# ON THE VARIATION OF MUSTELA (LUTREOLA) NUDIPES DESM.

by

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With Plates V—VIII and one textfigure

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In recent literature two subspecies of *Mustela nudipes*, viz., *Mustela nudipes nudipes* Desm. and *Mustela nudipes leucocephalus* (Gray), are recognized. In a survey of the Indo-Australian weasels, Dammerman (1940, p. 269) discussed the possibility of recognizing these two subspecies, but through lack of material he could not arrive at a definite conclusion. Since Dammerman's notes were published three more specimens were brought to light in the collections of our Museum. Moreover we had at our disposal two specimens from the collection of Mr. H. J. V. Sody, as well as four specimens and a skull in the Amsterdam Zoological Museum. A study of the variation of *Mustela nudipes* led us to reconsider the status of *Mustela hamakeri* Dammerman (1940, p. 266, pl. XV) as a distinct species.

Before describing and discussing the specimens examined by us, it may be useful to give a historical account of the species, of its subspecies, and of the names involved.

The first description of *Mustela nudipes* is that by Geoffroy Saint-Hilaire & F. Cuvier (1821), who also published a coloured plate showing this species. The authors gave the species the French name "Furet de Java", and the scientific name "*Nudipes*". The species is stated to belong to the "sous-genre des Putois", but neither for this subgenus, nor for the genus a scientific name is mentioned. In an earlier part of the same work the authors (1820) describe "Le Furet" under the name *Mustela Furo*, and, therefore, Dammerman accepts *Mustela* as the genus to which *nudipes* was referred by Geoffroy Saint-Hilaire & F. Cuvier. From a nomenclatorial point of view, it is more safe perhaps to accept Desmarest's use of "*mustela nudipes*" as the first valid one. Geoffroy Saint-Hilaire & F. Cuvier (1842, p. 3) use the name *Putorius nudipes*.

Originally the species was supposed to be an inhabitant of Java, but since the publication of the first description it has not been recorded from the

island, and, therefore, most authors believe the original indication of the type locality to be erroneous. Robinson & Kloss (1935, p. 305) substitute West Sumatra for Java as terra typica. Dammerman (1940, p. 270) is of the opinion that the rediscovery of *Mustela nudipes* in Java cannot be considered as totally excluded.

Gray (1865, p. 119) renamed the species *Gymnopus leucocephalus,* and described it as "Golden fulvous, nearly uniform, scarcely paler beneath; head white; toes elongate, webbed, nakedish." Moreover the species is stated to be uniform above and below. At the same time Gray describes a variety: "Var. End of tail paler; feet darker; front of the back with a pale vertebral streak, wider and more distinct between the shoulders" [1]). The distribution is given as Sumatra and Borneo, but it is not very clear to us, whether this distribution refers to the species as a whole, or to the variety as well. The latter point of view is accepted by Robinson & Kloss (1919, p. 305). For the present this question must be left unanswered.

Robinson & Kloss (1919, p. 304) when dealing with specimens from West Sumatra, use the name *Mustela nudipes nudipes,* thus apparently recognizing distinct subspecies. This is rather remarkable, as these authors write in the same paper (l.c., p. 306): "Sumatran, Bornean and Malayan skins appear to agree *inter se.* Specimens vary individually but we are unable to definitely associate these variations with locality. The colour appears to depend largely on the state of the pelage especially as regards the pale tip to the tail." These remarks can hardly be said to be in favour of the recognition of distinct subspecies. However this may be, by fixing West Sumatra as the terra typica of *nudipes,* Robinson & Kloss (l.c., p. 305) express the opinion that the species was based on a (West) Sumatran specimen. Moreover they suppress the name *Gymnopus leucocephalus,* which becomes a synonym of *Mustela nudipes nudipes.* In our opinion at least, this implies that they consider the *leucocephalus* of Gray to be based on Sumatran specimens too. Of Gray's variety, Robinson & Kloss (l.c., p. 305) state that it "agrees with specimens and with descriptions of one obtained by Dr. Abbott in South-east Borneo". From this we conclude that Robinson & Kloss believed Gray's variety to be the Bornean subspecies of *Mustela nudipes.*

Chasen & Kloss (1932, p. 14) use the name *Mustela nudipes leucocephalus* for a subspecies from Borneo and the Malay Peninsula. Moreover they write (l.c., p. 15): "Gray's "Variety" is apparently the typical Sumatran

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1) In a subsequent description, Gray (1869, p. 96) mentions a pale vertical streak. This is evidently a lapsus.

form while his *leucocephalus* is based on Bornean animals." This appears to be in contradiction with the earlier remarks by Robinson & Kloss (1919). The difference between the two subspecies is stated to be a difference in the colour of the tip of the tail: "Sumatran specimens before us have distinctly whitish-tipped tails: Bornean and Malayan are either much less particolored or are practically concolorous" (Chasen & Kloss, 1932, p. 15). The authors add, however, that "Larger series from the various localities may show that this difference is not material".

With regard to the possibility of recognizing two distinct subspecies it is, therefore, of special interest to check the difference in colour between the base and the tip of the tail. A second character that might be of some use is the pale vertebral streak mentioned by Gray (1865, p. 119) for the variety described by him.

The fact that Chasen & Kloss (1932, p. 15) describe Bornean and Malayan specimens as "either much les particolored or ..... practically concolorous" points to the existence of some difference in colour between the base and the tip of the tail in specimens from these regions. That a difference in colour may be present follows also from the description given by Lyon (1911, p. 119) of a specimen from southeastern Borneo. Lyon mentions that the tail of this specimen is "between clay color and ochraceous, with the terminal third buffy". Banks (1931, p. 64) in his account of the Mammals of Borneo writes that the tail is "occasionally more yellowish at the tip". A difference in colour, therefore, is sometimes present in Bornean specimens, although no specimens with a pure white tail tip have been described. On the other hand Sumatran specimens do not always possess whitish-tipped tails. Schneider (1905, p. 92) describes full-grown specimens from Sumatra as "bis auf den Vorderkopf gleichmässig prächtig rötlich gelbbraun gefärbt", and adds that young specimens are more whitish, "der Kopf ist ganz weiss und die Schwanzspitze ebenfalls weiss." Judging by Schneider's notes one would assume that a white tail tip is a character of young specimens, and that with increasing age the difference in colour between the base and the tip of the tail becomes less distinct.

A pale vertebral streak, like that mentioned by Gray (1865, p. 119) for his variety, has been recorded by Lyon (1911, p. 119) for a specimen from southeastern Borneo.

The following specimens have been examined by us:

Sumatra

1 ♂, Fort de Kock, Agam, Padang Highlands, W. Sumatra, 920 m, 31. I. 1918, leg. E. Jacobson, collector's nr. 397, Leiden Mus., Mamm., reg. no. 1013, skin (cat.

syst.: k) and skull (cat. ost.: k). This is one of the two specimens recorded by Robinson & Kloss (1919, p. 306).

1 ♂, Baloen, Moeara Laboe, Padang Highlands, W. Sumatra, VII. 1914, leg. E. Jacobson, collector's nr. 4379, Leiden Mus., Mamm., reg. no. 991, skin (cat. syst.: h) and skull (cat. ost.: h).

1 ♂, virginal forest near Telok Betong, Lampong Districts, S. Sumatra, XI. 1924, leg. Von Zengen, in the collection of Mr. H. J. V. Sody, skin and fragments of the skull.

1 ♀, Lampong Districts, S. Sumatra, in the collection of Mr. H. J. V. Sody, skin and skull.

1 ex., Deli, N. E. Sumatra, leg. Dr. B. Hagen, 8. IV. 1885, Leiden Mus., skin (cat. syst.: e) and skeleton (cat. ost.: d) [1].

1 ex., Tandjong Morawa, Deli, N. E. Sumatra, leg. Dr. B. Hagen, 1882, Leiden Mus., mounted skin (cat. syst.: a), skeleton with fragments of skull (cat. ost.: a) [1].

1 ex., Kampong Baroe near Medan, Deli, N.E. Sumatra, 12. XII. 1920, purchased from a native taxidermist and presented by Jhr. F. C. van Heurn, Leiden Mus., Mamm., reg. no. 1128, mounted skin (cat. syst.: g) and skull (cat. ost.: g) extracted from the mounted skin.

3 ♂♂, 1 ♀, Deli, N. E. Sumatra, leg. Dr. L. P. le Cosquino de Bussy, Zool. Mus. Amsterdam, from spirit (A, B, C: ♂♂; D: ♀).

1 ex., Serbodjadi, Deli, N. E. Sumatra, 19. VI. 1914, leg. Dr. L. P. le Cosquino de Bussy, Zool. Mus. Amsterdam, skull only.

1 ex., ♀?, type of *Mustela hamakeri* Dammerman, Djambi, S. Sumatra, 1936, leg. J. Th. Hamaker, coll. no. 238/38 (Mus. Buitenzorg, no. 3635), Leiden Mus., Mamm., reg. no. 4252, skin (from spirit) (cat. syst.: i) and skull (cat. ost.: i).

Borneo

1 ex., Dingai on the upper Long Bloeöe, Central Borneo, 14. XII. 1896, leg. Dr. Nieuwenhuis, collector's nr. 119, Leiden Mus., skin (cat. syst.: f) and skull (cat. ost.: e). Judging by the skin this specimen probably is a male.

1 ♂, Pontianak, W. Borneo, leg. Diard, Leiden Mus., mounted skin (cat. syst.: d) and skull (cat. ost.: c).

1 ♂, Bandjarmasin, S.E. Borneo, leg. Schwaner, Leiden Mus., mounted skin (cat. syst.: b) and skull (cat. ost.: b).

1 ex., Bandjarmasin, S.E. Borneo, leg. Schwaner, 1845, Leiden Mus., mounted skin (cat. syst.: c) and skull (cat. ost.: f) extracted from the mounted specimen. A comparatively young specimen in toothchange: $P^4$ and $M^1$ erupted, $pd^3$ being shed, $P^3$ erupting; $M_1$ and $M_2$ present, $P_3$ and $P_4$ erupting.

