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A NEW SPECIES OF *HYDROMYS* (MURIDAE) FROM WESTERN NEW GUINEA (IRIAN JAYA)

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With 2 text-figures and 3 plates

Abstract

A new species of the murid *Hydromys* is named and described, based on skins, skulls and dentitions. The sample comes from the Wissel Lakes region in the Indonesian half of New Guinea (Irian Jaya). In many features, the new species is a miniature version of *Hydromys chrysogaster* and may be more closely related to that large water rat than to *H. habbema*. Nothing is known about habits or habitat of the new rat, and it has not yet been collected elsewhere in Irian Jaya or in the eastern half of New Guinea (Papua).

Introduction

In 1969, Dr. A. M. Husson guided Musser through the collection of Asian rodents at the Rijksmuseum van Natuurlijke Historie in Leiden. Husson showed him a series of small amphibious rats collected near the Wissel Lakes by members of the 1939 New Guinea expedition of the Koninklijk Nederlandsch Aardrijkskundig Genootschap (Royal Netherlands Geographic Society; Boschma, 1943). George H. H. Tate, who had described the small *Hydromys habbema* from Lake Habbema in what was then Netherlands New Guinea (Tate & Archbold, 1941), had looked at the series from the Wissel Lakes and left a note with the determination, *H. habbema*, scribbled on it. Dr. Husson studied the specimens himself and disagreed with Tate's identification, but left the problem because of other duties. Husson asked Musser to study the sample while he was in Leiden. Musser did so and agreed with Husson that they were not *H. habbema* but an undescribed species. Husson sent the series to the American Museum of Natural History where it remained until Musser learned more about the endemic rats and mice of the New Guinea and Australian region in general, the hydromyines in particular, and *Hydromys* in detail. Through the years he examined holotypes of hydromyine taxa and compared them with the sample from the Wissel Lakes. One result is the present report. By describing a new species we point out that the species-diversity of murids on New Guinea is still incompletely known; that *Hydromys* has a wider morphological, phylogenetic, and probably ecological scope than has been realized; and that the western part of New Guinea has species of murids that may not occur in the eastern half.

ABBREVIATIONS, METHODS AND SPECIMENS

Specimens cited in the present report are in the British Museum (Natural History), London (BM); the American Museum of Natural History, New York (AMNH); and the Rijksmuseum van Natuurlijke Historie, Leiden (RMNH).

We used values for the standard skin measurements of total length, length of tail, length of hind foot and length of ear that were made by collectors in the field or preparators in the laboratory; length of tail was subtracted from total length to obtain length of head and body. We measured the length of the white tail segment, as well as the length of the tuft at the end of the tail, on the study skins. Cranial and dental measurements were taken with Anderson's craniometer attached to a Wild M5 stereomicroscope or with dial calipers graduated to tenths of mm. Limits of those measurements are illustrated in Musser (1979), except for the following: greatest length of skull was taken from the inion (the extension of premaxillaries anterior to the incisors) to the occiput where it forms the dorsal margin of the foramen magnum; the postorbital constriction was measured at the narrowest part of the postorbital region, situated behind the interorbital area and just in front of the braincase. In most other kinds of murids, the interorbital region is the narrowest area between the dorsal maxillary roots of the zygomatic arch and the front margin of the braincase, but in adult *Hydromys* the narrowest region is behind the orbit.

In all the analyses, we used samples of adults; we shall describe juveniles of the new species, but because there are so few juveniles in any of our samples of the three species we did not subject them to detailed comparative analyses. Adults are specimens in complete adult pelage in which the molars are moderately to well worn, and the configurations of the crania and mandibles are similar to those illustrated in plates 1 and 2.

So little is known about the secondary sexual variation in features associated with skins, skulls and teeth of the different species of *Hydromys* that we kept males separate from females in the analyses. We are not interested here in comparisons between sexes within each of the species, only comparisons of the same sex among the species.

For our purposes, we have assumed that all samples of the large *Hydromys* from Australia and New Guinea, although reflecting possibly significant geographic variation (see the discussion and map in Tate, 1951), represent one species, *H. chrysogaster* (Tate, 1951; Laurie & Hill, 1954); that *H. neobrittanicus* from New Britain is so closely related to *H. chrysogaster* (Tate, 1951: 236) that we have not bothered to contrast it with the new species from the Wissel Lakes; and that all samples we have identified as *H. habbema* represent one species, even though the few specimens from the eastern half of New Guinea average smaller in body size than those from Lake Habbema and adjacent areas. There is clearly a large *chrysogaster*-form of *Hydromys* (and *neobrittanicus* falls into this group), a small *habbema*-form of rat, and a third distinctive morphological type from the Wissel Lakes. We focus here on the contrasts between these three sets of samples; a detailed and critical study of geographic variation within *H. chrysogaster*, *H. neobrittanicus* and *H. habbema* is needed but outside the scope of our report.

The specimens of *H. habbema*, *H. chrysogaster* and *H. neobrittanicus* that we studied, and the localities where they were obtained, are listed below.

Hydromys habbema Tate & Archbold, 1941
(figs. 1, 2; pl. 1 fig. a, pl. 2 fig. a, pl. 3 fig. a)

Papua (numbers key to numbered localities in fig. 1). — 1. Morobe District: 1 mile west of Kaindi, Slate Creek, 2000 m (AMNH 191440). 2. East Highlands District: Mount Otto, Collins's Sawmill, 2215-2275 m (AMNH 191445-191448). 3. East Highlands District: Mount Wilhelm, Pengagl Creek, 8500 ft (AMNH 191441-191444); Baiyanka, Purari-Ramu divide, the southeast part of the Bismarck Range (BM 1947.1173, the holotype on which the name *Baiyankamys shawmayeri* is based: see Mahoney, 1968). 4. Western Highlands District: Mount Hagen, 5000 and 7000-8000 ft (AMNH 156431-156433); Tomba, 8000 ft, on the south spur of the Hagen Range in the Central Highlands (BM 1953.309).

Irian Jaya (see fig. 1). — 5. Lake Habbema, 15 km north of Mount Wilhelmina, 3225 m (AMNH 110048-110050, 110052-110062, 110064-110074, 152827); 7 km northeast of the top of Mount Wilhelmina, 3560 and 3600 m (AMNH 110076-110079).

