

REMARKS ON THE GIANT SQUIRRELS OF SUMATRA,
WITH DESCRIPTIONS OF TWO NEW SPECIES.

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The U. S. National Museum has in its collections 49 specimens of giant squirrels, genus *Ratufa*, from various parts of the island of Sumatra, all but two of which have been collected and presented by Dr. W. L. Abbott. I have also had at my disposal three specimens of Sumatran *Ratufa* belonging to the collection of the Academy of Natural Sciences of Philadelphia. To Mr. Witmer Stone of that institution my thanks are due for the use of them.

The giant squirrels on Sumatra fall into two distinct groups, representatives of which are found side by side in the same localities. Members of the *palliated* or *bicolor* group are known by their larger size, as well as by their dark heads, necks, shoulders, rumps, legs, and feet. Only one form of this group is at present known to occur on Sumatra. The *hypoleuca* group, so called from the first species described from Sumatra, contains smaller members than the other group, with white or buffy underparts, and with uniformly light brownish upper parts. Three well-marked forms of this group are found on Sumatra—typical *hypoleuca* on the west coast, and two new species on the east coast. (See map, Plate XXXIII.) All the forms of Sumatra giant squirrels may be readily known by the following key and descriptions:

SYNOPSIS AND KEY TO THE GIANT SQUIRRELS OF SUMATRA.

A. Upper surface of head, neck, shoulders, arms, legs, and feet black or blackish brown, different in color from the sides and rest of upper parts.

Ratufa palliata, p. 440.

A'. Entire upper parts and sides uniform light yellowish brown, sometimes becoming darker along the middle line of the lower back.

B. Underparts white or whitish, feet concolor with legs, size large; head and body, 340 to 370 mm.; tail, 400 to 435; hind foot with claws, 79 to 84; greatest length of skull, 65 to 67. *Ratufa hypoleuca*, p. 441.

- B'. Underparts buff to ochraceous buff, feet not concolor with legs, but in general a dark blackish brown, often lined with some ochraceous buff hairs; size large; head and body, 335 to 355 mm.; tail, 390 to 445; hind foot with claws, 81 to 84; greatest length of skull, 64 to 67.....*Ratufa arusinus*, p. 442.
- B''. Underparts buffy, feet concolor with legs, size small; head and body, 310 to 330 mm.; tail, 370 to 390; hind foot with claws, 73 to 78; greatest length of skull, 60 to 63.....*Ratufa catemana*, p. 443.

RATUFA PALLIATA Miller.

1902. *Ratufa palliata* MILLER. Proc. Acad. Nat. Sci. Phila., March, 1902, p. 147; issued June 11, 1902.

Type.—Adult male, skin and skull, Cat. No. 113162 U.S.N.M., collected along the Indragiri River, southeastern Sumatra, September 23, 1901, by Dr. W. L. Abbott. Original number, 1327.

Diagnostic characters.—Very similar to *Ratufa bicolor* from Java, but hind foot apparently larger; upper parts without the light speckling usually seen in *R. bicolor*, and tail never appearing clear buff, but an indefinite mixture of dark brownish and buffy, often appearing annulated. The light yellowish brown mantle mentioned in the original description as characteristic, while often present is not found to be a constant feature in all the examples of this species that have been collected by Doctor Abbott since the original account of the species appeared.

Color.—Upper surface of head and neck, shoulders and rump, and outer surface of fore and hind legs and fore and hind feet, blackish or dark brown; color of back between shoulders and rump, variable; in the type and some other specimens, dark cream-buff, becoming clay-color in the middle line, while in other individuals the middle line of the back has the general effect of Ridgway's seal brown, generally blending with the cream-buff color of the sides. Sides of head and neck, shoulders, and sides of body, as well as inner side of foreleg and a spot just above wrist, cream color, or cream-buff, and, except on the sides, contrasting with the black of the head, neck, etc. Underparts and inner side of hind legs generally cream-buff, but the dark bases of the hairs show to a considerable extent. Hairs of the tail, blackish-brown, lighter at the base, with a broad (6 mm.) subterminal cream or cream-buff ring and an inconspicuous brownish apex. The two colors of the tail are about equally prominent, and usually so arranged as to give the tail a somewhat annulated appearance.