## Colour descriptions of the specimens [2]

The female from the Lampong Districts is remarkable for its very light colour. It is uniformly Yellow Ocher above and below, without any trace of markings on back or belly. The sides of the neck, and the throat do not differ in coloration from back and belly. The head is much paler, of a

1) The vertebral column consists of 7 cervical, 14 thoracic, 6 lumbar, and 3 sacral vertebrae. Specimen d has 22 caudal vertebrae; in specimen a the tail is incomplete.

2) In so far as this was practicable the colours are indicated by the names used by R. Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912, IV + 44 pp., 53 pls. We have written Ridgway's colour names with a capital to distinguish them from those of our own invention.

Measurements in mm

TABLE I

| LOCALITY | Deli, specimen C | Serbodjadi | Fort de Kock | Deli, specimen A | Kampong Baroe | Bandjarmasin | Tandjong Morawa | Dingai | Deli, cat. ost.: d | Telok Betong | Lampong Districts | Deli, specimen B | Baloen | Djambi, type of *M. hamakeri* | Deli, specimen D | Pontianak | Bandjarmasin [5] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sex . . . . . | ♂ | ? | ♂ | ♂ | ? | ♂ | ? | ♂? | ? | ♂ | ♀ | ♂ | ♂ | ♀? | ♀ | ♂ | juv. |
| Condylobasal length . . | 62.8 | 60.9 | 60.6 | 60.5 | 59.5 | 59.4 | — | 58.9 | 58.9 | — | 58.0 | 57.9 | 57.1 | 56.4 | 56.2 | — | 51.1 |
| Zygomatic breadth . . . | 33.8 | 32.1 | 32.1 | 33.5 | 32.8 | 32.9 | — | — | 31.0 | — | 30.7 | 31.3 | — | — | 30.5 | — | 27.8 |
| Rostral breadth [1] . . . | 13.5 | 12.5 | 13.1 | 14.1 | 12.8 | 13.5 | — | 11.7 | 12.3 | 12.4 | 11.8 | 13.6 | 11.7 | 11.7 | — | 10.4 | 11.6 |
| Interorbital breadth . . | 13.2 | 12.8 | 13.5 | 13.9 | 13.0 | 13.2 | — | 12.9 | 12.0 | — | 12.4 | 12.1 | 12.2 | 10.9 | 12.3 | 11.4 | 10.8 |
| Postorbital constriction. | 11.7 | 12.4 | 13.9 | 13.8 | 13.8 | 12.4 | — | — | 12.1 | — | — | 14.1 | 13.2 | 11.8 | 13.1 | 12.6 | 12.6 |
| Median length of nasals | 11.6 | 11.5 | 11.1 | 10.6 | 10.5 | — | — | — | 9.7 | 7.6 | — | 6.9 | 9.4 | 8.0 | 11.5 | — | 6.4 |
| Palatal length [2] . . . . | 28.4 | 27.3 | 26.7 | 26.6 | 26.4 | 27.8 | — | 27.0 | 25.7 | 26.2 | 26.2 | 27.0 | 25.1 | 24.8 | 24.4 | 22.4 | 22.1 |
| Breadth of skull [3] . . . | 28.8 | 27.2 | 28.7 | 27.6 | 27.2 | 26.8 | — | 25.9 | 27.2 | — | 25.6 | 27.0 | 26.4 | 25.9 | 26.4 | 24.6 | 26.0 |
| C — $M^1$ [4] . . . . . | 18.0 | 16.8 | 17.3 | 17.3 | 17.5 | 16.7 | 17.9 | 17.1 | 16.8 | 17.2 | 16.2 | 17.8 | 17.0 | 15.9 | — | 14.9 | 15.3 |
| Length of $P^4$ . . . . . | 6.8 | 6.7 | 6.7 | 6.8 | 6.8 | 6.4 | 6.8 | 6.2 | 6.4 | 6.8 | 6.1 | 6.7 | 6.7 | 6.1 | 6.2 | 5.5 | 5.7 |
| Breadth of $P^4$. . . . . | 3.9 | 3.7 | 3.5 | 3.6 | 3.8 | 3.4 | 3.8 | 3.2 | 3.4 | 3.9 | 3.5 | 3.8 | 3.4 | 3.3 | 3.4 | 3.1 | 3.2 |
| Breadth of $M^1$ . . . . | 5.3 | 5.2 | 5.2 | 5.4 | 5.7 | 5.1 | 5.7 | 5.3 | 4.9 | 5.2 | 4.7 | 5.5 | 5.0 | 4.6 | 4.9 | 4.6 | 4.7 |
| Lateral length of $M^1$. . | 2.5 | 2.3 | 2.5 | 2.5 | 2.4 | 2.5 | 2.6 | 2.5 | 2.4 | 2.7 | 2.3 | 2.6 | 2.4 | 2.4 | 2.2 | 2.2 | 2.3 |
| Mesial length of $M^1$ . . | 2.8 | 2.5 | 2.4 | 3.2 | 2.6 | 2.5 | 2.8 | 2.9 | 2.6 | 2.9 | 2.4 | 3.0 | 2.5 | 2.8 | 2.4 | 2.5 | 2.4 |
| Length of mandible . . | 34.9 | 34 5 | 33.5 | 33.6 | 33.7 | 34.2 | 33.1 | 33.3 | 32.9 | 34.4 | 31.6 | 33.7 | 32.3 | 31.4 | 31.5 | 27.8 | 28.7 |
| C — $M_2$ . . . . . | 21.8 | 20.9 | 20.6 | 20.9 | 21.0 | 20.0 | 21.1 | 20.2 | 20.2 | 20.3 | 19.3 | 21.3 | 20.2 | 18.6 | 20.2 | 17.9 | 17.5 |
| Length of $M_1$. . . . . | 7.1 | 7.2 | 7.6 | 6.9 | 6.9 | 6.5 | 7.2 | 6.5 | 6.4 | 6.9 | 6.6 | 7.3 | 7.2 | 6.4 | 6.7 | 6.1 | 6.4 |
| Breadth of $M_1$ . . . . | 3.0 | 2.7 | 2.8 | 3.0 | 2.7 | 2.8 | 2.8 | 2.4 | 2.7 | 2.7 | 2.4 | 2.8 | 2.7 | 2.4 | 2.7 | 2.2 | 2.5 |

1) The rostral breadth has been measured over the roots of the canines.

2) The palatal length has been taken from the anterior border of the premaxillaries; it proved impracticable to take this measurement from the posterior border of the incisivi.

3) The breadth of the skull has been taken across the widest part of the braincase, and, in case the mastoid processus are prominent, across these.

4) The measurements of the toothrow, as well as those of the separate teeth, have been taken at the crowns.

5) The upper milkcarnassial ($pd^3$) has a length of 4.2 mm, and a breadth of 2.3 mm.

buffish white, with here and there a pale yellow-ocher tinge. The chin is white. The limbs are of about the same colour as the back; the feet are much paler, approaching to Light Buff. The tail has the same colour as the back; its tip is only a fraction paler, the difference being hardly discernible. In the very pale general colour this specimen resembles the type as figured by Geoffroy Saint-Hilaire & F. Cuvier (1821). The figure of the type, however, shows the head and the tip of the tail as of a more pure white [1]). A specimen recorded from the Lampong Districts by Stone & Rehn (1902, p. 136), and which is described as "of a golden-yellow with grayish-white head", also agrees with the specimen examined by us.

A male from Telok Betong (Lampong Districts) (Pl. V and VI right figure) is darker, the general colour of the back being slightly darker than Mars Yellow. The sides of the neck are somewhat more reddish in tint. A paler vertebral streak is present on the neck and between the shoulders; it appears to be bordered by a slightly darker streak on each side. The throat is of the same colour as the sides of the neck. The belly is slightly more yellowish than the back. The head is buffish, with indistinct markings of Pinkish Buff. The chin is whitish. The limbs are of the same colour as the back, except for the feet, which are paler, between Clay Color and Tawny-Olive. The basal half of the tail has the same colour as the back; the terminal half is Raw Sienna.

In a specimen from Deli, Sumatra, (cat. syst.: e), the difference between the general colour of the back and that of the sides of the neck is more marked. The back is Sudan Brown, and this colour is continued on the neck by two indistinct streaks. These streaks enclose between them a vertebral streak, which like the sides of the neck, is slightly darker than Mars Yellow. This vertebral streak, which is broadest between the shoulders, is continued over the anterior half of the back, where it tapers out. The dark colour of the back and the much brighter colour of the sides of the neck are clearly separated from each other by a more or less perpendicular line of demarcation across the anterior side of the shoulder. The limbs are of the same colour as the back, the feet paler and less reddish. The throat and fore chest are Raw Sienna. The belly is of the same colour as the back. The head is buffish, with slightly more brownish markings, which consist of an irregular streak on each side passing above the ear and eye towards the snout. The chin is buffish. The base of the tail is somewhat darker than the back (more like Auburn), the terminal half pale (more like Ochraceous Tawny).

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1) In the text the colour of the head and of the tail tip is given as yellowish white ("blanc-jaunâtre"), thus still more approaching the specimen examined by us.

With this specimen agrees a male from Baloen (Padang Highlands, W. Sumatra), which has the same markings. The back is slightly more yellowish; the sides of the neck and the vertebral streak are between Mars Yellow and Raw Sienna. The throat and fore chest are slightly more orange than the sides of the neck. Head whitish, the darker markings more distinct than in the foregoing specimen. Throat whitish. Base of tail darker than back (more like Argus Brown), terminal third Antimony Yellow.

A specimen from Dingai, Borneo, has the back Sanford's Brown, with here and there patches with a more golden tinge. The light vertebral streak and the dark streaks bordering it are present. The sides of the neck have the same colour as the golden tinged lighter patches of the back. Head buffish, no markings; chin buffish. The throat and fore chest slightly paler than the sides of the neck. A hardly distinct midventral streak of the same colour as the throat. The belly golden tinged as the lighter parts of the back. The tail has the same colour as the darker parts of the back; towards the tip it becomes more yellowish.