Hydromys chrysogaster E. Geoffroy, 1804 (not mapped)
(fig. 2; pl. 1 fig. c, pl. 2 fig. c, pl. 3 fig. c)

Papua. — 1. Western Division: upper Fly River, 1 mile below mouth of Black River (AMNH 105201); middle Fly River, Lake Daviumbu (AMNH 105772-105777); Fly River, north bank opposite Sturt Island (AMNH 105778, 105780); east bank of Fly River, Gaima (AMNH 105781); West Kussa Tarara (AMNH 105782). 2. Milne Bay District: Normanby Island, Waikaiuna, 20 m (AMNH 159582-159583, 159585-159586) and Mount Pabinama, 820 m (AMNH 159584); Kiriwina Island, Liluta, 10 m (AMNH 159587); Goodenough Island, east slopes, 1600 m (AMNH 158207); Peria Creek, 2 miles northeast of Opaigwari (AMNH 158205-158206). 3. East Highlands District: Kratke Mountains, Kassam (AMNH 191431-191434); Kratke Mountains, Sasara (AMNH 191430); Mount Michael (AMNH 191428); Okapa area, Purosa (AMNH 191429). 4. Morobe District: Oomsis Creek (AMNH 191427); Upper Markham Valley, Water Rice (AMNH 191436-191438); Upper Markham Valley, Umi River Camp (AMNH 191439); Mount Rawlinson, Gang Creek, 4300 ft (AMNH 194929); Huon Peninsula, Finschhafen (AMNH 194930).

Irian Jaya. — 1. Idenburg River: 4 km southwest of Bernard Camp, 850 m (AMNH 152072-152076); Bernard Camp, 50 m and 75 m (AMNH 152077-152078). 2. Hollandia (AMNH 109503).

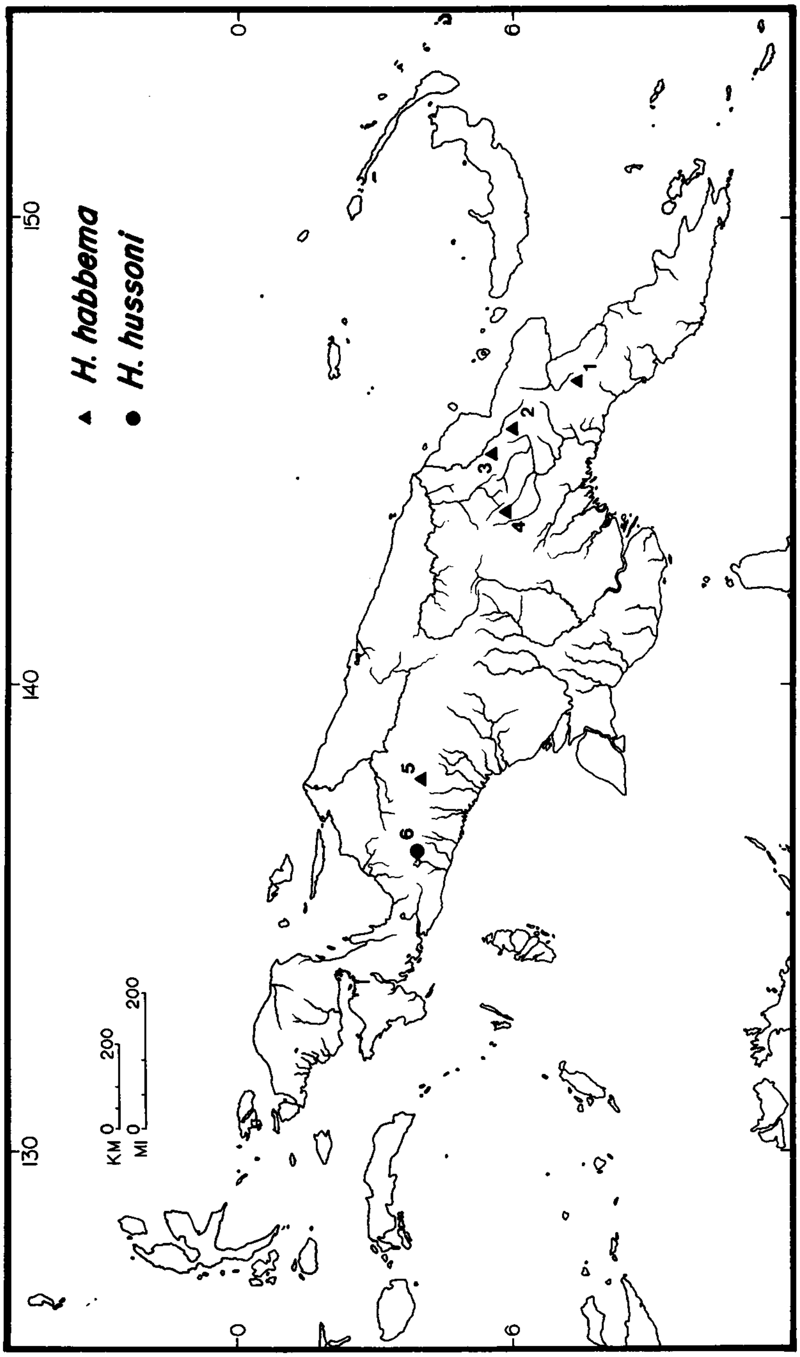

Fig. 1. Map showing places in New Guinea where our samples of *Hydromys habbema* (nos. 1-5) and *H. hussoni* (no. 6) were collected. Names of the localities and the catalog numbers of specimens collected at each place are listed in the text on pages 155, 157.

Hydromys neobrittanicus Tate & Archbold, 1935 (not mapped)

New Britain. — Bainings, Balayang, Wide Bay (AMNH 99867, holotype); Ais River, near Sanwimg Village, 500 ft (AMNH 194380).

Hydromys hussoni spec. nov.
(figs. 1, 2; pl. 1 fig. b, pl. 2 fig. b, pl. 3 fig. b)

Holotype. — RMNH 29140, an adult male (pls. 1-3) obtained from Lake Paniai on November 9, 1939. Father A. M. Husson told Musser that all the specimens of rats were collected by natives and brought to members of the expedition. Nearly all specimens were labelled as coming from the village of Enarotali (3°55′40″S, 136°22′6″E), 1765 m, on the east side of Paniai Lake, which was the headquarters of the zoologist of the expedition (Holthuis, 1949: 289). Presumably, the rats were caught somewhere near the lake and brought to Enarotali, which we designate as the type-locality. The holotype consists of a stuffed skin, cranium and mandible, all in good condition. The specimen was originally preserved in alcohol and prepared as a study skin in 1948.