A very young individual, Cat. No. 114547 U.S.N.M., from Tapanuli Bay, evidently in its first pelage, long and soft, deviates somewhat from the color pattern just described. The mantle is well developed, varying between a light clay color and ochraceous buff; the black of the head, neck, rump, and thigh is largely replaced by a color between hazel and chestnut; this color extends on the base of the tail, above, and is again indicated at the tip of the tail; the middle

portion of the tail is distinctly annulated. Cat. No. 141052, U.S.N.M., a nearly adult male from Tarussan Bay, is in general similar to Cat. No. 114597, U.S.N.M., but the mantle is darker and the reddish brown less conspicuous. Eight of the specimens have the light colored mantle well-marked, while in the remaining 13 it is practically absent. In certain skins, the mantle seems to be the result of a bleaching of the hairs as the pelage becomes old, but its presence in the two immature individuals shows that it may be found in fresh pelages. The pelage of the type is also apparently fresh. When the pelage is old, the hairs of the back, either uniformly or in irregular patches, assume a dull, dirty russet color; the tail assumes this color throughout and loses all traces of annulation, the light subapical bands of the hairs having nearly all worn off, and the tips of the hairs having a curled and singed appearance.

Skull and teeth.—The skull and teeth of *Ratufa palliata* are large and heavy, and are as easily distinguished on this account from those of the *hypoleuca* group as are the skins. The differences between skulls of *R. palliata* and *R. bicolor* are slight. The material at hand shows the Sumatran species to have shorter rostrum, nasals, and audital bullae, and the zygomatic width somewhat greater.

Measurements.—See page 445.

Specimens examined.—Twenty-two; 9 from Aru Bay, 2 from Salat Rupert, 1 from the Indragiri River, 6 from Tarussan Bay, 1 from Tapanuli Bay, 1 from Gunong Sugi, and 2 simply marked "Sumatra."

Remarks.—*Ratufa palliata* is apparently uniformly distributed over the island of Sumatra. (See map, Plate XXXIII.) Specimens from various localities agree in all essential respects with the type, but it is a matter of regret that the species is not represented by a good series from the type locality.

RATUFA HYPOLEUCA (Horsfield.)

1824. *Sciurus hypoleucos* HORSFIELD, Zoological Researches in Java (pages not numbered).

Type.—In the British Museum, collected by Sir Stamford Raffles, and hence probably from Benecoolen on the west coast of Sumatra. I have not seen the type of this species, nor specimens from the type locality. The following description is based on specimens from the vicinity of Tarussan Bay on the west coast of Sumatra, which agree in all respects with Horsfield's description of the species.

Diagnostic characters.—Upper parts uniform light brown, underparts white, feet concolor with legs; size large.

Color.—Middle line of back from behind shoulders to base of tail brown, not identical with any color in Ridgway's "Nomenclature of Colors," but nearest a dark Vandyke or Prout's brown; not contrasted with rest of upper parts; top of head and neck from behind

eyes, sides of neck and body, upper part of thighs, and upper part of forearm a grizzle of russet and dark brown, the former color more conspicuous; underparts, inner side of legs, sides of head and region about nose, inner side of ear and spot on thigh, white or nearly so; lower leg and arm a rather bright russet, and feet dull russet; tail seen from above concolor with lower back, seen from below whitish in the middle line, but at tip and margin same color as it is above. There is a marked contrast in color between the sides and underparts. Bordering the white underparts, the russet of the sides forms a bright and clear line, with scarcely any admixture of brown. The fringes on the fore and hind legs are bright clear russet. In worn pelage, the upper parts become dull wood-brown or clay-color. Similar changes take place in the tail.