On the whole the specimens from Deli (cat. syst.: e), Dingai and Baloen agree well with each other. The colour pattern is more clearly defined in a specimen from Kampong Baroe near Medan. The general colour is lighter than in the specimen from Dingai, but the demarcation between the colour of the back (Ochraceous Tawny) and that of the sides of the neck (Mars Yellow) is very distinct. A light vertebral streak and the dark streaks bordering it present. Head whitish with two irregular streaks above the ear and eye towards the snout; these streaks are distinct, although but slightly darker than the rest of the head. These streaks form the continuation of the dark longitudinal streaks on the neck. The whole of the back has a golden tinge. The tail is of about the same colour as the back, but without that tinge; the terminal third Antimony Yellow. The chin is white; the throat, fore chest and a midventral streak are Raw Sienna. The belly has the same colour as the back.

In the male from Fort de Kock the demarcation between dark and light parts is still more clearly marked (Pl. V and VI central figure). The back is Buckthorn Brown; two rather indistinct longitudinal streaks on the neck are of the same colour. The sides of the neck and a vertebral streak on the neck and anterior half of the back are Raw Sienna. The throat, the fore chest and a narrow midventral streak are of Yellow Ocher. The belly is Buckthorn Brown, except for the midventral streak and for a buffish patch of hairs in the preputial region. The head is whitish with rather indistinct markings of Light Ochraceous Buff; these markings consist of an irregular streak above the ear and eye towards the snout. The chin is

white. The tail is somewhat more brownish than the back, its terminal part (slightly under half of the total tail length) is Antimony Yellow.

The mounted specimens from Tandjong Morawa (Deli), from Pontianak (W. Borneo) and from Bandjarmasin (S. E. Borneo) certainly have faded through exposure to light, and it seems useless to describe the colour they have at present. In the specimen from Tandjong Morawa no distinct markings could be found; the tip of the tail is lacking, and there can be no certainty whether the terminal part of the tail, so far as this has been preserved, really was paler than the base. The male from Pontianak still shows traces of the demarcation between lighter and darker parts, like that found in the specimen from Kampong Baroe. However, no light vertebral streak could be found. The tip of the tail seems to be very slightly paler than the base, but this may be due to fading. The male from Bandjarmasin (cat. syst.: b) still shows the demarcation between the light and darker parts, and a pale vertebral streak. The tip of the tail is ever so slightly paler than the base, but as in the other mounted specimens this may be due to a different grade of fading. A second specimen from Bandjarmasin (cat. syst.: c) is rather young (in toothchange). The colour pattern is distinct, with a clear demarcation between light and dark, and a light vertebral streak; the terminal third of the tail is very much paler than the base.

The four spirit specimens in the Amsterdam Zoological Museum have been kept in spirit for many years and their state of preservation is not too good. The colour seems to have faded, and it is useless to record the actual colours which they now show. In specimens A, C and D the colour pattern can still be traced; the tip of the tail is paler than the base. In specimen B we could find no trace of the colour-pattern.

The type of *Mustela hamakeri* Dammerman (Pl. V and VI left figure) has the back and the streaks on the neck Prout's Brown, the dark parts of the head are somewhat paler, more like Sayal Brown. The hairs of the back have about the terminal half Ochraceous Buff, which gives the whole of the back a more or less golden tinge. The sides of the neck and the vertebral streak are Ochraceous Buff. The pale parts of the head, as well as the chin are Light Buff. The throat, the fore chest, and a midventral streak are Ochraceous Buff. The belly has about the same colour as the back. The limbs, inclusive of the feet, are Prout's Brown. The basal part of the tail is Van Dyke Brown, the terminal third is Warm Buff.

## Discussion

Comparing the type of *Mustela hamakeri* to the other specimens, it becomes clear that, although the back is much darker and the contrasts are more marked, the colour pattern is the same as in the male from Fort de Kock, as far as the essential points are concerned. The specimen from Fort de Kock connects the type of *hamakeri* to the specimen from Kampong Baroe, which has the same colour pattern, but which on the whole is paler and which has less marked contrasts. In its turn the Kampong Baroe specimen forms a link between the male from Fort de Kock and the specimens from Deli (cat. syst.: e), Baloen and Dingai, in which the colour pattern is still clearly discernible, and these again lead to the nearly uniformly coloured male from Telok Betong and to the uniformly coloured female from the Lampong Districts. In this way the specimens can be grouped in a more or less continuous series showing all stages from a clearly marked colour pattern with strong contrasts to uniformly coloured specimens. It is for these reasons that we consider *Mustela hamakeri* Dammerman as a synonym of *Mustela nudipes* Desm. It may be mentioned that Dr. Dammerman, when describing *hamakeri* considered the possibility of this weasel representing a subspecies of *nudipes*. As only one specimen was available, and as it was, therefore, impossible to check a difference in geographical distribution, Dr. Dammerman preferred to describe this weasel as a distinct species. When the two extremes of the series, viz., the very dark, clearly marked type of *hamakeri*, and the very pale, uniformly coloured female from the Lampong Districts, are placed side by side, one would hardly believe that they belong to the same species. Only the discovery of additional specimens (Baloen, Kampong Baroe, Lampong Districts, Dingai), which were not available to Dr. Dammerman, made it possible to trace the variation from one extreme (type of *hamakeri*) through the different intermediate stages to the other extreme (female from the Lampong Districts), and thus led us to our conclusion that *hamakeri* must be considered as a synonym of *nudipes*. The only satisfactory way to demonstrate the variation would be the publication of coloured plates of all the specimens examined; the high costs of such plates made this impossible. Therefore, Mr. M. A. Koekkoek made the drawings shown in plates V and VI, in which the colour pattern of the type of *hamakeri* (left figure), of the male from Fort de Kock (centre), and of the male from Telok Betong (right figure) is shown. Great care has been taken to represent the different colours by the correct tone of grey.

A difference in colour between the tip and the base of the tail was the

chief character on which Chasen & Kloss (1932, p. 15) separate the Sumatran and Bornean forms. The specimens from Sumatra examined by Chasen & Kloss had distinctly whitish-tipped tails. This is not the case in any of the Sumatran specimens examined by us; the colour of the tail tips noted by us were: Yellow Ocher, Raw Sienna, Ochraceous Tawny, Antimony Yellow, and Warm Buff. In this respect there appears to be no difference between Sumatran and Bornean specimens, as the rather young specimen from Bandjarmasin (cat. syst.: c) too has a very pale (buffy) tip to the tail, and the same is the case in a specimen from southeastern Borneo described by Lyon (1911, p. 119). The pale vertebral streak mentioned by Gray (1865, p. 119) for the variety described by him is present in specimens from Sumatra (Telok Betong, Deli (cat. syst.: e), Baloen, Kampong Baroe, Fort de Kock, Djambi), as well as in specimens from Borneo (Dingai, Bandjarmasin (cat. syst.: b, c)). In two specimens from Sumatra (♀ Lampong Districts, Tandjong Morawa) and in one from Borneo (Pontianak) no pale vertebral streak was found. It is present in the specimen from southeastern Borneo described by Lyon (1911, p. 119). The variation both in the colour of the tip of the tail, and in the presence or absence of a pale vertebral streak is large in specimens from Sumatra as well as in those from Borneo, and it appears not to be linked with geographical distribution. In no way did we succeed in finding characters on which to separate Sumatran specimens from those of Borneo. The facts at present available lead us to the conclusion, that, as far as the specimens from the Indo-Australian Archipelago are concerned, it is impossible to recognize two distinct subspecies.

## Skull (Pls. VII-VIII)

In the description of *Mustela hamakeri*, Dammerman (1940, p. 267) points to the close resemblance, which the skull of his new species bears to that of *Mustela nudipes*. The following differences are given. In *hamakeri* the skull is smaller; the dentition is proportionately distinctly weaker; the bullae are more elongated, and the inner anterior process, the processus styliformis, is much more forwardly extended and pointed; the inner margins of the bullae are perhaps somewhat less divergent; the maxillo-palatine suture is situated behind the line connecting the inner lobes of the upper carnassials.

1. Size. For comparison to the type skull of *hamakeri*, the skulls or fragments of skulls of fifteen specimens were available to us. The specimen in toothchange must be left out of consideration in so far as the size of the skull is concerned. Of the other complete skulls, that of a female

from Deli (Zool. Mus. Amsterdam, specimen D) with a condylobasal length of 56.2 mm is slightly smaller than the type of *hamakeri* (56.4 mm). The female skull from North Borneo recorded by Chasen & Kloss (1932, p. 14) is smaller still; its condylobasal length is given as 55 mm. Among the specimens examined by us, that from Pontianak, represented by an incomplete skull, is distinctly smaller. This is evident from a comparison of the palatal length of *hamakeri* (24.8 mm) to that of the Pontianak specimen (22.4 mm). As far as the size of the skull is concerned, the type of *hamakeri* comes within the range of variation of *nudipes*. Moreover it must be borne in mind, that the type of *hamakeri* is not fullgrown, for many of the sutures are still clearly visible.

2. Dentition. With regard to the development of the dentition, as expressed by the length of the maxillary toothrow, the specimen from Pontianak is smaller than the type of *hamakeri*, which differs only 0.3 mm from the female from the Lampong Districts. The length of the upper carnassial ($P^4$) is the same in *hamakeri* as in the Lampongs female, while both are larger in this respect than the Pontianak specimen and than the young specimen from Bandjarmasin (cat. ost.: f). In the length of the lower toothrow ($C\text{-}M_2$) the type of *hamakeri* is exactly intermediate between the Pontianak specimen and the Lampongs female; the length of the lower carnassial ($M_1$) is the same in the type of *hamakeri*, the young specimen from Bandjarmasin, and a specimen from Deli (cat. ost.: d). The breadth of the upper molar is exactly the same in the type of *hamakeri* as in the young Bandjarmasin specimen.

