality: greatest length, 66; basal length, 63; basilar length, 58; lateral palatal length, 30.6; palatal width at space between canine and first premolar, 19.6; zygomatic breadth, 39; mandible, 48.4; maxillary toothrow (alveoli), 30.6; mandibular toothrow (alveoli), 32.4.

*Specimens examined.*—Two, both from Pulo Tuangku.

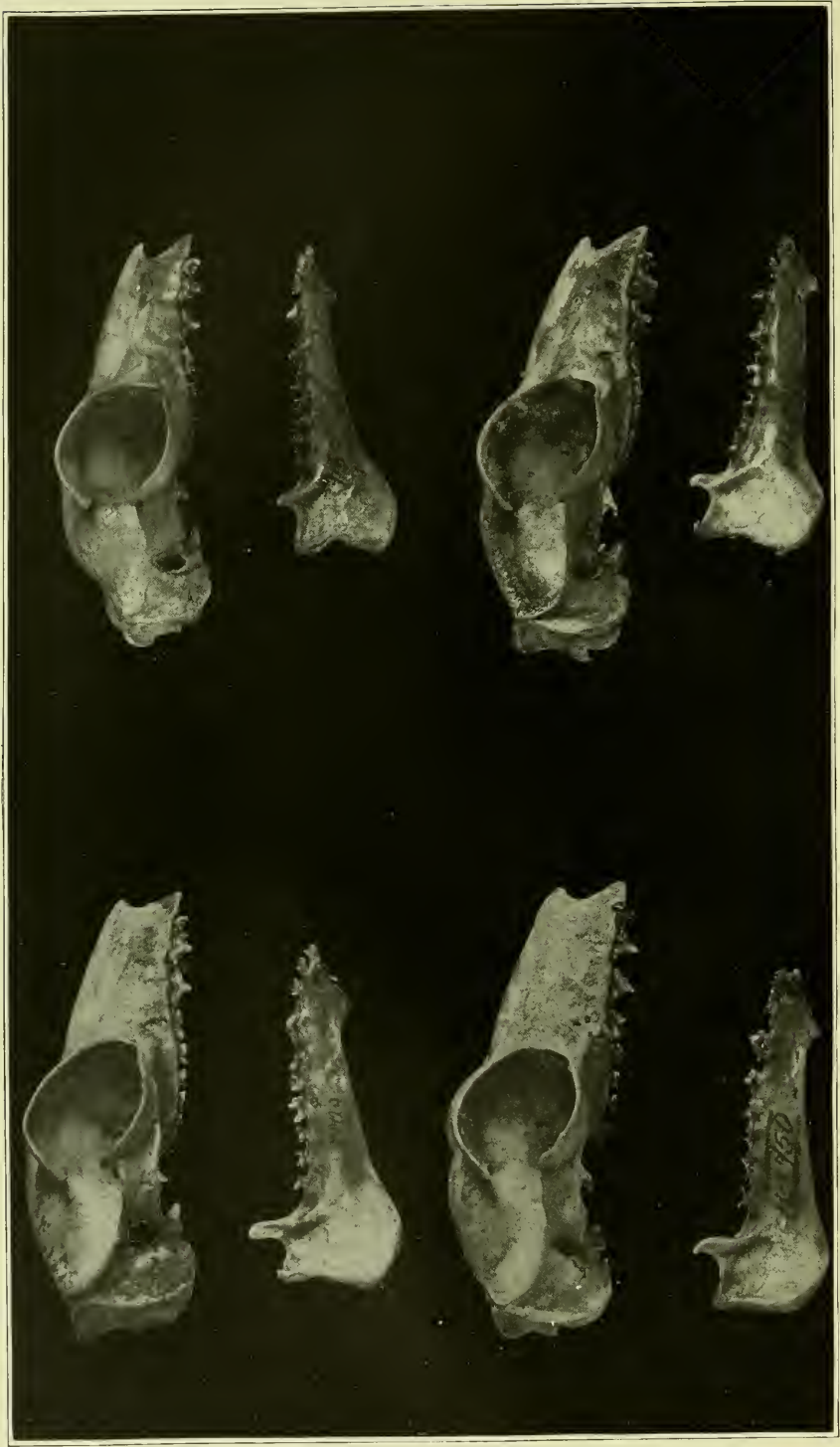
#### TUPAIA CASTANEA sp. nov.

*Type.*—Adult female (skin and skull), No. 115,608, United States National Museum. Collected on Pulo Bintang, Rhio Archipelago, August 11, 1902, by Dr. W. L. Abbott. Original number, 1872.

*Characters.*—Similar to *Tupaia splendidula* but larger and darker; underparts clear tawny-ochraceous.

*Color.*—Upperparts a fine, close mixture of black and ferruginous, the general effect slightly more red than the chestnut of Ridgway, though in certain lights appearing almost black. The hairs are everywhere very glossy. On occiput and forehead the chestnut fades rather abruptly into the light grizzled brown of face and cheeks. The pale element of this grizzle is ochraceous-buff, the dark element an indefinite blackish brown. The former is a little in excess. Outer surface of hind legs like back, outer surface of





1. *Galeopithecus volans*, female, No. 84,420, Trong, Lower Siam. 2. *Galeopithecus volans*, male, No. 115,943, Ramin River, Pahang. 3. *Galeopithecus saturatus*, female (type). 4. *Galeopithecus saturatus*, male, No. 121,747, Tana Bala, Batu Islands

front legs like face. Underparts, shoulder stripes, and inner surface of legs, clear tawny-ochraceous, the hairs on the chest and throat slaty at base. Feet and ears dusky, the former distinctly darker than legs. Tail light ferruginous, heavily clouded above with blackish brown at base and near tip. The second specimen shows no marked variation from the type.

*Skull and teeth.*—The skull and teeth closely resemble those of *Tupaia splendidula*, but are distinctly larger throughout.

*Measurements.*—External measurements of type: total length, 345; head and body, 200; tail vertebræ, 145; hind foot, 44 (42). External measurements of adult male from type locality: total length, 360; head and body, 210; tail vertebræ, 150; hind foot, 46 (44).

Cranial measurements of type: greatest length, 53 (50);<sup>1</sup> basal length, 49 (—); basilar length, 46 (—); palatal length, 28 (26); diastema, 3.4 (3.4); breadth of palate at middle of diastema, 5.6 (5.6); breadth of palate between middle molars, 10 (9); least inter-orbital breadth, 15.6 (14.8); zygomatic breadth, 25.4 (25); breadth of braincase above roots of zygomatics, 20 (19); maxillary toothrow exclusive of incisors (alveoli), 19 (19); mandible, 35 (34); mandibular toothrow exclusive of incisors (alveoli), 19.4 (19).

*Specimens examined.*—Two, both from Bintang Island.

*Remarks.*—The discovery of this treeshrew is of unusual interest, as it greatly extends the range of the group to which the species belongs. Hitherto three members have been known, *Tupaia splendidula* Gray from Bunguran Island, *T. lucida* (Thomas) from Pulo Laut, North Natunas, and *T. chrysomalla* Miller from the Anambas. The relationship of *Tupaia castanea* to these may be understood from the following key:

Upperparts light (approximately the ferruginous of Ridgway).

Head, neck, and shoulders paler than back; feet not darker than legs.

*Tupaia lucida.*

Head, neck, and shoulders not paler than back; feet darker than legs.

*Tupaia chrysomalla.*

Upperparts dark (approximately the chestnut of Ridgway).

Underparts buff; total length about 320; hind foot about 41 (39).

*Tupaia splendidula.*

Underparts tawny-ochraceous; total length about 350; hind foot about 45 (43).....*Tupaia castanea.*

The distribution of these treeshrews is difficult to understand. They are unknown on the mainland of the Malay Peninsula or on any of the larger islands; but Pulo Bintang is distant from the

<sup>1</sup> Measurements in parenthesis are those of an adult female *Tupaia splendidula* from Bunguran Island, North Natunas (No. 104,714).



coast of Johore by only 11 miles, while nearly 300 miles of open water lie between it and the Anambas, and a similar expanse separates the latter group from the Natunas. This apparent anomaly is doubtless in large part due to our very fragmentary knowledge of the fauna of the larger Malayan land masses.

**TUPAIA PULONIS** sp. nov.

*Type*.—Adult female (skin and skull), No. 112,449, United States National Museum. Collected on Pulo Aor, off coast of Johore, June 7, 1901, by Dr. W. L. Abbott. Original number, 1023.

*Characters*.—Similar to *Tupaia ferruginea* Raffles, but size larger, color of underparts much paler, and skull with rostral portion less elongate.