Measurements. — Values from a sample of adult males, adult females and from the holotype are listed in tables I and II.

Distribution. — Known only from the Wissel Lakes in Irian Jaya (fig. 1; see also the detailed map in Holthuis, 1949: pl. II). According to Holthuis (1949: 289), the region is "... a complex of lakes in the interior of W. New Guinea, named after flight-officer F. J. Wissel, who discovered it in 1937. The Wissel Lakes consist of three large lakes: Paniai Lake, the largest and most northern lake, Tage Lake, the smallest, situated just south of Paniai Lake, and Tigi lake, situated still more southwards. Tigi Lake is isolated, while Paniai Lake is connected with the Arafoera Sea by the Oeta River (in its upper reaches this river also is called Oerimoeka, Jawej or Zabiboe)."

Referred specimens. — In addition to the holotype, the following specimens are *H. hussoni*. Araboe Bivouac, 1750 m ("... situated on the Araboe River, which empties in the N. E. angle of Paniai Lake"; Holthuis, 1949: 289): RMNH 29149, 29171, 29178, 29740-29743. Paniai Lake, Enarotali, 1765 m: RMNH 29141-29148, 29150-29170, 28172-29177, 29179, 29744-29752.

Etymology. — Named in honor of Dr. A. M. Husson, former Curator in the Division of Mammals at the Rijksmuseum van Natuurlijke Historie, Leiden. Dr. Husson retired in October of 1975. He was the first to realize that the specimens from the Wissel Lakes represented a new species. During the period that Musser worked in the collections at Leiden, Dr. Husson provided him with every courtesy and service, including occasional gifts of good Dutch beer, which kept up his discipline at those times when measuring skulls and teeth became tedious to the point of exasperation.

Diagnosis. — A species of *Hydromys* that is the smallest of the known species in the genus, and that differs from the largest of these, *H. chrysogaster,* and from the smaller *H. habbema*, by possessing the following combination of characters: dark

TABLE I

External, cranial and dental measurements (in mm) of adult males in samples of *Hydromys habbema* and *H. hussoni*, and of the holotype of *H. hussoni*, RMNH 29140. The mean ± one standard deviation, size of sample after comma and the observed range in parentheses are listed, in that order, for each measurement. P refers to probabilities that means of the samples were drawn from the same taxon.

	H. habbema	P	*H. hussoni*	Holotype
Length of head and body	151.9 ± 6.4, 12 (144-162)	0.6-0.5	154.0 ± 11.3, 13 (128-167)	158
Length of tail	174.1 ± 10.4, 12 (160-187)	< 0.001	130.9 ± 11.1, 13 (113-152)	132
Length of hind foot	36.4 ± 0.9, 12 (35-38)	< 0.001	28.3 ± 1.8, 13 (25-31)	28
Length of ear	8.5 ± 0.9, 12 (6-10)	< 0.001	12.2 ± 0.5, 13 (11-13)	12
Greatest length of skull	34.54 ± 0.54, 10 (33.6-35.6)	< 0.001	32.14 ± 1.02, 15 (29.9-34.0)	33.4
Zygomatic breadth	17.21 ± 0.32, 11 (16.8-17.8)	< 0.001	15.90 ± 0.83, 11 (15.1-17.4)	16.6
Postorbital constriction	5.42 ± 0.11, 12 (5.3-5.6)	< 0.001	5.19 ± 0.15, 15 (5.0-5.6)	5.1
Length of nasals	11.64 ± 0.89, 9 (9.7-13.0)	< 0.001	10.32 ± 0.45, 15 (9.7-11.3)	
Breadth of rostrum	6.17 ± 0.24, 11 (5.9-6.5)	< 0.1-0.05	5.94 ± 0.30, 15 (5.5-6.4)	6.4
Breadth of braincase	15.47 ± 0.28, 11 (14.9-16.0)	< 0.001	13.77 ± 0.36, 15 (13.1-14.4)	14.1
Height of braincase	11.05 ± 0.23, 10 (10.6-11.4)	< 0.001	9.43 ± 0.25, 15 (8.9-9.8)	9.4
Breadth of incisor tips	1.53 ± 0.06, 12 (1.4-1.6)	< 0.001	1.74 ± 0.12, 14 (1.5-1.9)	1.9
Breadth of zygomatic plate	1.52 ± 0.14, 12 (1.3-1.8)	< 0.001	1.74 ± 0.12, 15 (1.5-2.0)	2.0
Length of diastema	8.45 ± 0.34, 12 (7.9-8.8)	0.4-0.3	8.56 ± 0.30, 15 (8.0-9.2)	8.7
Palatal length	16.05 ± 0.64, 12 (14.6-16.9)	0.1-0.05	16.46 ± 0.53, 15 (15.2-17.2)	17.1
Postpalatal length	12.9 ± 0.29, 10 (12.5-13.4)	< 0.001	12.37 ± 0.38, 15 (11.8-13.2)	12.3
Length of palatal bridge	7.80 ± 0.27, 12 (7.4-8.4)	0.5-0.4	7.88 ± 0.34, 15 (7.3-8.3)	8.2
Breadth of palatal bridge at M^1	3.91 ± 0.35, 12 (3.3-4.7)	< 0.001	2.93 ± 0.19, 15 (2.5-3.2)	3.1
Breadth of palatal bridge at M^2	4.93 ± 0.33, 12 (4.4-5.7)	< 0.001	4.02 ± 0.17, 15 (3.7-4.4)	4.2
Breadth of mesopterygoid fossa	2.32 ± 0.18, 12 (2.1-2.8)	0.6-0.5	2.28 ± 0.15, 15 (2.0-2.5)	2.5
Length of incisive foramina	3.90 ± 0.15, 11 (3.6-4.1)	< 0.001	3.17 ± 0.25, 15 (2.5-3.4)	3.3
Breadth of incisive foramina	2.18 ± 0.10, 11 (2.0-2.3)	< 0.001	1.98 ± 0.16, 13 (1.7-2.2)	2.2
Length of bulla	4.30 ± 0.18, 12 (4.1-4.6)	< 0.001	4.68 ± 0.22, 15 (4.2-5.0)	4.7
Alveolar length of M^{1-2}	5.25 ± 0.15, 12 (5.0-5.5)	< 0.001	4.72 ± 0.20, 15 (4.3-5.0)	4.7

TABLE II

External, cranial and dental measurements (in mm) of adult females in samples of *Hydromys habbema* and *H. hussoni*. The mean ± one standard deviation, size of sample after comma and the observed range in parentheses are listed, in that order, for each measurement. P refers to probabilities that means of the samples were drawn from the same taxon.