To check, whether the dentition of the type of *hamakeri* is relatively weaker than that of the other *nudipes* specimens examined by us we calculated a number of indices, which are shown in table 2. From this table, as well as from table 1 it is clear, that in all respects the type of *hamakeri* comes within the range of variation of *nudipes*.

3. Bullae. The shape of the bullae is moderately variable in *nudipes;* in some specimens they seem to be more elongate than in others, but we do not find any character in which the type of *hamakeri* differs from the species *nudipes* as a whole. The processus styliformis indeed is very well developed in the type of *hamakeri* (Pl. VII fig. 1); in other specimens this processus is absent (e.g., left bulla of the male from Bandjarmasin, pl. VII fig. 2), or it is very small. It is small but distinct on the right bulla of the Bandjarmasin male (Pl. VII fig. 2), and on the right bulla of the Pontianak specimen. The processus is well developed in the male from Fort de Kock (Pl. VII fig. 3) and a male from Deli (specimen A), although not equal to that of the type of *hamakeri*. On the left bulla of

Indices [1])

TABLE II

| LOCALITY | Sex | $\frac{C-M^1 \times 100}{\text{condylobasal length}}$ | $\frac{\text{length of } P^4 \times 100}{\text{condylobasal length}}$ | $\frac{\text{length of } P^4 \times 100}{C-M^1}$ | $\frac{\text{breadth of } P^4 \times 100}{\text{length of } P^4}$ | $\frac{\text{length of } M_1 \times 100}{C-M_2}$ | $\frac{\text{breadth of } M_1 \times 100}{\text{length of } M_1}$ |
|---|---|---|---|---|---|---|---|
| Deli, specimen C | ♂ | 28.7 | 10.8 | 37.8 | **57.4** | 32.6 | 42.3 |
| Serbodjadi | ? | **27.6** | 11.0 | **39.9** | 55.2 | 34.4 | 37.5 |
| Fort de Kock | ♂ | 28.5 | 11.1 | 38.7 | 52.2 | **36.9** | 36.8 |
| Deli, specimen A | ♂ | 28.6 | 11.2 | 39.3 | 52.9 | 33.0 | **43.5** |
| Kampong Baroe | ? | 29.4 | 11.4 | 38.9 | 55.9 | 32.9 | 39.1 |
| Bandjarmasin | ♂ | 28.1 | 10.8 | 38.3 | 53.1 | 32.5 | 43.1 |
| Tandjong Morawa | ? | — | — | 38.0 | 55.9 | 34.1 | 38.9 |
| Dingai | ♂ ? | 29.0 | 10.5 | **36.2** | 51.6 | 32.2 | 36.9 |
| Deli, cat. ost.: d | ? | 28.5 | 10.9 | 38.1 | 53.1 | **31.7** | 42.2 |
| Telok Betong | ♂ | — | — | 39.5 | 57.4 | 34.0 | 39.1 |
| Lampong Districts | ♀ | 27.9 | **10.5** | 37.7 | 57.4 | 34.2 | 36.4 |
| Deli, specimen B | ♂ | **30.7** | 11.6 | 37.6 | 56.7 | 34.3 | 38.4 |
| Baloen | ♂ | 29.8 | **11.6** | 39.4 | **50.6** | 35.6 | 37.5 |
| Djambi, type of *M. hamakeri* | ♀ ? | 28.2 | 10.8 | 38.4 | 54.1 | 34.4 | 37.5 |
| Deli, specimen D | ♀ | — | 11.0 | — | 54.8 | 33.2 | 40.3 |
| Pontianak | ♂ | — | — | 36.9 | 56.4 | 34.1 | **36.1** |
| Bandjarmasin | juv. | 29.9 | 11.2 | 37.3 | 56.1 | 36.6 | 39.1 |

the Kampong Baroe specimen the processus styliformis is strongly developed (Pl. VII fig. 4); the tip is broken off, but the processus seems to be just as large as in the type of *hamakeri*. In any case we do not believe that the difference in size of the processus styliformis is of specific value; the variation found in *nudipes* is too large for this.

The amount of divergence of the inner margins of the bullae is subject to variation, and the condition found in the type of *hamakeri* can be matched in specimens of *nudipes*. In a specimen from Deli (cat. ost.: d) the divergence seems to be even less.

4. The maxillo-palatine suture. The situation of this suture with respect to a line connecting the inner lobes of the upper carnassials is the same in the type of *hamakeri* (Pl. VII fig. 1) as in some *nudipes* specimens (Kampong Baroe, pl. VII fig. 4; Baloen, Deli, specimen D). In other specimens (e.g., Fort de Kock, pl. VII fig. 3) the suture is placed on the same level as the inner lobes of the carnassials.

1) The extreme values are printed in heavy type.

Thus from a comparison of the type skull of *Mustela hamakeri* to a series of skulls of *Mustela nudipes* we arrive again at the conclusion that there is not sufficient difference between the two to recognize them as distinct species. Both the colour pattern of the skin, and the structure of the skull and dentition show that *Mustela hamakeri* Dammerman must be considered a synonym of *Mustela nudipes* Desmarest. The type of *hamakeri* is an extreme variant of *nudipes*.

The synonymy is the following:

**Mustela nudipes** Desm. [1])

Furet de Java Geoffroy Saint-Hilaire & F. Cuvier, Hist. Nat. Mammif., vol. 2, tome III, pt. XXXII, September 1821, text and plate (J).

*Nudipes* Geoffroy Saint-Hilaire & F. Cuvier, Hist. Nat. Mammif., vol. 2, tome III, pt. XXXII, September 1821, p. 2 (J); Griffith, Animal Kingd., vol. 2, 1827, p. 288 (J) (in subgenus of the Putorii).

*mustela nudipes* Desmarest, Mammalogie, pt. 2, Suppl., 1822, p. 537 (J); Lesson, Hist. Nat. gén. part. Mammif. Oiseaux, vol. 5, 1836, p. 295 (J).

*Mustela nudipes,* F. Cuvier, Dict. Sci. nat., vol. 29, 1823, p. 253 (J) (in subg. Les Putois); Waterhouse, Cat. Mamm. Mus. Zool. Soc. Lond., 2nd ed., 1838, p. 34 (J, S); Müller, Zoogd. Ind. Arch., Verh. Nat. Gesch. Ned. Overz. Bez., Zoöl., 1839, p. 30 and 3rd page of table (S, B; not likely to occur in Java), and Isis, 1840, pp. 446-447 (S, B; Java improbable); Schinz, Volledige Nat. Hist. Zoogd., 1845, p. 167 (J); Wagner, Abh. Bayer. Ak. Wiss., Mathem. Phys. Cl., vol. 4 (Denkschr., vol. 19), pt. 2, 1845, pp. 81, 93 (reprint, pp. 191, 203) (S, B); Gray, List Osteol. Specim. Brit. Mus., 1847, p. 19 (J), p. X; Johannes, Wandelingen Tuin Kon. Zoöl. Gen. Natura Artis Magistra Amsterdam, 1855, p. 158 (J); J. F. Brandt, Mém. Ac. Imp. Sci. St. Pétersb., ser. 6, sc. math. phys. nat., vol. 8, 1856, p. 193 (reprint, p. 49) (J, S); Gray & Gerrard, Cat. Bones Mamm. Brit. Mus., 1862, p. 94 (J); Murray, Geogr. Distr. Mamm., 1866, p. 328 (S, B, M), p. 382 (B), p. 383 (J); Schlegel, Dierentuin, Zoogd., 1872, p. 43 (J, S); Blyth, Journ. As. Soc. Beng., vol. 44 (on cover 43), pt. II, extra number, 1875, p. 29 footnote (J, S, M, and possibly in Tenasserim); Jentink, Aardr. Weekbl., vol. 2, pt. 45, 1881, p. 290 (S, B); Martin, Säugeth., in: Illustr. Naturg. d. Thiere, vol. 1, pt. 1, 1882, p. 275 (S, B); Dammerman, Treubia, vol. 11, 1929, p. 35 (J, likely to occur; S, B, M); Sody, Natuurk. Tijdschr. Ned. Ind., vol. 90, 1930, p. 276 (not J; S); Dammerman, Temminckia, vol. 5, 1940, p. 269 (occurrence in Java not impossible. S, B, M), p. 271.

*M[ustela] nudipes,* Fischer, Synops. Mamm., 1829, p. 222 (in section Putorii) (J), and Addenda, 1830, p. 373; Blainville, Ostéographie des Mammif., vol. 2, Des Mustelas, 1842, pp. 40, 81, pl. XIII (figure of dentition); Mohnike, Blicke Pflanz. Thierl. Niederl. Malaienl., 1883, p. 415 (S, B).

*Must[ela] nudipes,* [Vigors], Cat. Zool. Specim., in: S. Raffles, Memoir Life Publ. Serv. Sir Thomas Stamford Raffles, 1830, p. 634 (S; never met with in Java); Hamilton Smith, Introd. Mamm., Naturalist's Library, Mamm., vol. 1, 1843, p. 184 (J), and 2nd ed., 1858, p. 184 (J); Schlegel, Handl. Dierk., vol. 1, 1857, p. 34 (J, S).

*Mustela nudipes nudipes,* Robinson & Kloss, Journ. Fed. Mal. St. Mus., vol. 7, pt. V (on cover: pt. IV), 1919, p. 304 (S); Sody, Natuurk. Tijdschr. Ned. Ind., vol. 89, 1929, p. 165 (J?).

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1) In parentheses we have mentioned the regions from which the authors record the species. J = Java, S = Sumatra, B = Borneo, M = Malay Peninsula.

*Mustela [(Putorius)] nudipes,* Is. Geoffroy Saint-Hilaire, Dict. Class. Hist. Nat., vol. 10, 1826, p. 214; Lesson, Manuel Mammal., 1827, p. 145 (J); Drapiez, Dict. class. Sci. nat., vol. 7, 1841, p. 149 (J); Chenu & Desmarest, Carnassiers, pt. 1, ± 1853, p. 273 (J); Drapiez, Dict. class. Sci. nat., in: Les Trois Règnes de la Nature, vol. 7, 1853, p. 149 (J).