*Color*.—Back and sides ochraceous-rufous, inconspicuously speckled by the black hair tips. On sides the ground color becomes somewhat lighter, and on neck, shoulders, and outer surface of front legs it fades to ochraceous-buff, the speckling at the same time becoming more evident. Head and feet an indefinite grizzled brown, the exact shade not far from the hair-brown of Ridgway. Shoulder stripes distinct, cream-buff. Underparts and inner surface of legs cream-buff in strong contrast with color of sides. Tail somewhat lighter than back, its upper surface a grizzle of black and dull cream-buff, its under surface clear buff at middle, grizzled buff and black along edges and at tip.

*Skull and teeth*.—The skull is larger than that of *Tupaia ferruginea* throughout, and in form it is relatively broader and more robust, particularly in the rostral portion. Teeth larger than those of *Tupaia ferruginea*, but of similar form. The larger size of the teeth is especially noticeable in the anterior upper molar, the posterior lower premolar, and the first and second lower molars.

*Measurements*.—External measurements of type: total length, 372; head and body, 197; tail vertebræ, 175; hind foot, 42 (40). External measurements of immature<sup>1</sup> male from the type locality: total length, 385; head and body, 195; tail vertebræ, 190; hind foot, 44 (42).

Cranial measurements of type: greatest length, 51.4 (49);<sup>2</sup> basal length, 45.8 (43); basilar length, 44.6 (41.6); palatal length, 27 (25.4); diastema, 3 (3.6); breadth of palate at middle of diastema, 6.8 (5.4); breadth of palate between middle molars, 9.8 (8); least

<sup>1</sup> Permanent dentition not wholly in place.

<sup>2</sup> Measurements in parenthesis are those of an adult female *Tupaia ferruginea* from Tanjong Dungun, Tringanu (No. 105,029).

interorbital breadth, 15.6 (13.8); zygomatic breadth, 26.4 (24); breadth of braincase above roots of zygomata, 19.6 (19); maxillary toothrow exclusive of incisors (alveoli), 19 (18); mandible, 35.4 (33.6); mandibular toothrow exclusive of incisors (alveoli), 19.4 (18); crowns of first and second lower molars together, 7 (6.2).

*Specimens examined*.—Two, both from Pulo Aor.

*Remarks*.—Its large size and the pale color of the underparts readily distinguish this species from *Tupaia ferruginea*. The color of the back, however, is essentially as in the animal inhabiting the neighboring portions of the Malay Peninsula, though the upper surface of the tail is not as dark nor as strongly suffused with yellow.

#### TUPAIA TEPHRURA sp. nov.

*Type*.—Adult female (skin and skull), No. 121,752, United States National Museum. Collected on Tana Bala, Batu Islands, Sumatra, February 12, 1903, by Dr. W. L. Abbott. Original number, 2276.

*Characters*.—In size and general appearance not unlike *Tupaia phæura* of Sinkep Island, but upperparts darker, shoulder stripes better developed, and tail conspicuously lighter than body, its distal half silvery buff-gray.

*Color*.—Type: upperparts mixed ferruginous and black, the former in excess on neck, shoulders, and anterior half of back, the latter in excess posteriorly. On crown the ferruginous is replaced by buff. Shoulder stripes buff, well developed, about 4 mm. wide at middle. Feet and ears blackish. Underparts buff somewhat darker than that of Ridgway, particularly on middle of chest; the anterior half of belly darkened by the brownish under color. Tail light buff, the proximal half heavily overlaid with blackish brown above, the distal half grizzled with blackish and silvery, the under side clear buff throughout, except brownish line along vertebræ and brownish edging.

*Skull and teeth*.—The skull and teeth do not differ appreciably from those of *Tupaia phæura*.

*Measurements*.—External measurements of type: total length, 323; head and body, 193; tail vertebræ, 130; hind foot, 41 (38.6). External measurements of adult male (No. 121,751) from the type locality: total length, 330; head and body, 180; tail vertebræ, 150; hind foot, 45 (42.6).

Cranial measurements of type: greatest length, 52; basal length, 46.4; basilar length, 45; palatal length, 28; diastema, 4; breadth of palate between middle molars, 9.2; least interorbital breadth, 15; zygomatic breadth, 25; breadth of braincase above roots of zygomata,

20; maxillary toothrow exclusive of incisors (alveoli), 19; mandible, 35; mandibular toothrow exclusive of incisors (alveoli), 19.4.

*Specimens examined*.—Two, both from Tana Bala.

*Remarks*.—The color of the underparts is exactly as in *Tupaia phœura*, that of the upperparts is slightly darker, and the tail is very different from that of the related species. When the hairs are in natural position the basal half of the tail does not differ appreciably in color from the back, except that the silvery tips of the hairs are more noticeable. The least disarrangement, however, brings to view the buff under color. The distal half is very different from the back, and the whole under side is very much lighter than in *Tupaia phœura*. Both specimens are in fresh, unworn pelage. In the male the shoulders and back are not quite as dark as in the female, and the buff of the tail is much paler. Otherwise the two specimens are essentially alike.

**TUPAIA CHRYSOGASTER** sp. nov.

(PLATE X, FIGURE 1)

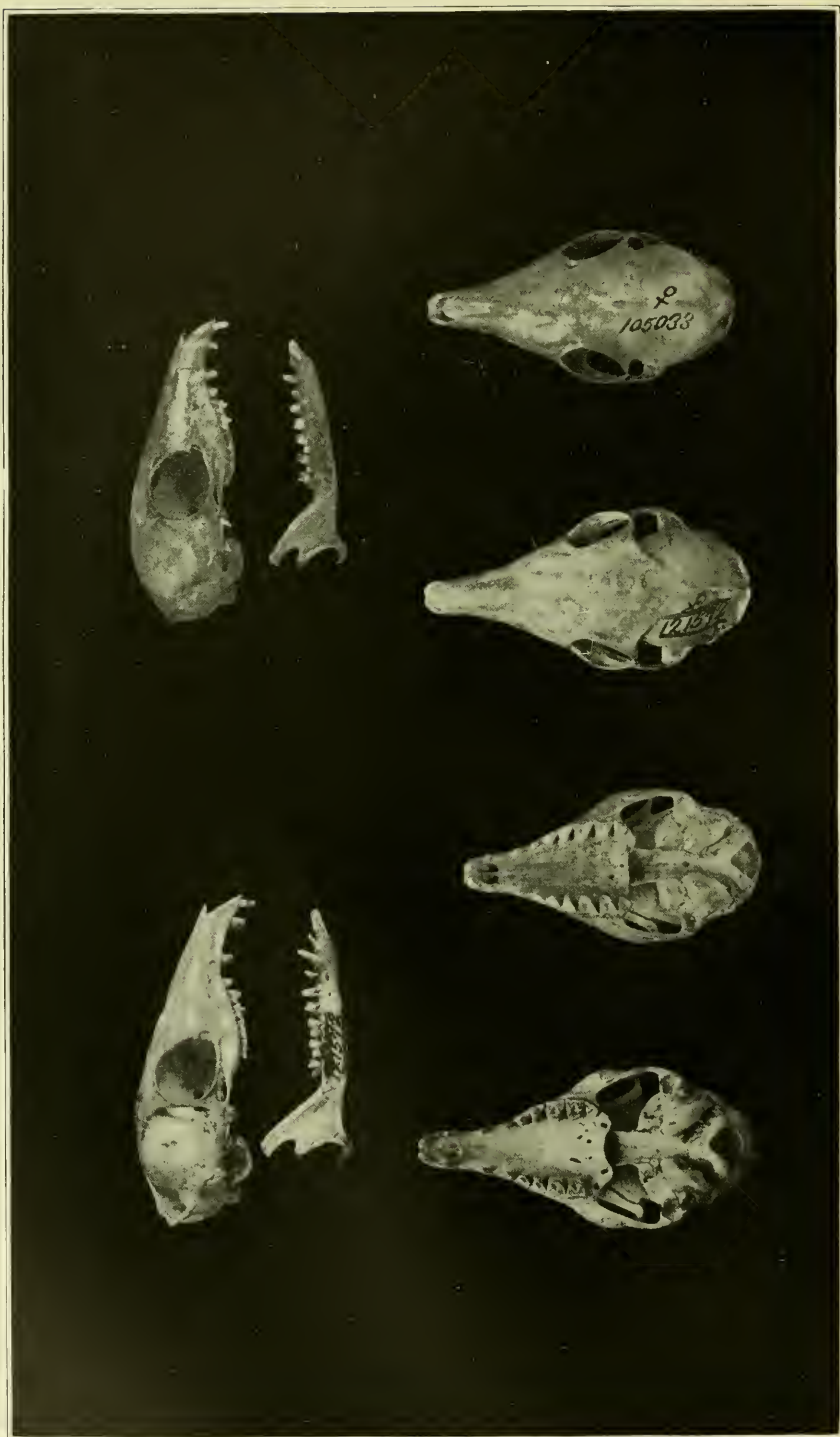
*Type*.—Adult female (skin and skull), No. 121,572, United States National Museum. Collected on North Pagi Island, Sumatra, November 21, 1902, by Dr. W. L. Abbott. Original number, 2078.