	H. habbema	P	*H. hussoni*
Length of head and body	150.1 ± 8.4, 8 (136-160)	1.10	150.1 ± 9.4, 7 (138-164)
Length of tail	163.2 ± 18.3, 8 (130-190)	<0.001	125.5 ± 14.3, 6 (103-144)
Length of hind foot	35.5 ± 1.0, 8 (35-38)	<0.001	27.4 ± 1.1, 7 (26-29)
Length of ear	8.1 ± 0.6, 8 (7-9)	<0.001	12.4 ± 0.8, 7 (12-14)
Greatest length of skull	33.35 ± 0.51, 8 (32.4-34.0)	<0.001	31.54 ± 0.87, 7 (30.1-32.8)
Zygomatic breadth	17.12 ± 0.48, 8 (16.6-18.1)	<0.001	15.60 ± 0.50, 7 (14.8-16.3)
Postorbital constriction	5.26 ± 0.19, 8 (5.1-5.6)	0.9-0.8	5.28 ± 0.14, 9 (5.1-5.5)
Length of nasals	11.65 ± 0.28, 7 (11.3-12.0)	<0.001	10.17 ± 0.43, 9 (9.4-10.6)
Breadth of rostrum	6.01 ± 0.14, 8 (5.8-6.2)	0.1-0.05	5.82 ± 0.21, 9 (5.6-6.1)
Breadth of braincase	15.60 ± 0.23, 8 (15.3-16.1)	<0.001	13.44 ± 0.28, 8 (13.1-13.8)
Height of braincase	10.96 ± 0.28, 8 (10.6-11.4)	<0.001	9.21 ± 0.19, 8 (8.9-9.5)
Breadth of incisor tips	1.54 ± 0.09, 8 (1.5-1.7)	0.05-0.02	1.67 ± 0.13, 9 (1.5-1.9)
Breadth of zygomatic plate	1.48 ± 0.12, 8 (1.3-1.7)	0.05-0.02	1.65 ± 0.11, 9 (1.5-1.8)
Length of diastema	8.51 ± 0.36, 8 (8.0-9.2)	0.6-0.5	8.39 ± 0.36, 9 (7.9-9.0)
Palatal length	15.70 ± 0.42, 8 (15.1-16.1)	0.2-0.1	16.11 ± 0.55, 9 (15.2-17.0)
Postpalatal length	13.27 ± 0.47, 8 (12.5-13.8)	<0.001	12.09 ± 0.48, 9 (11.5-12.8)
Length of palatal bridge	7.62 ± 0.28, 8 (7.2-8.0)	0.5-0.4	7.72 ± 0.28, 9 (7.3-8.1)
Breadth of palatal bridge at M^1	3.90 ± 0.45, 7 (3.4-4.5)	<0.001	2.99 ± 0.18, 9 (2.7-3.3)
Breadth of palatal bridge at M^2	4.97 ± 0.35, 7 (4.5-5.5)	<0.001	4.04 ± 0.20, 9 (3.7-4.4)
Breadth of mesopterygoid fossa	2.32 ± 0.19, 8 (2.1-2.7)	0.5-0.4	2.40 ± 0.10, 9 (2.3-2.6)
Length of incisive foramina	3.77 ± 0.24, 8 (3.5-4.2)	<0.001	3.08 ± 0.13, 9 (2.9-3.3)
Breadth of incisive foramina	2.25 ± 0.13, 8 (2.1-2.5)	0.01-0.001	2.02 ± 0.14, 9 (1.8-2.2)
Length of bulla	4.33 ± 0.15, 8 (4.1-4.5)	<0.001	4.76 ± 0.18, 9 (4.5-5.0)
Alveolar length of M^{1-2}	5.22 ± 0.23, 7 (5.0-5.6)	<0.001	4.71 ± 0.15, 9 (4.5-5.0)

chestnut upperparts (gray in *H. habbema*, agouti in *H. chrysogaster*); grayish ochraceous or rich ochraceous underparts (grayish silver or slate gray in *H. habbema*, grayish buff in *H. chrysogaster*); tail monocolored in some specimens or with a short distal white segment in others (all specimens of *H. habbema* and *H. chrysogaster* with a tail that is dark basally and white distally); skull, mandible and teeth smaller versions of those in *H. chrysogaster*; skull and molars smaller than those in *H. habbema*, but incisors absolutely and relatively wider; rostrum rectangular in dorsal outline (instead of tapered distally as in *H. habbema*); bullae absolutely longer than in *H. habbema* and longer relative to skull length than in *H. habbema* and *H. chrysogaster*; braincase low relative to its height (braincase relatively higher in the other two species).

Description and comparisons

The smallest of any species of *Hydromys* yet described, *H. hussoni* resembles *H. chrysogaster* more closely in external, cranial and dental features than it does *H. habbema*. Below we describe *H. hussoni* and contrast it with the other two species under the subheadings of 1) coloration and pelage; 2) size and proportions of external features; and 3) size, proportions and shape of skulls and teeth.

Coloration and pelage. — The upperparts of head and body of adult *H. hussoni* are covered by short, dense and brown pelage that is richer in tone along the middle of the dorsum and overlaid with buffy or ochraceous hues along the sides of head and body. The rich brown along the top of head and body is speckled with buff from the buffy-tipped hairs. Small clumps of white hairs distributed through the fur over the rump give that area a diffuse spotted pattern in many of the specimens. The ears are small and scantily haired but contrast with the head because they are darker, blackish brown. The tops of the front feet are dark brown from the forearm over the metatarsal area and usually to the end of the digits; the palmar surfaces and claws are unpigmented (although usually appearing yellowish because of grease stains, especially in old specimens). The dorsal surfaces of the hind feet are either tan or brown but always paler than the tops of the front feet; the plantar surfaces are the same color as the tops; the claws appear to be unpigmented. The tail is dark brown and densely covered with long hairs all the way to the tip in five specimens; the distal 2-19 percent of the tail length is white in 19 specimens with most individuals falling in the range of 3-11 percent (fig. 2). The hairs at the end of the tail form a thin but conspicuous tuft that is about 2 percent the length of the tail. The underparts are covered by short and thick fur that is either dark gray and tinged with buff (16 specimens) or rich ochraceous and lightly suffused with gray (8 specimens).