*M[ustela] [(Putorius)] nudipes,* Voigt, Das Thierreich, vol. 1, 1831, p. 147 (J); Z. G[erbe], Dict. pitt. Hist. Nat., vol. 5, 1837, p. 62 (J); Schinz, Synops. Mamm., vol. 1, 1844, p. 341 (S, B; in german text Japan, err. pro Java?); Giebel, Säugeth., 1855, p. 781 footnote, and 2nd ed., 1859, p. 781 footnote (S, B).

*Mustela (Putorius) nudipes,* Robinson & Kloss, Journ. Fed. Mal. St. Mus., vol. 8, pt. II, 1918, p. 74 (S).

*Putorius nudipes* [= *Mustela (Putorius) nudipes*], Cantor, Journ. As. Soc. Beng., vol. XV, no. 171 (n.s., no. 87), 1846, p. 194 (S, B, M); Boitard, Dict. Univ. Hist. Nat., vol. 8, 1847, p. 13, and 2nd ed., vol. 8, 1868, p. 582 (J).

*P[utorius] nudipes* [= *Mustela (Putorius) nudipes*], [Hamilton Smith], in: Griffith, Anim. Kingd., vol. 5, 1827, p. 121 (J); G. Cuvier, Règne Animal, 2nd ed., vol. 1, 1829, p. 144 (J); G. Cuvier, ibid., 3rd ed., vol. 1, 1836, p. 89 (J); G. Cuvier, ibid., ed. par une réunion de disciples de Cuvier, Mammifères, 1849, p. 175 (J).

*Putorius nudipes,* Geoffroy Saint-Hilaire & F. Cuvier, Hist. Nat. Mammif., vol. 4, tome VII, 1842, Table gén. et méthod., p. 3; Boitard, Dierg. Parijs, 1845, p. 174 (J); Gray, Zool. Voy. Samarang, Vertebrata I, Mamm., 1850, p. 17, (S, B, M); Gervais, Hist. Nat. Mammif., Carnivores etc., 1855, p. 113 (S, B); Thomas, Proc. Zool. Soc. Lond., 1886, p. 73 (M); Jentink, Cat. Ost. Mammif., Mus. Hist. Nat. Pays-Bas, vol. 9 bis, 1887, p. 114 (S, B); Jentink, Notes Leyden Mus., vol. 11, 1889, p. 24 (S, B); Hagen, Tijdschr. Kon. Ned. Aardr. Gen., ser. 2, vol. 7, 1890, p. 96 (S, B, M); Jentink, Cat. Syst. Mammif., Singes, Carnivores etc., Mus. Hist. Nat. Pays-Bas, vol. 11, 1892, p. 144 (S, B); Everett, Proc. Zool. Soc. Lond., 1893, p. 495 (Bornean group of islands); Hose, Mamm. Borneo, 1893, p. 27 (B); Grevé, Nova Acta Ac. Caes. Leop. Carol., vol. 63, pt. 1, 1894, p. 196 (J, S, B, Malacca, Sth Tenasserim [1])), p. 215, pl. XVIII; Jentink, Notes Leyden Mus., vol. 20, 1898, p. 121 (S, B) (with field note by Nieuwenhuis); Flower, Proc. Zool. Soc. Lond., 1900, p. 334 (J, S, M); Sanchez y Sanchez, An. Soc. Esp. Hist. Nat., vol. 29 (ser. 2, vol. 9), 1900, p. 208 footnote (cites the distribution given by Trouessart, 1897, p. 279, but states to have no personal experience of the occurrence in the Philippine Islands); Stone & Rehn, Proc. Ac. Nat. Sci. Philad., vol. 54, 1902, p. 136 (S); Bonhote, Fasciculi Malayenses, Zool., pt. 1, 1903, p. 11 (M); Tjeenk Willink, Natuurk. Tijdschr. Ned. Ind., vol. 65 (ser. 2, vol. 9), 1905, pp. 220, 324 (J, S, B); Lyon, Proc. U.S. Nat. Mus., vol. 40, 1911, p. 119 (B); Van Balen, Dierenw. Insul., vol. 1, Zoogd., 1914, p. 331 (J, S, B); Shelford, Naturalist in Borneo, 1916, p. 31 (B); Gyldenstolpe, Kgl. Sv. Vet. Ak. Handl., vol. 60, no. 6, 1919, p. 54 (B); Jacobson, Trop. Nat., vol. 9, 1919, p. 70 footnote (nom. indig. in Sumatra); Anon., Encycl. Ned. O. Ind., 2nd ed., vol. 4, 1921, p. 776 (S, B; records for Java probably incorrect); Banks, Journ. Mal. Br. Roy. As. Soc., vol. 9, pt. 2, 1931, pp. 63, 121, 122, 123, 125, 130 (B).

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1) Grevé (l.c., p. 196) mentions this species also from Palawan, Tambelan, Bungoran, Balabac, the Calamianes, Cuyo, Sulu, Sibutu and Paternoster. As far as we know it has never been actually taken in any of these islands. Grevé's statement finds its source in a paper by Everett (1893, p. 495), who includes the species in a list of mammals known from the Bornean group of islands, but who did not state, that the species mentioned in his list actually occurred in every one of the islands of this group. The error has been passed on by Trouessart (1897, p. 279; 1904, p. 209) and other authors.

*P[utorius] nudipes,* Blanford, Mammals, pt. 1, Fauna Brit. India, 1888, p. 171 (S, B, M; S. Tenasserim?).
*Mustela [(Foetorius)] nudipes,* Reichenbach, Prakt. Naturg. Mensch. Säugeth., new ed., 1855, p. 230 (J, S, B).
*Mustela (Gymnopus) nudipes,* Sterndale, Mammalia India Ceylon, 1884, p. 148 (J, S, B; Tenasserim?); Trouessart, Bull. Soc. ét. sci. Angers, Suppl. 1884, 1885, p. 42 (J, S, B, Malacca).
*Putorius (Ictis) nudipes,* Trouessart, Cat. Mamm., vol. 1, pts. 1-3, 1897, p. 279 (J, S, B, ?Malacca, Palawan etc., Calamianes, Sula Is., Paternoster Is.; see note on p. 162).
*I[ctis] nudipes,* Ménégaux, Mammif., vol. 1, n. d., p. 486 (J, S, B, Palawan, Sulu, Calamianes; see note on p. 162).
*Ictis nudipes,* Raven, Bull. Am. Mus. Nat. Hist., vol. 68, 1935, p. 258 (J, S, B, Malacca, Palawan, Calamianes, Sulu; see note on p. 162).
*Putorius (Arctogale) nudipes,* Trouessart, Cat. Mamm., Suppl., pts. 1-2, 1904, p. 209 (J, S, B, ?Malacca, Palawan, Calamianes, Sula; see note on p. 162).
*Arctogale nudipes,* Schneider, Zool. Jahrb., Syst., vol. 23, 1905, p. 92 (= *Putorius (Arctogale) nudipes*), p. 145 (S).
*Plesiogale nudipes,* Pocock, Proc. Zool. Soc. Lond., 1921, pp. 805, 807, 818, 819, 829, figs. 27E, 33A, 39C.
*M[ustela] [(Lutreola)] nudipes,* Dammerman, Temminckia, vol. 5, 1940, p. 271.
*Gymnopus leucocephalus* Gray, Proc. Zool. Soc. Lond., 1865, p. 119 (S, B); Gray, Cat. Carniv. Pachyd. Edent. Mamm. Brit. Mus., 1869, p. 96 (S, B); Palmer, Index Gen. Mamm., North Am. Fauna, no. 23, 1904, p. 305.
*Gymnopus leucocephalus* var., Gray, Proc. Zool. Soc. Lond., 1865, p. 119; Gray, Cat. Carniv. Pachyd. Edent. Mamm. Brit. Mus., 1869, p. 96.
*Mustela nudipes leucocephalus,* Chasen & Kloss, Bull. Raffles Mus., no. 6, 1931 (1932), p. 14 (B, M).
*Mustela nudipes leucophalus,* Raven, Bull. Am. Mus. Nat. Hist., vol. 68, 1935, p. 258 (S, North Borneo).
*Plesiogale gymnopus* Pocock, Proc. Zool. Soc. Lond., 1921, p. 806, explanation of fig. 27E (lapsus).
*Mustela hamakeri* Dammerman, Temminckia, vol. 5, 1940, pp. 266, 271, pl. XV (S).
*M[ustela] [(Lutreola)] hamakeri,* Dammerman, Temminckia, vol. 5, 1940, p. 271.
"naked-footed Polecat from Sumatra", Pocock, Proc. Zool. Soc. Lond., 1925, p. 25.