*Characters*.—Like the Javan *Tupaia hypochrysa* (Thomas), but upperparts darker than in *Tupaia ferruginea*, tail strongly tinged with yellowish brown below, and entire ventral surface of body and inner side of legs brownish yellow.

*Color*.—Type: upperparts and outer side of legs a fine, inconspicuous grizzle of black and dull ferruginous, the former in excess everywhere except on neck and along sides of body. Face slightly tinged with gray. Feet and ears blackish, but not strongly contrasted with surrounding parts. Ventral surface of body and inner side of legs clear brownish yellow, the exact shade ochraceous on throat, chest, legs, and along median line, somewhat tinged with clay-color elsewhere. The two colors form a rather sharp line of demarcation on legs, but on sides the fur is thin and the shades less definite. Wrists and ankles tinged with blackish. Tail like back above, but more coarsely grizzled, its under side a peculiar indefinite grizzled yellowish brown, very different from the gray of *Tupaia ferruginea*.

*Skull and teeth*.—The skull and teeth (pl. x, fig. 1) are larger than in *Tupaia ferruginea* (pl. x, fig. 2) and with age the rostrum becomes decidedly more elongate than is ever the case with the mainland animal. In the latter character the skull is intermediate between that of *Tupaia ferruginea* and that of *T. tana*. Its other





1<sup>a</sup> 1. *Tupaia chrysogaster*, female (type). 2. *Tupaia ferruginea*, No. 105933, Tanjong Dungun, Tringatu. 2<sup>b</sup>



details of form are, however, in essential agreement with the skull of *Tupaia ferruginea*.

*Measurements.*—External measurements of type: total length, 345; head and body, 205; tail vertebræ, 140; hind foot, 44.4 (42). External measurements of an adult male (No. 197,138) from the type locality: total length, 335; head and body, 197; tail vertebræ, 138; hind foot, 44 (42).

Cranial measurements of type: greatest length, 56 (49.4),<sup>1</sup> basal length, 49 (44); basilar length, 48 (42); palatal length, 30.6 (26.4); diastema, 5 (4.2); least distance from rim of orbit to tip of premaxillary, 26.6 (22.6); breadth of palate between middle molars, 9 (8.6); least interorbital breadth, 15 (14.8); zygomatic breadth, 26.6 (25); breadth of braincase above roots of zygomata, 20 (19); mandible, 38 (33); maxillary tooththrow exclusive of incisors, 20 (18); mandibular tooththrow exclusive of incisors, 20 (18.6).

*Specimens examined.*—Ten, all from the Pagi Islands.

*Remarks.*—This series shows no important variation in color. In a few specimens there is a faintly indicated shoulder stripe, but in the majority, as in the type, there is no trace of this. The underparts are occasionally less bright than in the type, and the indefinite brown wash on sides of belly varies slightly in amount. Occasionally there is a slight grayish tinge at axilla.

This species needs comparison with only one other, the *Tupaia hypochrysa* of Thomas. In the Javan animal, however, the yellow of the underparts is "a rich golden colour, almost 'orpiment orange' of Ridgway," and is confined to the throat and chest. The rest of the coloration is said to be similar to that of *Tupaia ferruginea*. This would make the upperparts lighter than in *T. chrysogaster*, and the under side of the tail gray instead of yellowish brown.

#### TUPAIA CERVICALIS sp. nov.

*Type.*—Adult male (skin and skull), No. 121,754, United States National Museum. Collected on Tana Bala, Batu Islands, Sumatra, February 14, 1903, by Dr. W. L. Abbott. Original number, 2294.

*Characters.*—Like *Tupaia tana*, but gray neck markings paler, more extensive, and more conspicuous; black of back more sharply defined from red of sides, and teeth larger.

*Color.*—Type: the general color of underparts, tail, and back is essentially as in *Tupaia tana*, and requires no detailed description.

<sup>1</sup> Measurements in parenthesis are those of an adult female *Tupaia ferruginea* from Singapore (No. 105,079).

The sides, however, are a lighter, duller ochraceous-rufous, and the posterior half of back a deeper, more glossy black. The black area is thus better outlined laterally, while the very sharp contrast with the shoulders and neck throw it still more strongly in relief. Light neck stripes grizzled, whitish cream-buff, slightly tinged with tawny on posterior third, very sharply defined against the tawny sides of neck and blackish median stripe. Crown and face a dull grizzle of whitish and dark brown, nearly as pale as light neck stripes.

*Skull and teeth.*—The skull is in all respects similar to that of *Tupaia tana*. Teeth as in the related species, but molars larger.

*Measurements.*—External measurements of type: total length, 375; head and body, 210; tail vertebræ, 165; hind foot, 46 (44). External measurements of adult female from the type locality: total length, 365; head and body, 215; tail vertebræ, 150; hind foot, 45.4 (42).

Cranial measurements of type: greatest length, 59; basal length, 52; basilar length, 51; palatal length, 33; diastema, 5; breadth of palate between middle molars, 8.6; least interorbital breadth, 14.8; zygomatic breadth, 25; breadth of braincase above roots of zygomata, 20; maxillary tooththrow exclusive of incisors (alveoli), 22; mandible, 39; mandibular tooththrow exclusive of incisors (alveoli), 22.

*Specimens examined.*—Two, both from Tana Bala.

#### PTEROPUS GEMINORUM sp. nov.

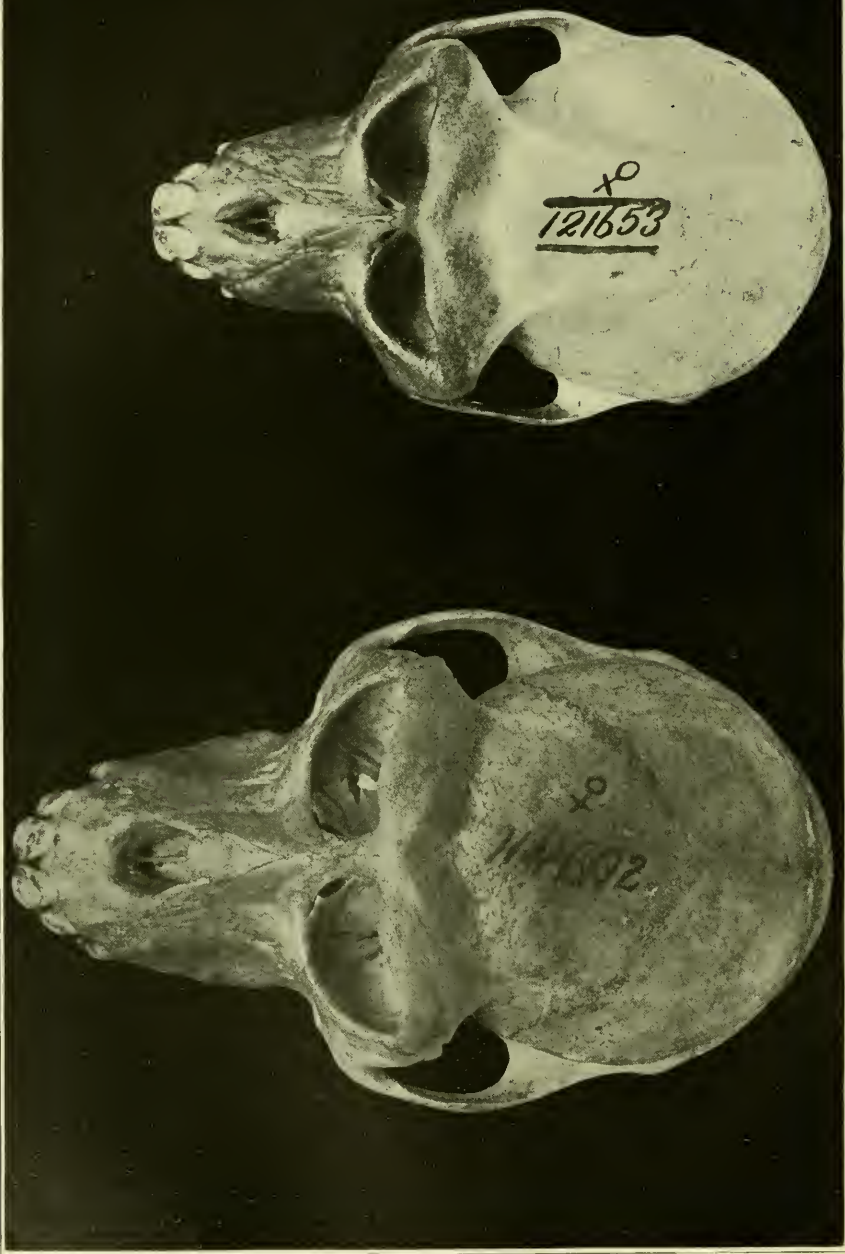
*Type.*—Adult female (skin and skull), No. 104,464, United States National Museum. Collected on South Twin Island, Mergui Archipelago, January 28, 1900, by Dr. W. L. Abbott. Original number, 283.