Hydromys chrysogaster is similar to *H. hussoni* in coloration. The primary differences between the two species are that *H. chrysogaster* has, on the average, darker upperparts in which more blackish brown rather than rich brown tones predominate; and underparts that are overall yellowish buff suffused with pale gray rather than richer orange-buff suffused with dark gray. In 40 specimens of

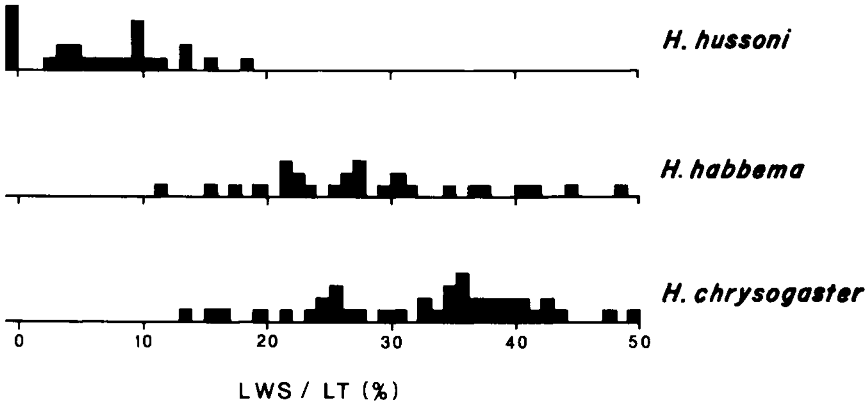

Fig. 2. Distribution of values obtained from the ratio: length of white segment of tail/length of tail (LWS/LT), in samples of *Hydromys hussoni*, *H. habbema* and *H. chrysogaster* from New Guinea. See text for discussion.

H. chrysogaster, yellowish buff is the average hue, with some specimens being grayer and others more intensely pigmented rich ochraceous; two specimens are partially melanistic, a color phase not found in the samples of *H. hussoni* and *H. habbema.* Other than body size and intensity of coloration, the most conspicuous contrast in external features between *H. hussoni* and *H. chrysogaster* is in the bicoloration of the tail. All specimens of *H. chrysogaster* that we examined had a bicolored tail in which the basal portion is brown or black and the distal segment white. In our sample, the length of the white segment ranged from 14-50 percent of the length of the tail with most specimens falling in the range of 22-44 percent (fig. 2), a contrast to *H. hussoni* which either has a monocolored brown tail or one in which less than 20 percent of its length is white.

The coloration of *H. habbema* is strikingly different. The fur over the entire upperparts of *H. habbema* feels softer and much denser than that of the other two species. The pelage is gray or dark gray and lightly frosted along the middle of the dorsum; the sides of head and body are more densely frosted because there are more hairs with pale gray or silver tips in that region. The small ears are densely covered with gray hairs and nearly concealed by the surrounding fur; in *H. hussoni* and *H. chrysogaster*, the ears are scantily haired, dark and more conspicuous. The densely furred underparts are grayish silver (22 specimens) or slate-gray (14 specimens), unlike those of the other two species in which buffy and ochraceous hues are usual. As in *H. chrysogaster*, all our specimens of *H. habbema* have bicolored tails in which the basal portions are brownish gray to dark brown and the distal segments white. Lengths of the white segments ranged from 12-49 percent with most specimens falling into the range of 22-32 percent (fig. 2). Coloration of the front feet as well as the plantar surfaces is similar to that in the other two species. The tops of the hind feet, however, may be paler than in *H. hussoni* and *H. chrysogaster.* Some specimens appear to have hind feet in which the tops are unpigmented, others appear darker but we cannot tell whether the color is a result of staining from grease or of pigmentation.

There is a slight difference in coloration and texture of pelage between adults and juveniles. Juveniles of all three species resemble the adults in color but are darker. Their pelages are softer and silky to the touch, rather than woolly as in adults.

In table V, we have listed some features of juveniles and very young adults in our sample of *H. hussoni*. Males and females with skulls about 30 mm long and longer are in full adult pelage. Specimens with shorter cranial lengths are in juvenile pelage. The smallest and youngest specimen that was represented by a sexed skin and skull is RMNH 29155, in which the molars had broken through the bone but were still incompletely erupted. The molars were completely erupted in all the other juveniles.

Size and proportions of external features. — Body size of *H. hussoni* is about half that of *H. chrysogaster*; *H. hussoni* and *H. habbema* are more comparable in size, but the former is still absolutely smaller in most dimensions, and there are significant proportional differences between the two species as well. (We constructed ratio diagrams as explained by Musser, 1970, using samples of males from each of the three species; from that diagram we determined the proportional differences in external, cranial and dental dimensions between *H. hussoni* and *H. habbema* that were significant at the 0.05 level of statistical probability or less, then noted where *H. chrysogaster* fits proportionally in comparison to the other two species. We have not illustrated the ratio diagram — it is filed in the Department of Mammalogy at the American Museum of Natural History — but we do provide ratios in table IV that express the proportions we consider to be important.) There are no significant differences in mean values of length of head and body between males and females of *H. hussoni* and *H. habbema*. In contrast, both sexes of *H. hussoni* differ significantly from those of *H. habbema* in having a shorter tail that is also shorter than the combined length of head and body (the tail is much longer than head and body in *H. habbema*), an absolutely shorter hind foot that is also shorter relative to length of head and body, and larger ears, both absolutely and relative to body size (tables I, II and IV).

H. hussoni is obviously much smaller than *H. chrysogaster* (compare tables I and II with table III), but the contrast involves more than simply absolute distinctions in size. The proportions of length of ear and hind foot relative to length of head and body in *H. chrysogaster* are like those in *H. habbema*, not *H. hussoni* (table IV); tail length in *H. chrysogaster* averages about as long as length of head and body, whereas the tail is conspicuously shorter than head and body in *H. hussoni*.