## Os penis (textfig. 1)

The baculum (os penis, os priapi) of three specimens (Zool. Mus. Amserdam: A. B, C) has been examined by us. The following description is based on that of specimen C, which is the largest. The baculum is a long slender bone of which the distal extremity is curved upwards. At its base it is about lozenge-shaped in cross section, with a dorsal and ventral keel. The dorsal keel rapidly broadens anteriorly and so passes into the rounded upper surface of the shaft. The ventral keel is very short and does not reach beyond the basal part of the bone; anterior to the base, the ventral surface is flat, narrowing rapidly anteriorly. Thus the proximal part of the shaft is more or less triangular in cross section, with the base of the triangle at the ventral side, while more anteriorly, at about the middle of the shaft the cross section is triangular too, but with the base at the

dorsal side. Therefore, the sides of the triangle which proximally face dorso-laterally, rotate so as to face latero-ventrally at the distal end of the shaft. These sides bear a very shallow groove. At the base of the upward curve the bone shows a distinct constriction. Anteriorly to this the shaft is

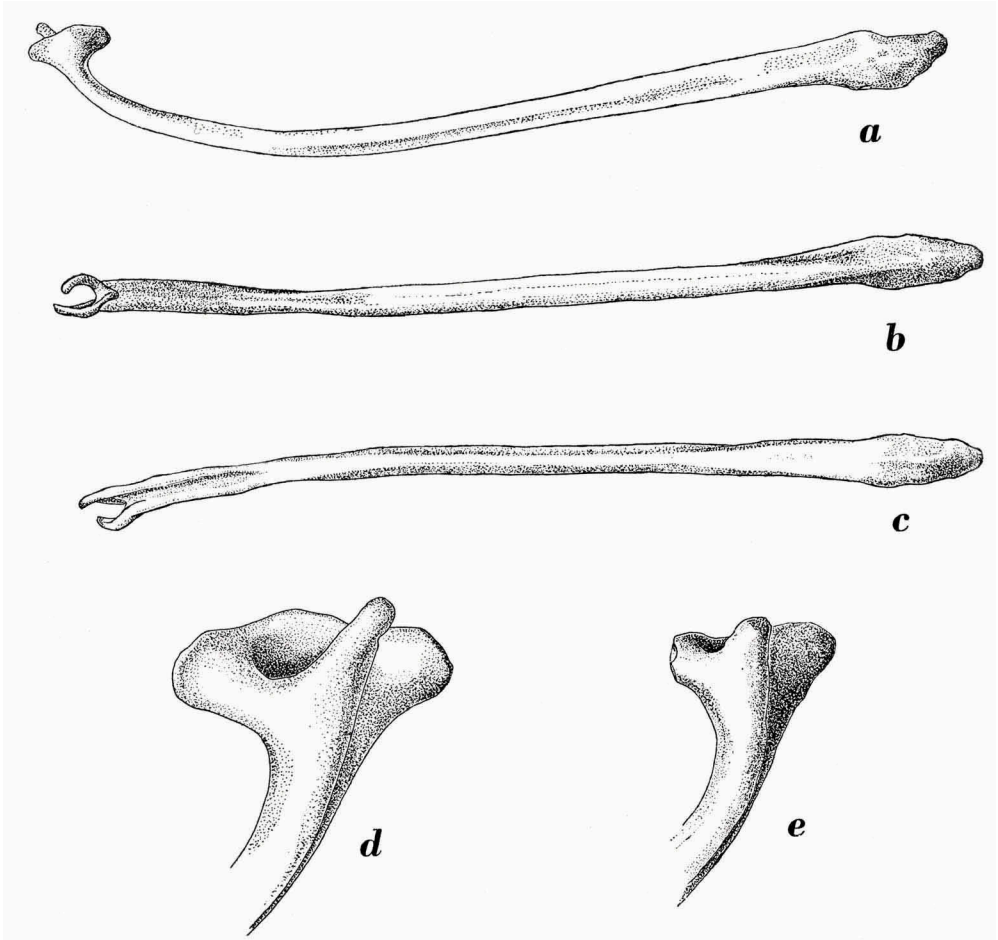


Fig. 1. *Mustela* (*Lutreola*) *nudipes* Desm., Deli, Sumatra, Zool. Mus. Amsterdam. *a*, penis bone of specimen C, left side view; *b*, id., upper view. *c*, id., lower view; *d*, id., right side view of the tip; *e*, penis bone of specimen B, right side of the tip *a-c*, × 2; *d-e*, × 7½.

broadened and more or less depressed, with a deep ventral furrow. This distal part of the bone gently curves upward for some distance, the apex making a somewhat stronger upward curve. The apex (textfig. 1 a, d) consists of a rather broad plate, which is expanded anteriorly and posteriorly; this plate is formed by the left wall of the furrow. Posteriorly it is

connected with the right wall of the furrow, which is much lower. This right wall bears a more or less cylindrical processus (textfig. 1d), which is directed obliquely upwards and forwards, and which is slightly bent inwards. The whole distal extremity of the baculum, from the constriction onwards, deviates slightly to the right. Total length 58.8 mm.

The penis bones of the other males are slightly damaged at the base, so that they cannot be measured, but they are smaller. In shape they agree with the one described above, but in specimen B, which is the smallest of the three, the cylindrical processus and the broad plate are not so strongly developed (textfig. 1e). In other species too the baculum of young specimens is simpler in form (Pohl, 1909).

## Generic Position

The specific name *nudipes* has been used in connection with several generic names, e.g., *Mustela, Putorius Ictis, Arctogale* (cf. synonymy on p. 161). This was partly due to the confusion existing with regard to the use of the name *Mustela* (Brongersma, 1941, pp. 115-116). Gray (1865, p. 118) placed *nudipes,* together with three other species, in a separate genus *Gymnopus.* This genus was not accepted by subsequent authors, until Pocock (1921, p. 818) revived it, and proposed to name it *Plesiogale,* as *Gymnopus* Gray, 1865, was preoccupied by *Gymnopus* Brookes, 1828. As mentioned by Dammerman (1940, p. 270) *Plesiogale* Pocock, 1921, is preoccupied by *Plesiogale* Pomel, 1847. Dammerman (l.c.) is of the opinion, that there is no need to place *nudipes* in a separate genus or subgenus, and this author (l.c., p. 271) refers *nudipes* to the subgenus *Lutreola* Wagn., 1841 of the genus *Mustela* L., 1758 [1]). Now that the penis bone of *nudipes* is known, it becomes necessary to reconsider the generic and subgeneric position of this species.

Using the key to the subgenera of *Mustela* occurring in Europe, as published by Miller (1912, p. 382) *nudipes* agrees best with *Lutreola* for the following reasons: 1. the mastoid width is less than the distance from basion to palation; 2. the bullae are not triangular in outline; 3. the inner margins of the bullae are distinctly divergent: 4. the rostrum is flattened above, and 5. the tail is bushy. Not enough is known about the life habits of *nudipes* to say that it is semi-aquatic. Nieuwenhuis (in Jentink, 1898, p. 121) mentions that the specimen from Dingai, Borneo was captured while crossing a river; Banks (1931, p. 64) mentions the occurrence on the banks of a stream, but this is not yet sufficient evidence to qualify the

1) In the present paper *Mustela* L., 1758 is accepted as a genus of which *Mustela erminea* L., 1758, is the type species (cf. Brongersma, 1941, p. 116).

species as semi-aquatic. Using the key to the subgenera of *Putorius* (= *Mustela* as accepted in the present paper) published by Satunin (1911, p. 267) *nudipes* again agrees best with *Lutreola*. It must be borne in mind, however, that neither Miller, nor Satunin considered *nudipes* in connection with the subgenera recognized by them, and it seemed worth while to us to make a more direct comparison of *nudipes* to the species of the subgenus *Lutreola*.

Unhappily we do not dispose of a penis bone of *Mustela* (*Lutreola*) *lutreola* L. for comparison to that of *nudipes*, but the baculum of *lutreola* has been figured and/or described by De Montlezun (1911, p. 137, fig. on p. 135 [1])), Pohl (1911, p. 158, fig. 4) and Chaine (1925, p. 88 [2])). The baculum of *Mustela* (*Lutreola*) *vison* Schreb., a species closely related to the European mink, has been figured by De Blainville (1842, pl. X); of this species we examined a baculum taken from a mounted specimen in the collections of our museum. Moreover we examined a penis bone of *Mustela* (*Lutreola*) *itatsi* Temm., belonging to the collection of Mr. H. J. V. Sody. The baculum of *nudipes* differs from that of *lutreola, vison* and *itatsi*, in the broad plate, which is formed by the left wall of the ventral furrow, and by the cylindrical processus at the right side of this furrow (textfig. 1 d). In these characters the baculum of *nudipes* differs from those of other Mustelidae, such as these are figured and/or described by De Blainville (1842), Gilbert (1892), Pohl (1909, 1911), De Montlezun (1911), Pocock (1918) and Chaine (1925), and therefore, the question arises whether *nudipes* can be referred to the subgenus *Lutreola* or even to the genus *Mustela*. The characters of the skull and dentition point to the genus *Mustela*, and we think that it would be unwise to separate *nudipes* from this genus.

Pocock (1921) does not describe the external characters of *Mustela* (*Lutreola*) *lutreola* L., but in a later paper (Pocock, 1925, pp. 21-25) the external characters of the American mink (*Mustela* (*Lutreola*) *vison* Schreb.) are described, and it is clear that *nudipes* differs from *vison* in the shape of the rhinarium, and in the nakedness of the soles.

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1) The paper by A. de Montlezun which appeared in the publications of the Société d'histoire naturelle de Toulouse, vol. 42, 1909, and which is cited by Chaine (1925) was not available to us.

2) Under *Putorius lutreola* (= *Mustela* (*Lutreola*) *lutreola* L.) Chaine gives a reference to De Blainville (1842, pl. X). The figure published by De Blainville shows the penis bone of the American mink (*Mustela* (*Lutreola*) *vison* (Schreb.) and not that of the European mink. Under the same heading Chaine gives a reference to fig. 4 on pl. XXVII of Gilbert's (1892) paper, but Gilbert (1892, pp. 817, 830) refers this figure to *Putorius foetidus* (= *Mustela* (*Putorius*) *putorius* L.).

From the species of the other subgenera, viz., *Mustela* s.s., *Lutreola* Wagn., *Gale* Wagn., *Kolonokus* Satunin, and *Putorius* Cuv., such as these are recognized by other authors, *nudipes* differs in the shape of the penis bone, which at its extremity bears a broad plate on the left side, and a cylindrical process on the right side (textfig. 14). Moreover it differs in the soles of the feet being completely naked with the plantar and carpal pads larger than in the other subgenera (cf. Pocock, 1921, p. 818, textfig. 33 A-B as compared to textfig. 33 C-F, and as compared to Pocock, 1925, pp. 23-25, textfig. 5 A-B).

The mastoid width is less than the distance from basion to palation. The distance from the rim of the orbit to the gnathion is about equal to the distance between the antorbital foramina. The auditory bullae are not flasklike and not distinctly triangular; their wall is thinner than in *Putorius*, the cells being less numerous and somewhat larger. The crypts in the interior of the bulla which are formed by bony septs and bars are more developed than in *Putorius*; they are larger and deeper, especially anteriorly and posteriorly. No meatal tube. The paroccipital process is small; it is closely applied to the posterior margin of the bulla. The inner margins of the bullae are distinctly divergent posteriorly. The mastoid process is small, but it is distinctly projecting in adult specimens. The rostrum is flattened.