*Characters.*—Similar to *Pteropus hypomelanus* and *P. lepidus*, but color darker and teeth smaller.

*Color.*—Type: back dark hair-brown, sprinkled with silvery whitish hairs, and with an indistinct brownish yellow wash along edges of membrane. Neck russet, blackening laterally. Head grayish ochraceous-buff. Underparts blackish, irregularly suffused with russet and sprinkled with silvery whitish hair-tips. Ears, feet, and membranes black.

*Skull and teeth.*—The skull is in all respects essentially like that of *Pteropus hypomelanus* from the Natuna Islands, though the palate is usually less broad. Teeth as in *Pteropus hypomelanus* but smaller, the difference particularly noticeable in the second upper molar and first lower molar.





1. *Macacus nemestrinus*, female, No. 114,502, Tapanuli Bay, Sumatra. 2. *Macacus pagensis*, female (type).

*Measurements.*—External measurements of type: head and body, 215; tibia, 55; foot, 45 (36); forearm, 115; thumb, 62 (52); second digit, 105 (103); third digit, 257; fourth digit, 202; fifth digit, 177; ear from meatus, 23; ear from crown, 21; width of ear, 15.

Cranial measurements of type: greatest length, 64; basal length, 60; basilar length, 56; median palatal length, 35; palatal breadth between anterior molars, 10; zygomatic breadth, 33; least inter-orbital breadth in front of postorbital processes, 8.4; least inter-orbital breadth behind postorbital processes, 8; distance between tips of postorbital processes, 24; greatest breadth of braincase above roots of zygomata, 23; greatest depth of braincase, 18; occipital depth, 12; depth of rostrum at middle of diastema, 6.8; maxillary tooththrow (exclusive of incisors), 23.4; crown of first upper molar,  $4.8 \times 3$ ; mandible, 49.4; mandibular tooththrow (exclusive of incisors), 27; crown of first lower molar,  $4.4 \times 2.6$ .

*Specimens examined.*—Fifteen (seven skins), all from South Twin Island.

*Remarks.*—The series shows little variation in color. Such as there is chiefly involves the greater or less amount of blackish suffusion on the neck, and the strength of the yellowish tinge in the gray of the head. In one female (No. 104,466) the sides of the abdomen are strongly washed with silvery gray.

#### MACACUS PAGENSIS sp. nov.

(PLATE XI, FIGURE 2; PLATE XII, FIGURE 2; PLATE XIII, FIGURE 1)

*Type.*—Adult female (skin and skull), No. 121,653, United States National Museum. Collected on South Pagi Island, Sumatra, November 17, 1902, by Dr. W. L. Abbott. Original number, 2053.

*Characters.*—Like *Macacus nemestrinus* but much smaller. General color darker than in the related species, but sides of neck light yellowish brown, in strong contrast with dorsal surface.

*Fur.*—The fur does not differ essentially from that of an adult female Sumatran specimen, except that the tail is much more thinly haired, and there are some peculiarities in the growth of the hair on head. The tail is so sparsely haired that the skin is nowhere concealed except at extreme base, while in *M. nemestrinus* no skin can be seen. This may be a seasonal character, but the fact that the scattered hairs on the tail of *Macacus pagensis* are all of the same light brown color, those of the upper surface showing no suggestion of the blackish dorsal stripe of the related animal, makes it seem probable that the tail is always essentially as in the type. On forehead the hairs from a line joining anterior bases of ears all grow



forward, while in *M. nemestrinus* those in a band about 20 mm. wide above the eyebrows grow backward, meeting the others in an indistinct ridge. The hairs of the cheeks are all directed backward, to and surrounding base of ears. There is thus no indication of the conspicuous semicircle of antrorse hairs surrounding front of ear in the larger species.

*Color.*—Dorsal surface from forehead to base of tail clear bister, darker than that of Ridgway, the drab underfur appearing irregularly at surface when hair is disarranged. Sides of body and inner surface of arms and legs isabella-color. Belly isabella-color, fading to light fawn-color on chest and throat. Outer surface of arms light russet, that of legs dark isabella-color except on thighs, which are mostly covered by an extension of the brown area of back. A similar but less extensive wash covers proximal half of upper arm. Sides of neck grayish cream-buff in striking contrast with upper surface. Cheeks and chin brown like that of back, but not quite as dark. Hands and feet dusky brownish. Tail sprinkled with isabella-colored hairs. "Callosities fleshy brown. Palms and soles light fleshy brown."<sup>1</sup>

*Skull and teeth.*—The skull (pl. XI, fig. 2; pl. XII, fig. 2; pl. XIII, fig. 1) is very much smaller than that of a slightly younger female of *Macacus nemestrinus* (pl. XI, fig. 1; pl. XII, fig. 1; pl. XIII, fig. 2) from Tapanuli Bay, Sumatra. In general form, however, the two do not appreciably differ. The bony palate is concave laterally (when viewed from below, but to a less degree than in the larger animal. Its median line is nearly straight, and shows only a trace of the deep longitudinal concavity so conspicuous in *M. nemestrinus* in region between premolars. Audital bullæ a little more swollen antero-laterally than in *M. nemestrinus*, but this character may be purely individual. Teeth as in *Macacus nemestrinus* but smaller throughout. In the larger animal the last upper molar is provided with a distinct fifth cusp on the outer posterior margin of the crown. Scarcely a trace of this can be detected in *Macacus pagensis*. Similarly the back lower molar has one less cusp than that of *Macacus nemestrinus*. The missing cusp in this tooth appears to be the posterior on inner side. Whether these differences are any more than individual peculiarities it is impossible to tell.

*Measurements.*—External measurements of type: total length, 580 (690);<sup>2</sup> head and body, 435 (480); tail vertebræ, 145 (210);

<sup>1</sup> Collector's note on label.

<sup>2</sup> Measurements in parenthesis are those of a younger female of *Macacus nemestrinus* from Tapanuli Bay, Sumatra (No. 114,502).





1. *Macacus nemestrinus*, female, No. 114,502, Tapanuli Bay, Sumatra. 2. *Macacus pugensis*, female (type).

foot, 125 (152); foot without claws, 120 (148); ear from meatus, 31 (32); ear from crown, 28 (26); width of ear, 30 (32).

Cranial measurements of type: greatest length, 111 (134); basal length, 78 (96); basilar length, 76 (92); least palatal length, 38 (52.4); palatal breadth between front molars, 20.6 (26.4); zygomatic breadth, 71 (85); mastoid breadth, 62.6 (72); greatest breadth of braincase above roots of zygomata, 61 (68); least breadth of braincase immediately behind orbits, 42 (50); greatest orbital breadth, 60 (66); least distance from orbit to alveolus of inner incisor, 33 (47.6) greatest depth of braincase, 47.4 (48); mandible, 79.6 (94); maxillary toothrow exclusive of incisors (alveoli), 35.4 (41.6); three upper molars together (crowns), 22.6 (26); mandibular toothrow exclusive of incisors (alveoli), 40.4 (47); three lower molars together (crowns), 23.4 (28).

*Specimens examined*.—Two, the type, and a very young individual, both from South Pagi Island.

*Remarks*.—The young, of which the type was the parent, closely resembles the adult in all respects, except that the tail is somewhat less thinly haired.

#### MACACUS PHÆURA sp. nov.

*Type*.—Adult male (skin and skull), No. 121,870, United States National Museum. Collected at Siaba Bay, Nias Island, Sumatra, March 20, 1903, by Dr. W. L. Abbott. Original number, 2399.

*Characters*.—Similar to *Macacus fascicularis*,<sup>1</sup> but general color slightly darker, and upper surface of tail conspicuously blackish.