Size, proportions and shape of skulls and teeth. — *Hydromys hussoni* has a small and compact cranium in which the rostrum is short and broad, the braincase smooth and low, the bullae are large and the incisors wide (pls. 1 and 2). In size, the cranium is close to that of *H. habbema* but smaller. Out of the 20 cranial and dental measurements listed in tables I and II, no significant differences exist between males and females of *H. hussoni* and *H. habbema* in only five measurements

TABLE III

External, cranial and dental measurements (in mm) of adult males of *Hydromys chrysogaster* from New Guinea (specimens in AMNH)

	105201	158206	191435	191437	191431	152073	152078
Length of head and body	253	289	245	237	244	260	252
Length of tail	300	280	247	241	249	245	228
Length of ear	13	19	18	18	19	15	16
Length of hind foot	61	60	57	56	58	55	54
Greatest length of skull	56.4	55.1	49.4	50.1	50.5	49.3	49.9
Zygomatic breadth	27.0	27.2	24.7	24.2	25.4	23.7	23.6
Postorbital constriction	7.1	6.3	6.8	6.8	6.1	6.9	7.1
Length of nasals	18.8	18.2	15.7	15.5	16.3	15.6	15.3
Breadth of rostrum	11.2	11.0	10.6	10.1	9.7	9.5	10.0
Breadth of braincase	20.8	19.1	18.9	19.4	19.5	19.6	19.3
Height of braincase	15.9	14.8	14.6	14.1	13.9	13.5	14.0
Breadth of incisor tips	2.5	3.2	2.8	2.8	—	2.6	2.9
Breadth of zygomatic plate	2.6	2.6	2.7	2.5	2.7	2.6	3.1
Length of diastema	16.0	15.5	14.1	13.8	13.5	13.2	14.2
Palatal length	29.0	27.6	26.3	26.3	26.1	25.6	26.0
Postpalatal length	20.3	21.4	18.4	18.1	18.9	17.7	18.4
Length of palatal bridge	14.1	13.7	13.0	12.6	13.3	12.9	12.7
Breadth of palatal bridge at M^1	5.9	5.5	5.7	5.9	5.3	5.1	5.8
Breadth of palatal bridge at M^2	6.9	7.3	6.7	6.5	6.1	7.0	7.2
Breadth of mesopterygoid fossa	4.8	4.5	4.2	4.1	4.1	4.2	4.4
Length of incisive foramina	5.9	5.6	5.7	6.0	5.0	5.0	5.4
Breadth of incisive foramina	3.9	2.9	3.5	4.0	3.2	3.4	3.2
Length of bulla	6.2	6.6	6.0	6.1	5.9	6.4	5.8
Alveolar length of M^{1-2}	8.7	8.1	8.1	8.2	8.4	8.2	8.2

(breadth of rostrum, length of palatal bridge, breadth of mesopterygoid fossa, length of diastema and palatal length). No significant difference existed between females of the two species in one other measurement, postorbital constriction; males of *H. hussoni*, however, had, on the average, significantly narrower postorbital regions than males of *H. habbema*. Both males and females of *H. hussoni* had, on the average, significantly wider zygomatic plates and longer bullae than those of *H. habbema*; in all other dimensions (and that is most of them) males and females of *H. hussoni* averaged significantly smaller than those of *H. habbema*.

Various proportions of the crania and teeth differ significantly between the two species. Compared with *H. habbema*, *H. hussoni* has a broader postorbital constriction relative to breadth of braincase; a lower braincase relative to its height; shorter nasals relative to length of skull; wider zygomatic plates relative to all other cranial dimensions; a longer diastema, palate and palatal bridge relative to length of skull; a narrower palatal bridge (at the level of the first upper molars) relative to breath of braincase and all other cranial dimensions; a wider mesopterygoid fossa relative to breadth of palatal bridge (at levels of the first and second upper molars); wider incisor tips relative to breadth of rostrum; longer

TABLE IV

Ratios (in percent) of external, cranial and dental dimensions in three species of *Hydromys*, based on samples of males listed in tables I-III

	H. habbema	*H. hussoni*	*H. chrysogaster*
Leng. ear/leng. head and body	6	8	6
Leng. tail/leng. head and body	115	85	101
Leng. hind foot/leng. head and body	24	19	23
Post. orb. br./br. braincase	35	38	35
Depth braincase/br. braincase	71	69	74
Leng. nasals/leng. skull	34	32	32
Br. zygo. plate/leng. skull	4	5	5
Leng. diastema/leng. skull	25	27	29
Palatal leng./leng. skull	47	51	52
Leng. pal. bridge/leng. skull	23	25	26
Br. pal. bridge-M^2/br. braincase	32	29	35
Br. meso. fossa/br. pal. bridge-M^2	47	57	64
Br. incisor tips/br. rostrum	25	30	27
Leng. bulla/leng. skull	12	15	12
Leng. incis. for./leng. diastema	46	37	38
Leng. M^{1-2}/palatal leng.	33	29	30
Leng. M^{1-2}/leng. pal. bridge	67	60	63

bullae relative to length of skull and all other length dimensions; shorter incisive foramina relative to length of diastema; and shorter maxillary toothrow relative to palatal length and length of palatal bridge (table IV).

The crania of *H. hussoni* and *H. habbema* illustrated in plates 1 and 2 provide examples of the differences in shape between the two species. *Hydromys hussoni* contrasts with *H. habbema* by possessing the following features: 1) a short and squat rostrum, nearly rectangular in dorsal or ventral outline (instead of tapering distally so that the rostrum is triangular in outline and appears more delicate in build); 2) a less constricted postorbital region; 3) a lower braincase (apparent in pl. 2); 4) conspicuously larger bullae; and 5) wider, more robust zygomatic plates.

The two species also differ in shape of the dentary. Each dentary of *H. hussoni* is higher and less gracile in build than those of *H. habbema*, especially the portion anterior to the toothrow, which is short and thick (from dorsal to ventral surface) in *H. hussoni* but long and slender in *H. habbema* (pl. 2).

The configurations of incisors and molars are similar in the two species. Size is the primary difference we note: *H. habbema* has narrower incisors and larger molars than *H. hussoni* (pl. 3).