Dental formula $I\frac{3-3}{3-3}\,C\frac{1-1}{1-1}\,P\frac{3-3}{3-3}\,M\frac{1-1}{2-2}$. The upper carnassial ($P^4$) has a low, but well developed posterior cusp; the height of the main cusp is distinctly more than half the length of the crown measured along the outer border. Upper molar ($M^1$) panduriform with a distinct constriction, the outer lobe generally slightly smaller than the inner; the main axis of the crown is about perpendicular to the median line of the skull. Lower carnassial without metaconid; its posterior heel with a trenchant longitudinal ridge. The posterior border of $P^3$ shears against the anterior border of $P_4$. The inner cusp of $P^4$ acts against the anterior border of the paraconid of $M_1$. The point of $P^2$ is opposite to the middle or to the posterior border of $P_2$.

Ears low and rounded with a distinct bursa. Rhinarium large with deep infranarial portions (Pocock, 1921, p. 807, textfig. 27 E-F). Tail bushy.

The feet are webbed, but as was shown by Pocock (1921, p. 818) this is also the case in the other subgenera.

Although there are several characters in which *nudipes* differs from other groups of species we think it unwise to recognize a separate subgenus to contain *nudipes* (and perhaps *Mustela strigidorsa* Gray, cf. Pocock, 1921,

p. 818), as it seems useless to recognize so many separate subgenera in so small a genus as *Mustela* L. Therefore, we refer *nudipes,* on account of its skullcharacters to the subgenus *Lutreola* Wagn., as was already done by Dammerman (1940, p. 271).

The tongue bears seven circumvallate papillae arranged in a V. In this respect *nudipes* appears to differ from *Mustela* (*Lutreola*) *vison* as recorded by Sonntag (1923, p. 143: *Putorius vison*) and from *Mustela* (*Mustela*) *erminea* L. (Sonntag, 1923, p. 143). The fungiform papillae are inconspicuous. The conical papillae are largest in the middle of the tongue decreasing in size anteriorly and posteriorly. No lateral organs.

We are greatly indebted to Dr. C. de Jong, curator of our Museum, for the photographs of the skulls and mandibles, reproduced on plates VII and VIII. To Prof. Dr. L. F. de Beaufort and Mr. J. van der Dussen, Zoölogisch Museum, Amsterdam, and to Mr. H. J. V. Sody our thanks are due for the loan of specimens. The drawings for plates V and VI were made by Mr. M. A. Koekkoek, those for textfigure 1 by Mr. P. van 't Zelfde.

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## EXPLANATION OF THE PLATES

### PLATE V

*Mustela nudipes* Desm., skins, dorsal view.

Left: type of *Mustela hamakeri* Damm., Djambi, Sumatra.
Centre: ♂, Fort de Kock, Padang Highlands, Sumatra.
Right: ♂, Telok Betong, Lampong Districts, Sumatra.
All figures × ½.

### PLATE VI

*Mustela nudipes* Desm., skins, ventral view.

Left: type of *Mustela hamakeri* Damm., Djambi, Sumatra.
Centre: ♂, Fort de Kock, Padang Highlands, Sumatra.
Right: ♂, Telok Betong, Lampong Districts, Sumatra.
All figures × ½.

### PLATE VII

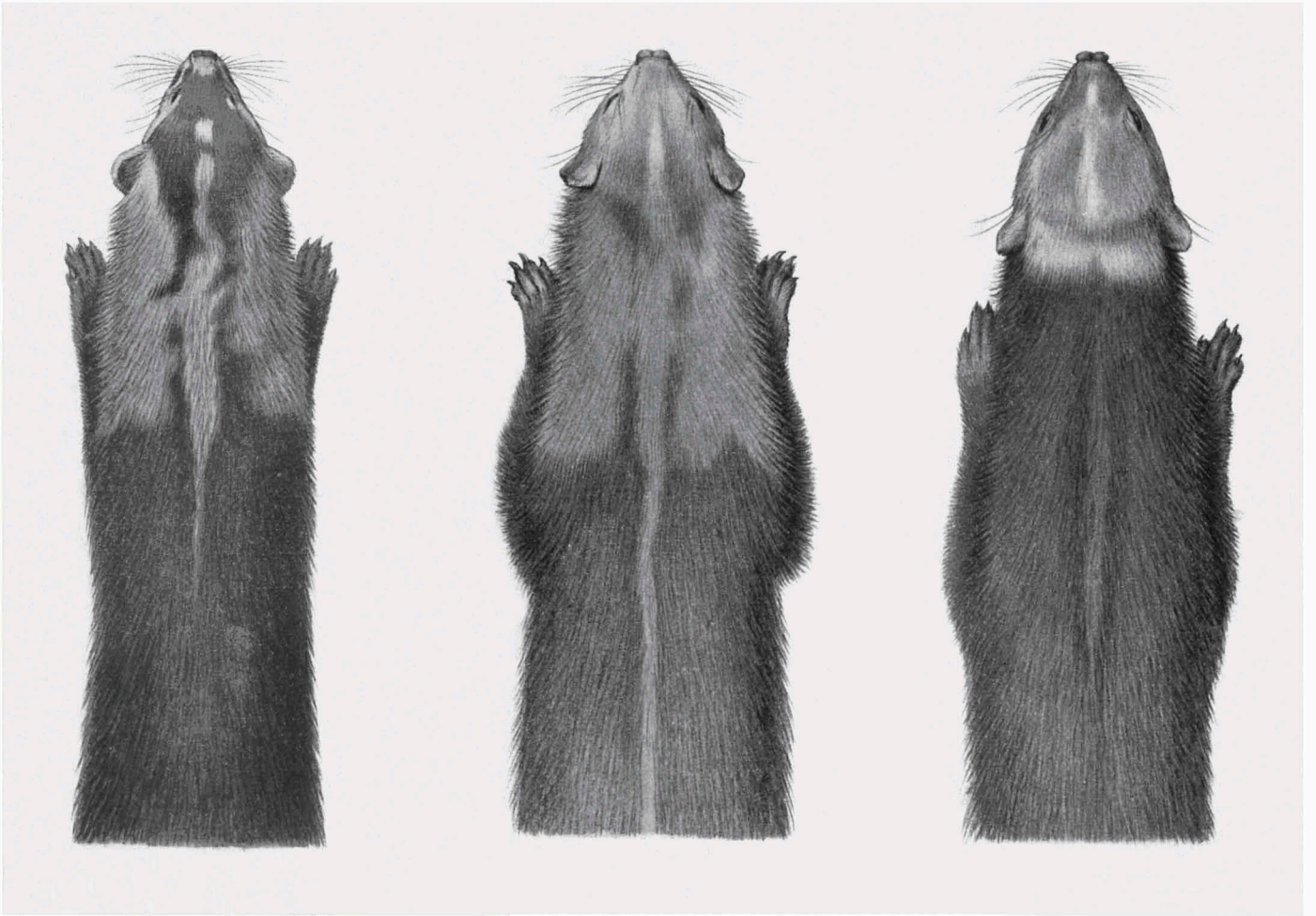
*Mustela nudipes* Desm., skulls, lower view.

Fig. 1. Type of *Mustela hamakeri* Damm., cat. ost.: i.
Fig. 2 ♂, Bandjarmasin, cat. ost.: b.
Fig. 3. ♂, Fort de Kock, cat. ost.: k.
Fig. 4. Kampong Baroe, cat. ost.: g.
All figures approximately × 1½.

### PLATE VIII

*Mustela nudipes* Desm.

Fig. 1. Type of *Mustela hamakeri* Damm., cat. ost.: i, skull, side view.
Fig. 2. ♂, Fort de Kock, cat. ost.: k, skull, side view.
Fig. 3. Type of *Mustela hamakeri* Damm., cat. ost.: i, skull, upper view.
Fig. 4. ♂, Fort de Kock, cat. ost.: k, skull, upper view.
Fig. 5. Type of *Mustela hamakeri* Damm., cat. ost.: i, lower jaw, side view.
Fig. 6. ♂, Fort de Kock, cat. ost.: k, left mandible, side view.
Fig. 7. ♂, Fort de Kock, cat. ost.: k, right mandible, side view.
Figs. 1-5, approximately × 1⅖; figs. 6-7, approximately × 1½.