*Color*.—Type: back and sides buff, slightly browner and more yellow than that of Ridgway, and everywhere inconspicuously grizzled with black. The sides are a trifle less yellowish than the back. Outer surface of arms like sides of body, but distinctly tinged with gray; outer surface of legs essentially like sides of body. Fingers, toes, and sides of feet indefinite dark brown. Crown like back. Forehead sprinkled with blackish hairs. Cheeks grizzled buffy gray. Underparts, sides of neck, and inner surface of legs pale ecru-drab. Tail ecru-drab below, blackish above. Near base the hairs of the upper surface of the tail are inconspicuously grizzled with buffy brown annulations. Beyond middle the blackish becomes diluted with ecru-drab.

*Skull and teeth*.—The skull and teeth show no tangible characters to distinguish them from those of *Macacus fascicularis*.

<sup>1</sup>For use of the name *Macacus fascicularis* (Raffles) in place of *M. cynomolgus* see Bonhote, *Fasciculi Malayenses*, Zoology, I, p. 3. July, 1903.

*Measurements.*—External measurements of type: total length, 940; head and body, 460; tail vertebræ, 480; foot, 130 (127); skull, greatest length, 116; basal length, 85; basilar length, 82; zygomatic breadth, 77; maxillary toothrow exclusive of incisors (alveoli), 34.

*Specimens examined.*—Four, all from Siaba Bay, Nias Island.

*Remarks.*—Although the characters on which this species is based are slight they are very constant in the four skins as compared with an extensive series of *Macacus fascicularis* from various localities in Sumatra, the Malay Peninsula, and elsewhere.

#### PRESBYTES RHIONIS sp. nov.

*Type.*—Adult female (skin and skull), No. 115,665, United States National Museum. Collected at Telok Pemudong, Pulo Bintang, Rhio Archipelago, August 15, 1902, by Dr. W. L. Abbott. Original number, 1888.

*Characters.*—Like *Presbytes natunæ* (Thomas and Hartert), but color not as dark.

*Color.*—Type: general color above, from region between ears to and including basal fourth of tail, broccoli-brown, washed with wood-brown on shoulders and tail and with chocolate on sides and lumbar region. The hairs are ecru-drab at base, and the irregular appearance of this color at surface further complicates any attempt at an exact description. From axilla to thigh may be traced a faintly indicated dark line about 25 mm. in width bordering the whitish of ventral surface. Front part of crown darker than back, the color becoming almost black on forehead and temples. Feet and hands blackish. On arms this color fades into the general tint of the body at region of elbows, but on legs it is continued, with only a slight admixture of brown, to thigh patch, and along outer side of this to join the faint dark lateral stripe. Thigh patches large and conspicuous, as in *Presbytes natunæ*, white, slightly tinged with cream-color. Above they are sharply defined from the brown lumbar region, but below and at the sides they fade somewhat gradually into the color of the neighboring parts. Entire ventral surface, inner side of arms to elbows and of legs to knee white, tinged with gray, particularly on chest and thighs. The light area on arms and legs is continued to wrists and ankles, but beyond knees and elbows it is much encroached upon by the dark brown. The tail darkens from proximal fourth until at tip it is seal-brown. The under surface is nowhere different from the upper surface.

The series shows some trifling variations in the exact shade of the dark areas, but this is chiefly due to bleaching of the hairs, and none





1. *Macacus pagensis*, female (type). 2. *Macacus nemestrinus*, female,  
No. 114,502, Tapanuli Bay, Sumatra.



of the skins shows any very close approach to the blackish hues of *Presbytes natunæ*.

*Skull and teeth.*—The skull and teeth appear to be identical with those of *Presbytes natunæ*.

*Measurements.*—External measurements of type: total length, 1173; head and body, 468; tail vertebræ, 705; foot, 150 (145). Measurements of adult male from type locality: total length, 1213; head and body, 550; tail vertebræ, 663; foot, 150 (147).

Cranial measurements of type: greatest length, 88 (86);<sup>1</sup> basal length, 63 (61); basilar length, 57 (56); least palatal length, 24 (23); palatal breadth (between front molars), 18.8 (18); zygomatic breadth, 66 (65); mastoid breadth, 58.4 (54); greatest breadth of braincase above roots of zygomata, 52.4 (52); least breadth of braincase immediately behind orbits, 46 (43); greatest orbital breadth, 62 (57.6); least distance from orbit to alveolus of inner incisor, 15.6 (15.6); greatest depth of braincase, 43 (43); mandible, 61 (62); maxillary toothrow (exclusive of incisors), 27 (26); mandibular toothrow (exclusive of incisors), 32.2 (31.8).

*Specimens examined.*—Seven (one skull without skin), all from Pulo Bintang.

*Remarks.*—Although closely related to *Presbytes natunæ*, this monkey is readily distinguishable by the absence of the blackish cast on back, legs, and tail. It is common on Pulo Bintang, and Dr. Abbott notes that its cry is exactly like the shrill *ka—ka—ka* of *P. natunæ* and *P. sumatranus*. From this cry is derived the Malay name, "kaka." In the living and freshly killed animals the palms and soles are black, the face is slaty, and the eyelids and lips are fleshy white.

#### PRESBYTES BATUANUS sp. nov.

*Type.*—Adult male (skin and skull), No. 121,810, United States National Museum. Collected on Pulo Pinie, Batu Islands, Sumatra, March 4, 1903, by Dr. W. L. Abbott. Original number, 2369.

*Characters.*—Similar to *Presbytes sumatranus*, but not as large and tail not as long. Skull somewhat broader than in the Sumatran animal.

*Color.*—Type: belly, under side of tail to about middle, inner surface of thighs, and median line of chest grayish white. Remainder of fur black, the back and crown lightened by a brownish wash. Beyond middle of tail the grayish white stripe on ventral surface becomes much reduced in width, and its distinctness is further

<sup>1</sup> Measurements in parenthesis are those of an adult female *Presbytes natunæ* from Bunguran Island (No. 104,849).



of the skins shows any very close approach to the blackish hues of *Presbytes natunæ*.

*Skull and teeth*.—The skull and teeth appear to be identical with those of *Presbytes natunæ*.

*Measurements*.—External measurements of type: total length, 1173; head and body, 468; tail vertebræ, 705; foot, 150 (145). Measurements of adult male from type locality: total length, 1213; head and body, 550; tail vertebræ, 663; foot, 150 (147).

Cranial measurements of type: greatest length, 88 (86);<sup>1</sup> basal length, 63 (61); basilar length, 57 (56); least palatal length, 24 (23); palatal breadth (between front molars), 18.8 (18); zygomatic breadth, 66 (65); mastoid breadth, 58.4 (54); greatest breadth of braincase above roots of zygomata, 52.4 (52); least breadth of braincase immediately behind orbits, 46 (43); greatest orbital breadth, 62 (57.6); least distance from orbit to alveolus of inner incisor, 15.6 (15.6); greatest depth of braincase, 43 (43); mandible, 61 (62); maxillary toothrow (exclusive of incisors), 27 (26); mandibular toothrow (exclusive of incisors), 32.2 (31.8).

*Specimens examined*.—Seven (one skull without skin), all from Pulo Bintang.

*Remarks*.—Although closely related to *Presbytes natunæ*, this monkey is readily distinguishable by the absence of the blackish cast on back, legs, and tail. It is common on Pulo Bintang, and Dr. Abbott notes that its cry is exactly like the shrill *ka—ka—ka* of *P. natunæ* and *P. sumatranus*. From this cry is derived the Malay name, "kaka." In the living and freshly killed animals the palms and soles are black, the face is slaty, and the eyelids and lips are fleshy white.

#### PRESBYTES BATUANUS sp. nov.

*Type*.—Adult male (skin and skull), No. 121,810, United States National Museum. Collected on Pulo Pinie, Batu Islands, Sumatra, March 4, 1903, by Dr. W. L. Abbott. Original number, 2369.

*Characters*.—Similar to *Presbytes sumatranus*, but not as large and tail not as long. Skull somewhat broader than in the Sumatran animal.

*Color*.—Type: belly, under side of tail to about middle, inner surface of thighs, and median line of chest grayish white. Remainder of fur black, the back and crown lightened by a brownish wash. Beyond middle of tail the grayish white stripe on ventral surface becomes much reduced in width, and its distinctness is further

<sup>1</sup> Measurements in parenthesis are those of an adult female *Presbytes natunæ* from Bunguran Island (No. 104,849).



lessened by admixture of black hairs. It may be traced however to extreme tip, which is also grayish. The gray of the tail is somewhat washed with pale buff.

*Skull and teeth.*—The skull of *Presbytes batuanus* is smaller than that of *P. sumatranus* and its width is greater in proportion to the length. The orbits are better defined from outline of braincase above, and the frontal region is less swollen. Teeth as in *Presbytes sumatranus*, but uniformly smaller.

*Measurements.*—External measurements of type: total length, 1150; head and body, 485; tail vertebræ, 665; foot, 163 (161).