Skull and teeth.—The skull and teeth of *Ratufa hypoleuca* show no special characters; they are large like those of the form from Aru Bay, and much smaller than those of *R. palliata*.

Measurements.—See page 445.

Specimens examined.—Seven from Tarussan Bay and two from Gunong Sugi.

Remarks.—*Ratufa hypoleuca* is probably confined to the western side and highlands of Sumatra, while in the swamp lands of the east side it is replaced by a related form, and in the northern portion of the island still another form of it occurs. (See map, Plate XXXIII.)

RATUFA ARUSINUS, new species.

Type.—Adult male, skin and skull, Cat. No. 143351 U.S.N.M., collected at Aru Bay, northeast coast of Sumatra, January 16, 1906, by Dr. W. L. Abbott. Original number, 4635.

Diagnostic characters.—Similar to *Ratufa hypoleuca*, but underparts dark buff, instead of white; fore and hind feet dark brown, instead of concolor with legs; and white markings about the head less conspicuous.

Color.—Upper parts of head, neck, and body, sides of body, and outer sides of forelegs a fine grizzle of a color between buff and raw sienna, and one similar to Prout's brown, the former color in excess anteriorly and on the sides, the latter in excess posteriorly in the middle line. Entire underparts, inner and outer sides of hind legs, inner side of forelegs, and fringe on outside dark buff or ochraceous buff. Spot on thigh cream-buff or whitish. Fore and hind feet a very dark mummy brown, containing here and there a few scattered raw sienna hairs. Cheeks and small area about the mouth dirty whitish, irregularly lined with some light and dark brownish hairs. The whitened area on the head is much less extensive than it is in *R. hypoleuca* and is not found on the forehead between the eyes. Tail seen from above a very dark brown, similar to Ridgway's seal brown; below, the outer

margin and tip is the same, followed by an irregular line of the color of the underparts of body, while centrally it is irregularly cream-buff; the short-haired portion in the middle line is a mixture of ochraceous buff and blackish brown. In worn pelages the brown of the upper parts of body becomes lighter and duller, and the grizzling is less conspicuous; the brown of the tail becomes much lighter.

Skull and teeth.—These show no special characters, and it is apparently impossible to distinguish skulls of *Ratufa arusinus* from skulls of *R. hypoleuca*.

Measurements.—*Ratufa arusinus* closely agrees with *R. hypoleuca* in size. See page 445.

Specimens examined.—Thirteen from the vicinity of Aru Bay, northeastern Sumatra.

Remarks.—While clearly related to *Ratufa hypoleuca*, *R. arusinus* possesses several well-marked characters, such as light upper parts, dark buff underparts, brown feet, and less white about the head, by which it may be differentiated from the former. At present it is known only from the vicinity of Aru Bay. Possibly it may have a distribution similar to that of *Sciurus vittatus albescens* and be found to occur throughout the northern end of Sumatra.

RATUFA CATEMANA, new species.

1902. *Ratufa hypoleuca* MILLER, Proc. Acad. Nat. Sci. Phila., March, 1902, p. 149; issued June 11, 1902. Indragiri River specimens.

Type.—Adult male, skin and skull, Cat. No. 123124, U.S.N.M., collected along the Kateman River, southeastern Sumatra, August 27, 1903, by Dr. W. L. Abbott. Original number, 2759.

Diagnostic characters.—Similar to *Ratufa hypoleuca*, but much smaller, upper parts lighter, under parts usually buff instead of white, and white about head much less conspicuous.