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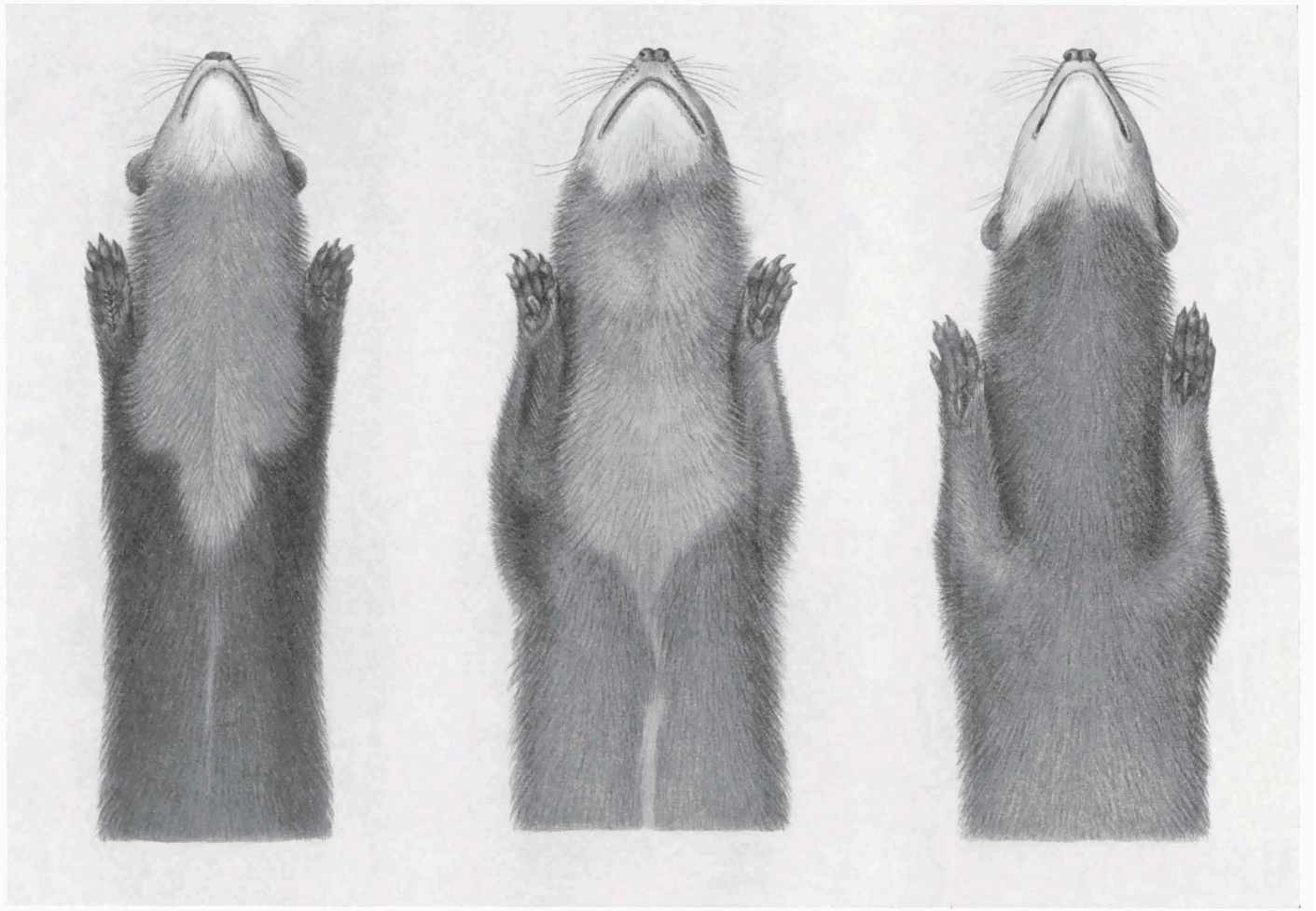

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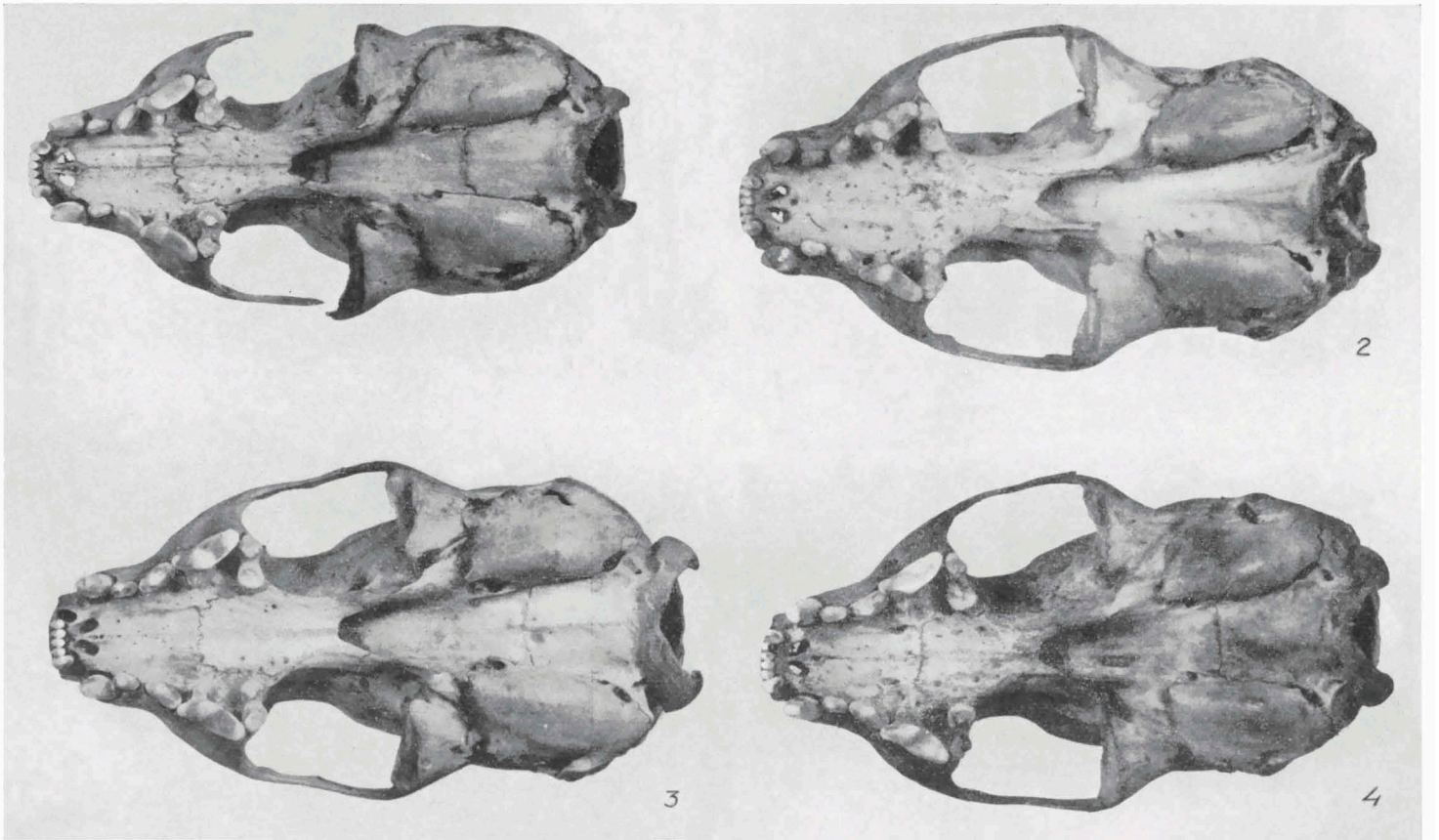


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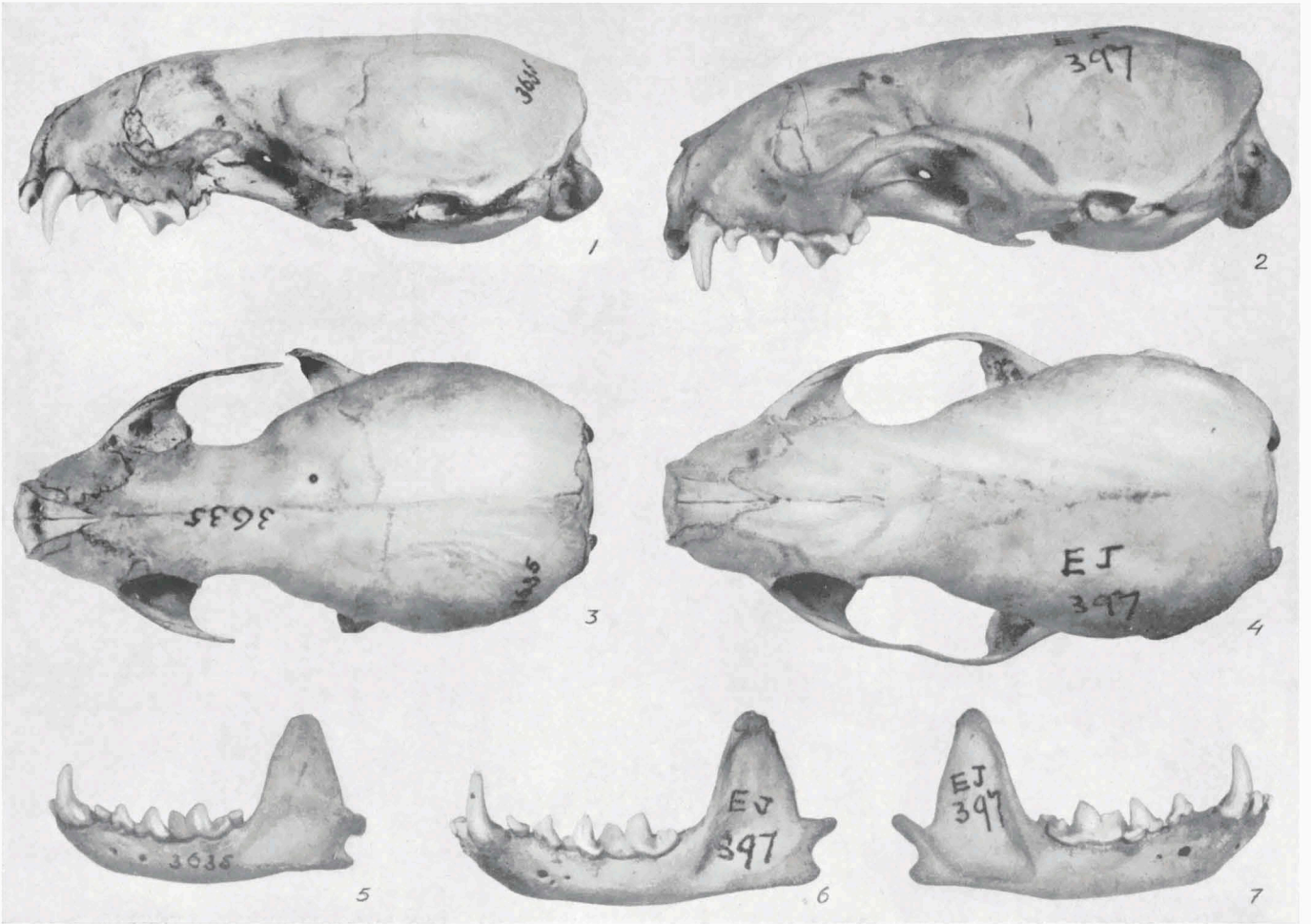


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