Cranial measurements of type: greatest length, 90 (96.4)<sup>1</sup>; basal length, 64.6 (69); basilar length, 59 (65); median palatal length, 29 (30); palatal breadth between front molars, 17.4 (18); zygomatic breadth, 72 (73); mastoid breadth, 58 (62); greatest breadth of braincase above roots of zygomata, 52.6 (56); least breadth of braincase immediately behind orbits, 41 (43); greatest orbital breadth, 61.4 (62); least distance from orbit to alveolus of inner incisor, 17 (21); greatest depth of braincase, 42.6 (44.6); mandible, 64 (66.6); maxillary toothrow exclusive of incisors (alveoli), 28 (29); three upper molars together (crowns), 16.8 (16.8); mandibular toothrow exclusive of incisors (alveoli), 33 (32); three lower molars together (crowns), 18.4 (17).

*Specimens examined.*—Ten, all from the Batu Islands.

*Remarks.*—The Batu *Presbytes* is readily distinguishable from its Sumatran representative by the smaller general size, and particularly by the shorter tail. Of four adults of the latter from Tapanuli Bay none has the tail less than 730 mm. in length, while among the nine adults of *Presbytes batuanus* the longest tail is only 710 mm. The series shows no variations worthy of special note.

#### SIMIAs gen. nov. (Cercopithecidæ).

*Type.*—*Simias concolor* sp. nov.

*Characters.*—Skull essentially as in *Nasalis*, but rostrum less produced and nasals not as wide. Nose like that of *Rhinopithecus*. Tail about one-third as long as head and body, naked except for an inconspicuous tuft of hair at tip. Ischial callosities large and conspicuous. Teeth as in *Nasalis*, *Rhinopithecus*, and *Presbytes*. No cheek pouches.

*Remarks.*—This genus combines the more important structural characters of *Nasalis* and *Rhinopithecus* with an external form un-

<sup>1</sup>Measurements in parenthesis are those of an adult male *Presbytes sumatranus* from Tapanuli Bay, Sumatra (No. 114,507).



*Simias concolor* (from photograph of freshly killed individual).



like that of its relatives and strongly suggesting *Macacus nemestrinus*. The nasal bones are fully as long as in *Nasalis larvatus*, though their width is less and their anterior extremities probably never form a distinct median projection. Among the nine skulls that I have examined none shows any tendency toward the rudimentary form of nasals characteristic of *Presbytes* and to an even greater degree of *Rhinopithecus*. The interorbital region is relatively longer and narrower than in any of the related genera, and the orbits are better defined above, two characters that give the skull a strong resemblance to that of *Macacus*. The facial profile is nearly straight from forehead to middle of nares. The development of the rostrum is intermediate between that of *Nasalis* and *Presbytes*, and appears to be closely similar to that in the two species of *Rhinopithecus* whose skulls are known. The teeth do not differ appreciably from those of the members of the related genera. Although the skull agrees so closely with that of *Nasalis* the nose is very different, showing no tubular elongation. As in *Rhinopithecus* the apertures of the nostrils are directly on the surface of the very wide upper lip; and it is only the superior nasal margin that is lengthened to give the face its snub-nosed aspect. While the structural characters of the head are essentially a combination of those of the previously known genera, the form of the body departs widely from that of other members of the subfamily *Presbytinae*, particularly in the shortness of the arms and tail, and resembles the pig-tailed macaques. The limbs are not as robust as in *Macacus nemestrinus*, but the tail is of about the same relative length, and the ischial callosities are fully as conspicuous. Although distinct from each other and from *Presbytes*, the genera *Nasalis*, *Rhinopithecus*, and *Simias* form a compact and easily recognizable group.

**SIMIAS CONCOLOR** sp. nov.

(PLATES XIV, XV, XVI)

*Type*.—Adult male (skin and skull), No. 121,659, United States National Museum. Collected on South Pagi Island, Sumatra, December 3, 1902, by Dr. W. L. Abbott. Original number, 2103.

*Characters*.—Nose and teeth essentially like those of *Rhinopithecus roxellana* and *R. bieti* as described and figured by Milne-Edwards. Skull essentially as in *Nasalis larvatus* but smaller, the rostrum less produced, and nasal bones narrower. Size and general form about as in *Macacus nemestrinus*; tail only one-third as long as head and body, naked except for an inconspicuous tuft of hair at tip. General color throughout dusky brown, the underparts darker than back.

*External form.*—In general external form this species very closely resembles *Macacus nemestrinus*, differing only in its slightly longer, less robust arms and legs, and relatively smaller, more rounded head. The hands and feet appear to be broader. The tail is proportioned almost exactly as in *Macacus nemestrinus*.

*Face.*—The physiognomy of *Simias concolor*, as shown by photographs of a freshly killed individual (pl. XIV) is essentially like that of *Rhinopithecus roxellana*. The elevated ridge above the nostrils is less abrupt than in the Tibetan animal as figured by Milne-Edwards, and the concavity extending from this ridge to the eyebrows is longer and less deep. Otherwise there is a very close agreement between the two species.

*Callosities.*—The callosities are very large and conspicuous, even more so than in *Macacus nemestrinus*. In the male they are joined solidly together along the median line, but in the female they are separated by a narrow strip of softer skin.

*Fur.*—The fur is of the same length as that of *Macacus nemestrinus*, except that the underparts are thickly haired from chin to hypogastric region. The latter, together with the axillæ and inner side of upper arm are nearly bare. On head the hair spreads uniformly from forehead, that of middle growing directly backwards, that of sides standing out as distinct tufts over ears. On cheeks the hairs grow upwards, meeting the ear tufts and continuing them backward beneath ears. Slightly below middle of cheek the hair abruptly changes direction and grows downward, forming a thin tuft on each side of the chin. Like rest of under surface of body the chin is closely furred except the space immediately about lips. On shoulders and back of neck the hairs are slightly elongated, but not enough to form a distinct cape.

*Color.*—Type: general color throughout clove-brown somewhat lightened by drabby reflections. On underparts, head, legs, lumbar region, and terminal tuft of tail, the brown is unmixed with lighter color, and on hands and feet it darkens almost to black. On neck, shoulders, outer side of upperarm, and entire back to lumbar region, most of the hairs have a buff annulation about 4 mm. in width near tip. These annulations are most abundant on neck and shoulders, where they are also paler than elsewhere, approaching a grayish cream-buff. In this region they produce a distinct grizzled effect, much like that of the same parts in *Macacus umbrosus* and *M. fuscus*. On sides of body they become less distinct than on back, and the ground color at the same time changes to a rather dark broccoli-brown. The naked portion of face and chin is bordered by







*Simias concolor*, male (type).





*Simiops concolor*, male (type).

whitish hairs, but these are not numerous enough to be very conspicuous. "Palms, soles, face, and callosities black in both sexes. Anus pinkish white in male. Iris brown."<sup>1</sup>

*Skull and teeth.*—The skull (pls. xv, xvi) rather closely resembles that of an adult male *Nasalis larvatus*, but is considerably smaller; the rostral portion is less developed, and the upper margins of the orbits are more distinctly outlined from the braincase. As compared with the skulls of *Rhinopithecus* figured by Milne-Edwards, the width is less in proportion to the length, the anterior nares are narrower, the orbits are nearer together, the ridge above them is less curved, and the whole facial aspect is more suggestive of *Macacus*. Rostrum decidedly more produced than in the Tibetan species. Teeth essentially as in *Presbytes*, but inner cusps of upper molars and outer cusps of lower molars even better developed and in height almost equal to those of the opposite side of the teeth.

*Measurements.*—External measurements of type: total length, 740; head and body, 550; tail vertebræ, 190; pencil, 20; foot, 170; ear from meatus, 24; ear from crown, 12; width of ear, 24. External measurements of an adult female (No. 121,658) from South Pagi Island: total length, 650; head and body, 550; tail vertebræ, 100; pencil, 10; foot, 150.

Cranial measurements of type: greatest length, 106; basal length, 82; basilar length, 77; median palatal length, 36; palatal breadth between front molars, 21.6; zygomatic breadth, 75.4; mastoid breadth, 62; greatest breadth of braincase above roots of zygomata, 56; least breadth of braincase immediately behind orbits, 39.6; greatest orbital breadth, 64.6; least interorbital breadth, 8.8; least distance from orbit to alveolus of inner incisor, 32; greatest depth of braincase, 43; mandible, 74; depth of mandible at posterior end of last molar, 27.4; maxillary toothrow exclusive of incisors (alveoli), 34.6; three upper molars together (crowns), 21.6; mandibular toothrow exclusive of incisors (alveoli), 40.6; three lower molars together (crowns), 23.

*Specimens examined.*—Ten, all from South Pagi Island.