Color.—The colors of *Ratufa catemana* are rather difficult to describe. The specimens were collected in August and September and appear to be in old and worn pelage, not comparable with the pelage of the species described above. Top of head and neck, upper parts and sides of body, and upper surface of tail have the general effect of Ridgway's broccoli or wood brown. Where there is an indication of fresh pelage, especially along the sides, the color seems to be similar to that of *Ratufa arusinus*. The fore and hind feet and outer surfaces of legs and sides of body bordering the light underparts are tawny, with a slight amount of dark-brown grizzling on the feet and arms. The underparts vary from whitish (especially in the Indragiri River skins) to a dark buff or ochraceous buff. The tail, above, is generally a dull brown, similar to Ridgway's wood or broccoli brown. A young example, Cat. No. 123125, U.S.N.M., shows indistinct annulations on the tail. The outer edge and the tip of the tail seen from

below are colored as they are above, the basal portion of the hairs is light buffy and the middle portion ochraceous buffy. The short appressed hairs underneath are mummy brown, with some ochraceous buff hairs intermingled. Sides of head, white or buffy; cheeks and nose, ochraceous buff, with some dark brown grizzling. Thigh spot, buffy.

Skull and teeth.—These show no special characters, except for their smaller size.

Measurements.—See page 445.

Specimens examined.—Three from Indragiri River; five from Kate-man River.

Remarks.—From its geographical position, *Ratufa catemana* is naturally associated with *R. hypoleuca* and *R. arusinus*, but its resemblance in point of size and coloration to *R. affinis* of Singapore and the Malay Peninsula is very striking. It differs from *R. affinis* principally in having much darker upper parts, more white about the head, and in having the feet concolor with the legs. Mr. Miller, in his paper on Doctor Abbott's Indragiri River collection, pointed out that this giant squirrel might be different from *Ratufa hypoleuca* of the west coast. The Sumatran giant squirrels of the *hypoleuca* group show in differentiation a striking analogy to the squirrels of the *Sciurus vittatus* group,^a in which the form inhabiting the lowlands of south-eastern Sumatra is indistinguishable from that on the Malay Peninsula; in which specimens from northern Sumatra differ from those taken elsewhere on the island and in which the Tarussan Bay form differs from east coast varieties. Whether the three forms of the *hypoleuca* group are subspecies of one species it is impossible to say. The material at present shows them to be very different, so that no specimen in any one of the three series can be mistaken for any specimen in another of the series.

^a See Lyon, Smithsonian Miscell. Coll., XLVIII, p. 277, Feb. 4, 1907.

Measurements of giant squirrels from Sumatra.