The cranium, dentaries and teeth in *H. hussoni* are essentially miniature versions of those in *H. chrysogaster* (pls. 1-3); furthermore, *H. hussoni* is proportionally more similar in cranial and dental features to *H. chrysogaster* than to *H. habbema* (table IV). Of the 14 cranial and dental ratios listed in table IV, *H. hussoni* and

TABLE V

Some characteristics of juveniles and young adults of *Hydromys hussoni* (abbreviations: M, male; F, female; LHB, length of head and body; LT, length of tail; LHF, length of hind foot; LE, length of ear; GLS, greatest length of skull)

RMNH	Sex	LHB	LT	LHF	LE	GLS	Pelage	Molars
29144	M	169	106	23	11	29.9	Fully adult, freshly molted	All erupted
29166	M	131	117	26	12	29.3	Fully juvenile	All erupted
29152	F	138	116	26	12	30.1	Fully adult, freshly molted	All erupted
29142	F	—	—	—	—	29.1	Fully juvenile	All erupted
29179	F	122	106	25	12	28.5	Fully juvenile	All erupted
29145	F	122	103	25	11	29.2	Fully juvenile	All erupted
29168	F	100	82	22	11	26.2	Fully juvenile	All erupted
29151	F	98	82	22	10	26.6	Fully juvenile	All erupted
29155	F	92	68	20	10	24.4	Fully juvenile	Incompletely erupted

H. chrysogaster are proportionally similar in ten ratios, and *H. chrysogaster* is more like *H. habbema* in four only (narrow postorbital region relative to breadth of braincase, high braincase relative to its breadth, wide palatal bridge relative to breadth of braincase, and small bullae relative to length of skull).

DISCUSSION

We initially compared specimens of the rat from the Wissel Lakes to samples of species in all the valid genera from New Guinea and Australia that are considered to be hydromyines (Tate, 1951): *Leptomys*, *Paraleptomys*, *Pseudohydromys*, *Microhydromys*, *Neohydromys*, *Mayermys*, *Parahydromys*, *Crossomys*, *Xeromys* and *Hydromys*. The Wissel Lakes animal is more like *Hydromys habbema* and *H. chrysogaster* in skin, cranium, dentary and teeth than any other known hydromyine species. And within *Hydromys*, *H. hussoni* is distinctive but may be phylogenetically more closely related to the larger *H. chrysogaster* than to *H. habbema*. In color and texture of pelage, and in most cranial and dental configurations and proportions, *H. hussoni* and *H. chrysogaster* cluster and stand apart from *H. habbema*. The different pelage coloration and texture, along with the delicate and tapered rostrum, narrow incisors, relatively narrower zygomatic plates and more gracile dentaries with their more slender anterior portions separate *H. habbema* from the other two species. Judged from our comparisons among the three species based on skins, skulls and dentitions, we agree with other workers (Tate, 1951; Laurie & Hill, 1954; Lidicker, 1968) who have kept *habbema* and *chrysogaster* in the same genus, and we add *hussoni* to it. Should data from other sets of characters indicate that *H. habbema* is so distinctive as to warrant subgeneric or generic status, then the name *Baiyankamys*, as Mahoney (1968) pointed out, is available; in such an arrangement, our data suggest that *H. hussoni* and *H. chrysogaster* (as well as *H. neobrittanicus*) should remain in the same genus or subgenus. Information about phallic morphology in *H. hussoni* would be especially useful because Lidicker (1968) already constrasted the phallic characters of *H. habbema* and *H. chrysogaster*.

The actual geographic distribution of *H. hussoni* is an aspect that requires study. The murid fauna of the western, or Indonesian, half of New Guinea is poorly known. Although our sample of *H. hussoni* comes from one small area only, the species may be more widespread in western New Guinea than our material indicates; possibly it is endemic to that half of the island. Papuan New Guinea has been reasonably well collected and to our knowledge no specimens of *H. hussoni* have ever been obtained there. That a species of rodent occurs in one half of the island does not mean that it also occurs in the other, as is illustrated by the geographic distribution of species of the tree rat *Chiruromys*: all are known from the eastern half of New Guinea only, and most occur on the southeastern peninsula (Dennis & Menzies, 1979).

The ecologies of *H. hussoni*, *H. chrysogaster* and *H. habbema* also need study: at present there is little information about the natural histories of these species. We cannot, for example, provide a description of the habitat of *H. hussoni* and we have no information about its habits or the composition of its diet. Nor do we know if it occurs together with the large *H. chrysogaster* in the lakes, rivers and streams of the Wissel Lakes region; we do not even know if *H. hussoni* is restricted to middle altitudes and lowlands. We only know that *H. habbema* is a water rat of the high mountains (see Archbold et al., 1942; Brass, 1964), that *H. chrysogaster* is spread throughout New Guinea at middle altitudes and in the lowlands (Tate, 1951) and that *H. hussoni* has been found at the Wissel Lakes only. Much work is needed to elucidate the natural history of each species, as well as the ecological relationships among them, and between each one and other rats and mice that may occur in the same area.