*Remarks.*—This monkey is so different from all other known species that further comparison is unnecessary.

The specimens show no appreciable variation, except that the females are uniformly much smaller than the males. Two young individuals (male, No. 121,655, and female, No. 121,656), 455 mm. and 465 mm. respectively in length, and with the milk dentition still in place, are light cream-buff throughout. Another (female, No.

<sup>1</sup>Collector's note; does not refer specifically to the type specimen.



121,662) of the same size is normal. In the type the tuft of hairs at end of tail is better developed than in any of the others. This tuft is occasionally represented by a mere lengthening of the short hairs that are sprinkled over the rest of the tail.

**SYMPHALANGUS KLOSSII** sp. nov.

(PLATE XVII, FIGURE 2; PLATE XVIII, FIGURE 2; PLATE XIX, FIGURE 1)

*Type*.—Adult male (skin and skull), No. 121,678, United States National Museum. Collected on South Pagi Island, Sumatra, November 13, 1902, by Dr. W. L. Abbott. Original number, 2032.

*Characters*.—A dwarf siamang of about half the weight of *Symphalangus syndactylus*. Fur shorter and less woolly than in the Sumatran animal. Throat densely furred in both sexes.

*Fur*.—The fur is moderately long, and of a silky texture, not coarse and woolly as in *Symphalangus syndactylus*. It shows only a slight tendency to lengthen on neck and shoulders, and scarcely any on thighs and outer surface of upper arms. On underparts it is rather shorter than elsewhere, becoming rather thin in hypogastric region, but on throat it continues uninterruptedly to chin. Eyebrows scarcely lengthened, giving the forehead a peculiar rounded appearance.

*Color*.—The color is black throughout, and there are no whitish hairs on face and chin.

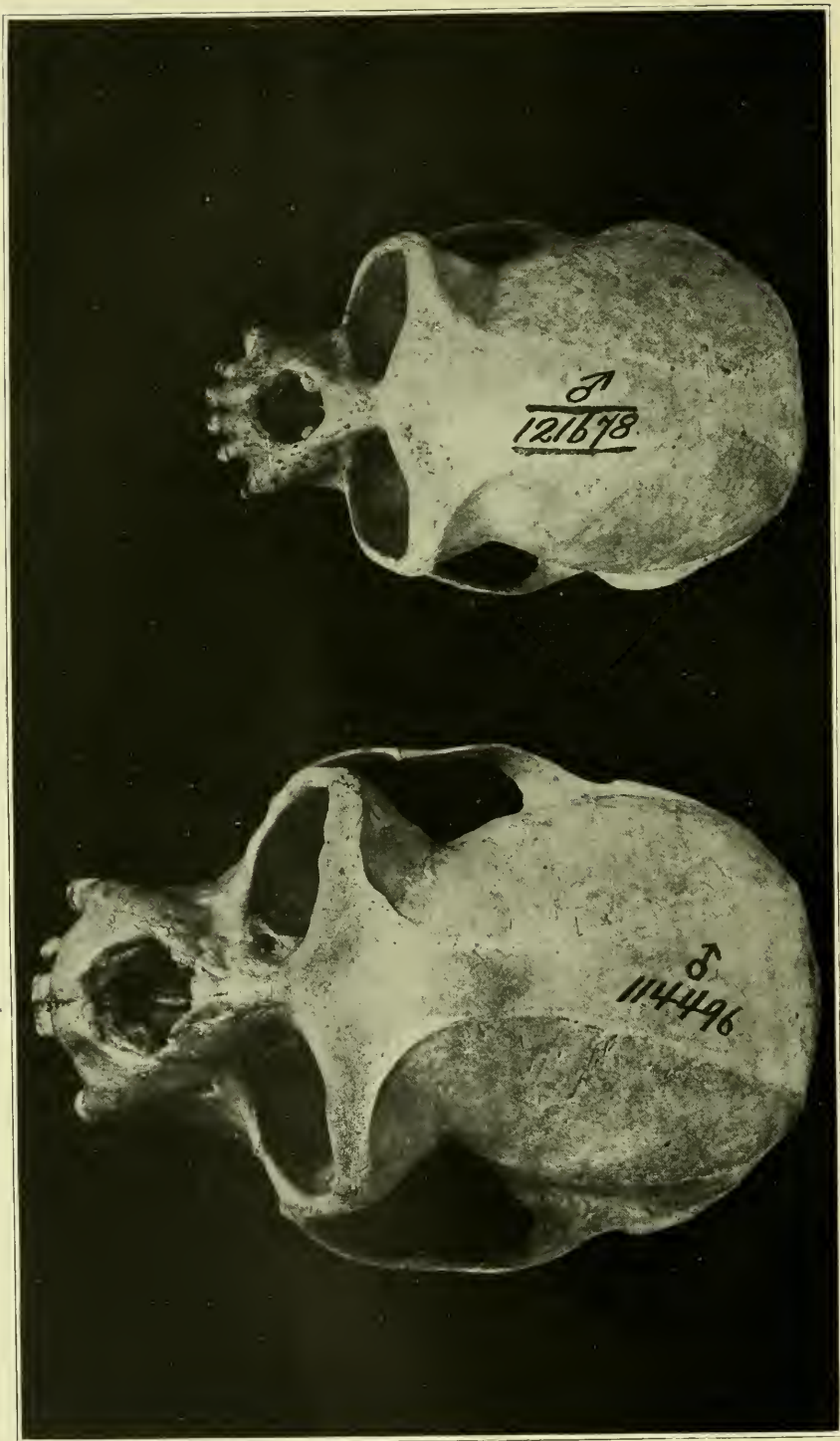
*Skull and teeth*.—The skull and teeth (pl. xvii, fig. 2; pl. xviii, fig. 2; pl. xix, fig. 1) so closely resemble those of *Symphalangus syndactylus* (pl. xvii, fig. 1; pl. xviii, fig. 1; pl. xix, fig. 2) that I can detect no constant differences other than size.

*Measurements*.—External measurements of type: head and body, to symphysis pubis, 440 (525);<sup>1</sup> foot, 130 (154). External measurements of an adult female (No. 121,687) from the type locality: head and body, 445; foot, 123.

Cranial measurements of type: greatest length, 97 (129);<sup>1</sup> basal length, 75 (109); basilar length, 70 (104); median palatal length, 36.8 (59); palatal breadth between front molars, 16.4 (27); zygomatic breadth, 65 (90); mastoid breadth, 64 (78); greatest breadth of braincase above roots of zygomata, 56.6 (66); least breadth of braincase immediately behind orbits, 45.4 (49); greatest orbital breadth, 58 (75); least interorbital breadth, 9 (15); least distance from orbit to alveolus of middle incisor, 23.6 (38); greatest depth of braincase, 46 (55); mandible, 68 (95); depth of mandible at pos-

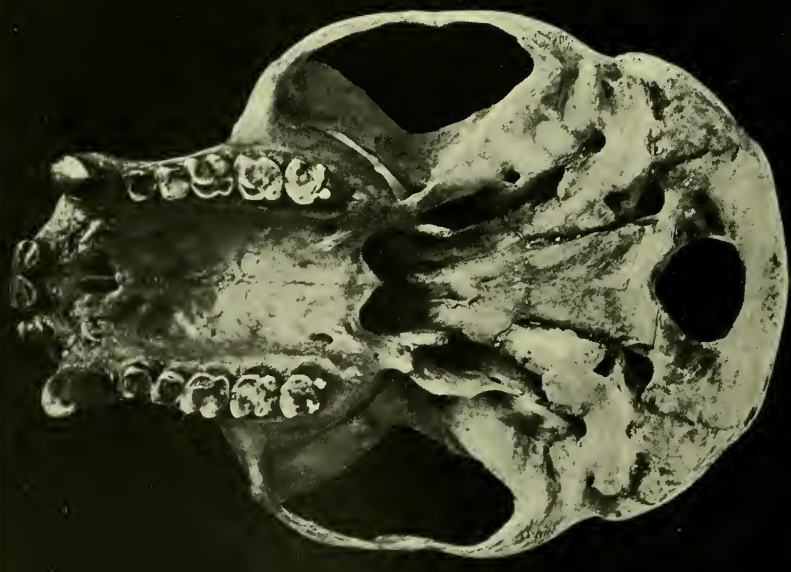
<sup>1</sup> Measurements in parenthesis are those of an adult male *Symphalangus syndactylus* from Tapanuli Bay, Sumatra (No. 114,496).





1. *Symphalangis syndactylus*, male, No. 114,496, Tapanuli Bay, Sumatra. 2. *Symphalangis klossii*, male (type).