Name.	Locality.	Num. ber.	Sex.	Head and body. ^a	Tail. ^a	Hind foot with claws. ^b	Greatest length of skull.	Zygomat-ic breadth.	Interorbital con-strict-ion.	Maxillary tooth row (alveol.).
				mm.	mm.	mm.	mm.	mm.	mm.	mm.
<i>E. hypoleuca</i> ...	Tarussan Bay..	141040	Male adult.....	355	430	80	66.4	40.5	26	13
Do.....	do.....	141041	do.....	365	435	79	66.2	41	26.8	13.7
Do.....	do.....	141042	Female adult.....	340	410	84	64.5	41	26.1	13.1
Do.....	do.....	141043	Male adult.....	347	430	83	66.6	40.5	26.3	12.9
Do.....	do.....	141044	do.....	350	400	79	.....	.....	26	12.5
Do.....	do.....	141045	do.....	370	430	84	64.6	39.9	25.8	12.9
Do.....	do.....	141046	do.....	350	410	82	65.8	41.8	25.2	13.3
Do.....	Gunong Sugi....	c6657	Female adult.....	.....	83	64	.....	.....	25.8	12.5
Do.....	do.....	c6658	Male adult.....	.....	81	65.9	.....	.....	25.3	12.8
<i>R. catemana</i> ...	Indragiri River.	113163	do.....	330	375	76	62	39.4	26.2	12.4
Do.....	do.....	113164	do.....	320	380	77	61.1	.....	25.5	12.1
Do.....	do.....	113165	Female adult.....	330	370	79	59.6	37.2	24.4	11.7
Do.....	Kateman River.	123123	Male adult.....	310	330	77	61	37.4	24.6	11.4
Do.....	do.....	d123124	do.....	320	385	74	61.9	38.5	24.6	12.3
Do.....	do.....	123125	Male immature...	275	380	73	57.7	35.8	23.8	11.2
Do.....	do.....	123126	Female adult.....	310	375	75	60.5	38.3	25.4	12.1
Do.....	do.....	123127	do.....	325	380	78	62.3	39.3	25.6	11.9
<i>R. aruinus</i>	Aru Bay.....	143346	Male young adult	345	405	81	63.7	37.8	24	12.7
Do.....	do.....	143347	Male adult.....	335	420	82	64	38.7	25.9	12.5
Do.....	do.....	143348	Female adult.....	355	400	81	66.6	42.5	27	13
Do.....	do.....	143349	Male adult.....	350	400	81.5	64.2	40.4	25.8	12.7
Do.....	do.....	143350	do.....	355	365	84	64	38.9	23.7	12.7
Do.....	do.....	d143351	do.....	354	405	81.5	65.9	40.8	25.7	12.6
Do.....	do.....	143352	do.....	350	400	80	66	40	25.7	12.2
Do.....	do.....	143353	do.....	350	440	82	67	41.1	26.8	12.3
Do.....	do.....	143354	Female adult.....	310	370	82	67	40	25.8	12.8
Do.....	do.....	143355	Female young adult.	310	405	83	62.7	37.7	23.7	12.8
Do.....	do.....	143356	Female adult.....	340	450	84	65.8	39.3	25	12.8
Do.....	do.....	143357	do.....	340	465	83.5	66.1	39.9	26.5	12.1
Do.....	do.....	143358	do.....	350	445	83.5	65.1	41.8	26.8	12.4
<i>R. palliati</i> ...	do.....	143359	Male adult.....	368	472	88	71.9	44.6	29.1	13.7
Do.....	do.....	143360	do.....	350	452	83	69.7	41.7	27	13.7
Do.....	do.....	143361	do.....	360	440	84	69.6	45	28.8	13.3
Do.....	do.....	143362	do.....	370	460	81	69.3	41.9	26.8	13.4
Do.....	do.....	143363	do.....	.....	460	85	69.3	43.1	28.9	13.5
Do.....	do.....	143364	Female adult.....	390	455	90	72.4	44	27.3	14.3
Do.....	do.....	143365	do.....	375	480	86	73.7	44	28.4	14.7
Do.....	do.....	143366	do.....	370	455	85	70.6	45	28.9	14.3
Do.....	do.....	143367	do.....	355	460	84	71.2	44.3	28.2	14.8
Do.....	Salat Rupert...	143368	Male adult.....	360	433	83	70.2	44.7	27.9	13.1
Do.....	do.....	143369	Female adult.....	365	435	86	70.5	45.8	29.3	13
Do.....	Indragiri River.	d113162	Male adult.....	345	425	83.5	68.2	42.5	28.8	13
Do.....	Gunong Sugi....	c6656	Adult.....	.....	81	68.6	44.4	29.9	13.4	
Do.....	"Sumatra" ^b	114003	Male adult.....	.....	80	66.5	41.7	26.4	14.4	
Do.....	do.....	114004	Female adult.....	.....	80	67.8	41.1	27	14.1	
Do.....	Tarussan Bay..	141047	do.....	380	470	90	72.6	46.7	28.3	14.5
Do.....	do.....	141048	do.....	352	455	86	71	45.7	30.3	14.2
Do.....	do.....	141049	Male adult.....	360	455	86	.....	.....	.....	.....
Do.....	do.....	141050	Female adult.....	380	460	85	72.3	47.2	31	14
Do.....	do.....	141051	do.....	398	476	86.5	72	46.2	29.5	13.4
Do.....	do.....	141052	Male immature...	360	440	85	68.8	42	27.8	14.2
Do.....	Tapanuli Bay...	114547	Female immature	270	370	82	59.6	34.6	22.5	13.6

^a Collector's measurements.

^b Measured by writer after relaxing feet in water for 48 hours.

^c Coll. Acad. Nat. Sci. Phila.

^d Type.