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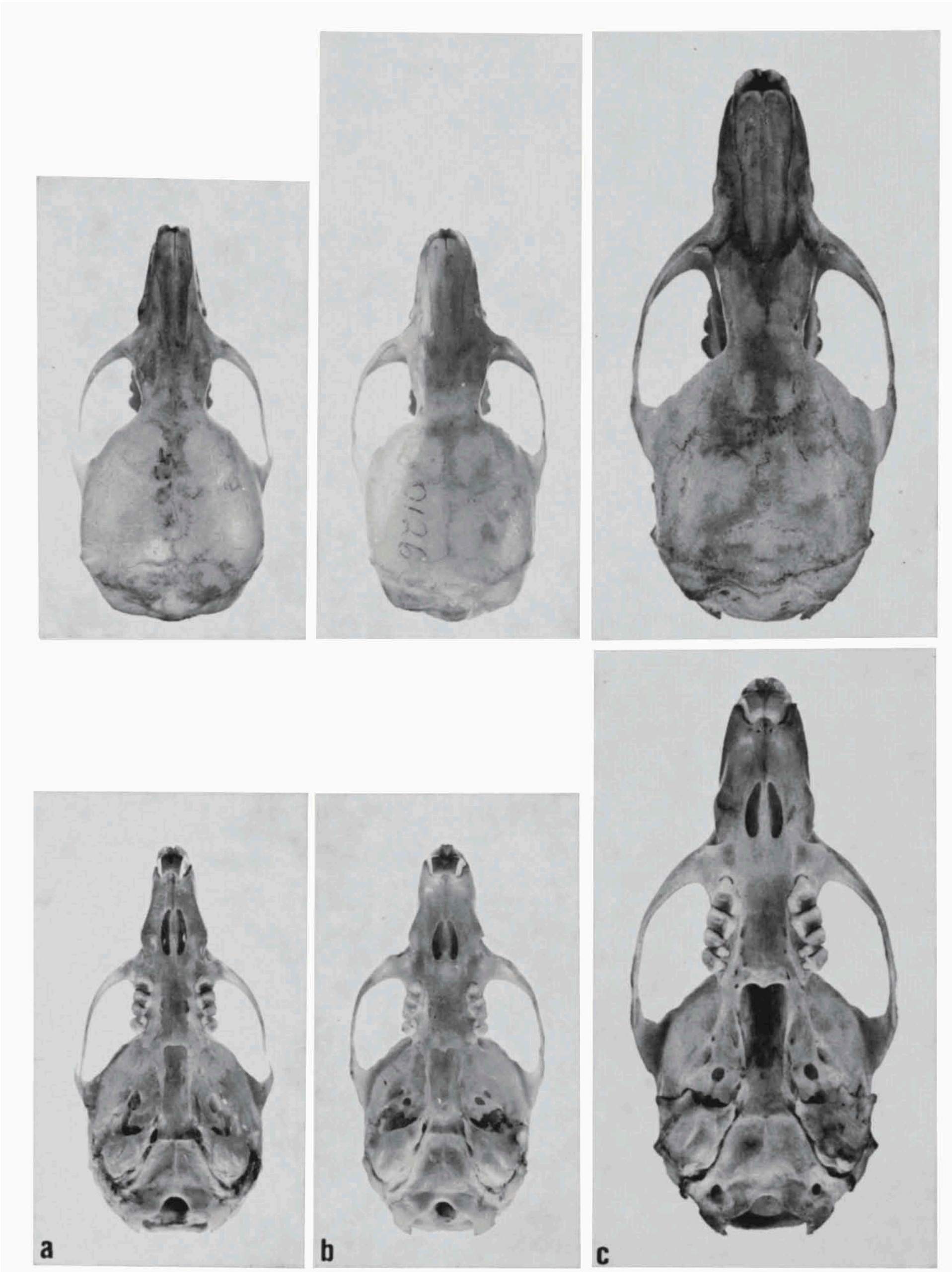
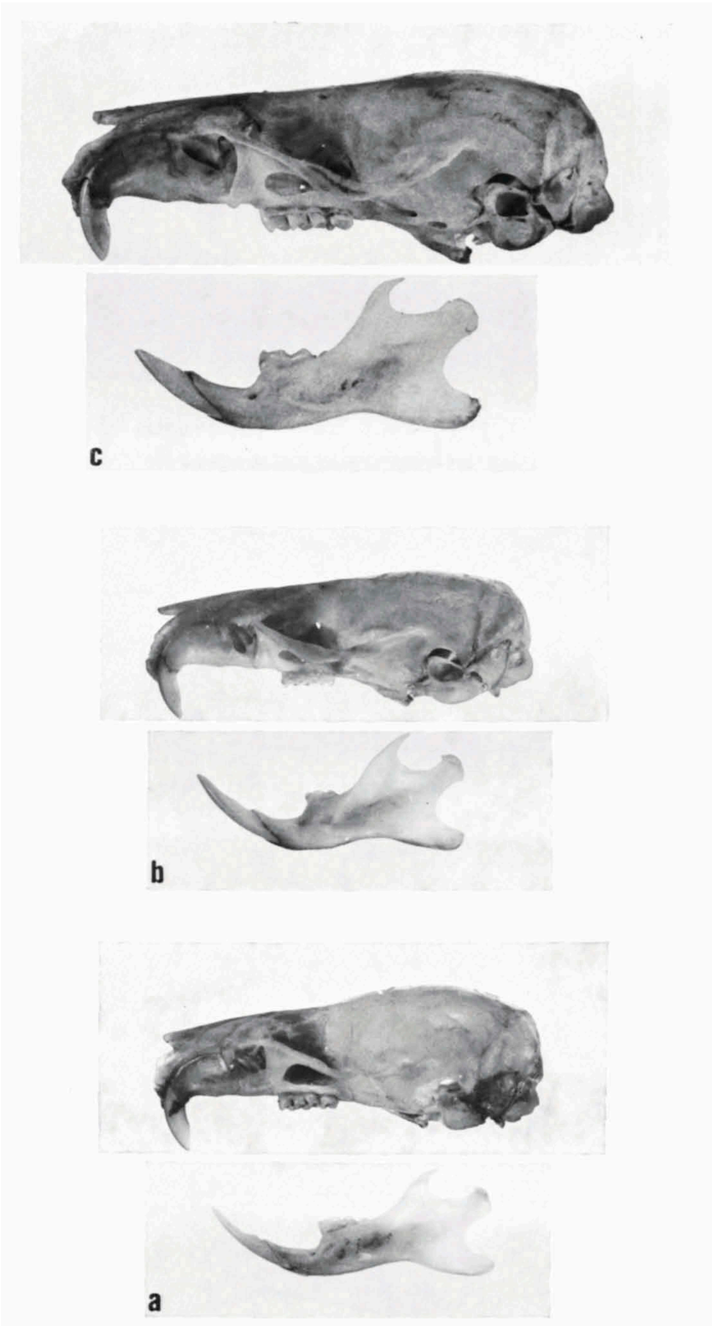


Dorsal (top) and ventral (bottom) views of cranium of: (a) adult *Hydromys habbema*, AMNH 110055 (holotype); (b) adult *H. hussoni*, RMNH 29140 (holotype); (c) adult *H. chrysogaster*, AMNH 191432. All are approximately × 1.5.



Lateral view of cranium and left dentary of: (a) *Hydromys habbema*, AMNH 110055; (b) *H. hussoni*, RMNH 29140; (c) *H. chrysogaster*, AMNH 191432. All are approximately × 1.5.

Occlusal views of M^{1-3} (left side) and M_{1-2} (right side) of: (a) *Hydromys habbema*, AMNH 110065; (b) *H. hussoni*, RMNH 29166; (c) *H. chrysogaster*, AMNH 191439. All are approximately × 9.