1. *Symphalangus syndactylus*, male, No. 114,496, Tapanuli Bay, Sumatra. 2. *Symphalangus klossii*, male (type).



terior end of last molar, 10 (15.4); depth of mandible through coronoid process, 20.4 (36); maxillary toothrow exclusive of incisors (alveoli), 30.6 (45.4); three upper molars together (crowns), 14.8 (25); crown of first upper molar,  $5 \times 6$  ( $8 \times 7.6$ ); mandibular molar series exclusive of incisors (alveoli), 34 (50); three lower molars together (crowns), 17 (25.4); crown of first lower molar,  $5.8 \times 5$  ( $8.6 \times 7$ ).

*Weight*.—Weight of type, 6.12; weight of a second adult male, 5.21; weight of four adult females respectively, 5.21, 5.78, 6.12, and 6.46 kg.<sup>1</sup>

*Specimens examined*.—Eighteen (four young in alcohol), all from South Pagi Island.

*Remarks*.—At Dr. Abbott's request I have named this siamang after Mr. C. B. Kloss, to whose aid was due much of the success of the second expedition to the coast and islands of western Sumatra. The characters of the species are so striking that no special comparison is required with *Symphalangus syndactylus*, the only other member of the genus at present known.

#### LIST OF THE SPECIES DESCRIBED IN THIS PAPER.

|                                      |                                       |
|--------------------------------------|---------------------------------------|
| <i>Tragulus batuanus</i> , p. 2.     | <i>Sciurus matthæus</i> , p. 19.      |
| <i>Tragulus russulus</i> , p. 3.     | <i>Sciurus lucas</i> , p. 20.         |
| <i>Ratufa insignis</i> , p. 4.       | <i>Sciurus casensis</i> , p. 20.      |
| <i>Ratufa conspicua</i> , p. 5.      | <i>Sciurus altinsularis</i> , p. 21.  |
| <i>Ratufa balæ</i> , p. 6.           | <i>Sciurus rubeculus</i> , p. 22.     |
| <i>Ratufa masæ</i> , p. 7.           | <i>Funambulus obscurus</i> , p. 23.   |
| <i>Ratufa piniensis</i> , p. 8.      | <i>Funambulus rostratus</i> , p. 24.  |
| <i>Sciurus bilimitatus</i> , p. 8.   | <i>Funambulus peninsulae</i> , p. 25. |
| <i>Sciurus pemangilensis</i> , p. 9. | <i>Sciuropterus mærens</i> , p. 26.   |
| <i>Sciurus aoris</i> , p. 10.        | <i>Petaurista batuanæ</i> , p. 27.    |
| <i>Sciurus peninsularis</i> , p. 10. | <i>Mus stridens</i> , p. 28.          |
| <i>Sciurus pannovianus</i> , p. 11.  | <i>Mus matthæus</i> , p. 29.          |
| <i>Sciurus ictericus</i> , p. 12.    | <i>Mus stridulus</i> , p. 29.         |
| <i>Sciurus atratus</i> , p. 13.      | <i>Mus lucas</i> , p. 30.             |
| <i>Sciurus piniensis</i> , p. 14.    | <i>Mus soccatus</i> , p. 30.          |
| <i>Sciurus balæ</i> , p. 14.         | <i>Mus masæ</i> , p. 32.              |
| <i>Sciurus pumilus</i> , p. 15.      | <i>Mus balæ</i> , p. 33.              |
| <i>Sciurus lancavensis</i> , p. 16.  | <i>Mus lugens</i> , p. 33.            |
| <i>Sciurus adangensis</i> , p. 17.   | <i>Mus julianus</i> , p. 34.          |
| <i>Sciurus sullivanus</i> , p. 17.   | <i>Mus gilbiventer</i> , p. 35.       |
| <i>Sciurus domesticus</i> , p. 18.   | <i>Mus luteolus</i> , p. 36.          |
| <i>Sciurus bentincanus</i> , p. 19.  | <i>Mus umbridorsum</i> , p. 37.       |

<sup>1</sup>The weight of four adult *Symphalangus syndactylus* from Tapanuli Bay, Sumatra, is as follows: two males, 11.79 and 12.70; two females, 9.71 and 11.56 kg.

- |   |                                       |
|---|---------------------------------------|
| <i>Mus bentinicanus</i> , p. 38.        | <i>Galeopithecus tuancus</i> , p. 53. |
| <i>Mus casensis</i> , p. 38.            | <i>Tupaia castanea</i> , p. 54.       |
| <i>Mus domelicus</i> , p. 39.           | <i>Tupaia pulonis</i> , p. 56.        |
| <i>Mus pagensis</i> , p. 39.            | <i>Tupaia tephurura</i> , p. 57.      |
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| <i>Atherura zygomatica</i> , p. 42.     | <i>Tupaia cervicalis</i> , p. 59.     |
| <i>Hemigale minor</i> , p. 43.          | <i>Pteropus geminorum</i> , p. 60.    |
| <i>Paradoxurus lignicolor</i> , p. 44.  | <i>Macacus pagensis</i> , p. 61.      |
| <i>Galeopithecus pumilus</i> , p. 46.   | <i>Macacus phæura</i> , p. 63.        |
| <i>Galeopithecus aoris</i> , p. 47.     | <i>Presbytes rhionis</i> , p. 64.     |
| <i>Galeopithecus gracilis</i> , p. 49.  | <i>Presbytes batuanus</i> , p. 65.    |
| <i>Galeopithecus natunæ</i> , p. 50.    | <i>Simias concolor</i> , p. 67.       |
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(PLATES)

(All figures, unless otherwise stated, are four-fifths natural size.)

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- Figure 1. *Sciuropterus mærens*, type.  
Figure 2. *Funambulus obscurus*, type.

## PLATE II

- Figure 1. *Petaurista nitidula*, male, No. 104,622, Bunguran Island, North Natunas.  
Figure 2. *Petaurista nitida*, male, No. 121,499, eastern Java.  
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- Figure 1. *Paradoxurus lignicolor*, type.  
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## PLATE V

- Figure 1. *Paradoxurus lignicolor*, type.  
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- Figure 1. *Galeopithecus gracilis*, type.  
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- Figure 1. *Galeopithecus volans*, female, No. 84,420, Trong, Lower Siam.  
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Figure 3. *Galeopithecus saturatus*, type.  
Figure 4. *Galeopithecus saturatus*, male, No. 121,747, Tana Bala, Batu Islands.



1. *Symphalangus klossii*, male (type). 2. *Symphalangus syndactylus*, male,  
No. 114,496, Tapanuli Bay, Sumatra.



## PLATE VIII

Figure 1. *Galeopithecus volans*, female, No. 84,420, Trong, Lower Siam.

Figure 2. *Galeopithecus volans*, male, No. 115,493, Rumpin River, Pahang.

Figure 3. *Galeopithecus saturatus*, type.

Figure 4. *Galeopithecus saturatus*, male, No. 121,747, Tana Bala, Batu Islands.

## PLATE IX

Figure 1. *Galeopithecus volans*, female, No. 84,420, Trong, Lower Siam.

Figure 2. *Galeopithecus volans*, male, No. 115,493, Rumpin River, Pahang.

Figure 3. *Galeopithecus saturatus*, type.

Figure 4. *Galeopithecus saturatus*, male, No. 121,747, Tana Bala, Batu Islands.

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Figure 1. *Tupaia chrysogaster*, type.

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Figure 1. *Macacus nemestrinus*, female, No. 114,502, Tapanuli Bay, Sumatra.

Figure 2. *Macacus pagensis*, type.

## PLATE XII

Figure 1. *Macacus nemestrinus*, female, No. 114,502, Tapanuli Bay, Sumatra.

Figure 2. *Macacus pagensis*, type.

## PLATE XIII

Figure 1. *Macacus pagensis*, type.

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## PLATE XIV

Figure 1. *Simias concolor*, adult, greatly reduced. From photograph of freshly killed individual.

## PLATE XV

Figure 1. *Simias concolor*, type.

## PLATE XVI

Figure 1. *Simias concolor*, type.

## PLATE XVII

Figure 1. *Symphalangus syndactylus*, male, No. 114,496, Tapanuli Bay, Sumatra.

Figure 2. *Symphalangus klossii*, type.

## PLATE XVIII

Figure 1. *Symphalangus syndactylus*, male, No. 114,496, Tapanuli Bay, Sumatra.

Figure 2. *Symphalangus klossii*, type.

## PLATE XIX

Figure 1. *Symphalangus klossii*, type.

Figure 1. *Symphalangus syndactylus*, male, No. 114,496, Tapanuli Bay, Sumatra.

## (TEXT FIGURE)

Figure 1. Skull of *Chiropodomys niadis*  $\times 2$  (page 40).