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MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN, NO. 58

A SYSTEMATIC REVIEW OF THE
NEOTROPICAL WATER RATS
OF THE GENUS *NECTOMYS*
(CRICETINAE)

BY
PHILIP HERSHKOVITZ

ANN ARBOR
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FREDERICK M. GAIGE
Director of the Museum of Zoology

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A SYSTEMATIC REVIEW OF THE NEOTROPICAL WATER RATS OF THE GENUS *NECTOMYS* (CRICETINAE)

INTRODUCTION

THE rats of the genus *Nectomys* are comparatively large cricetines with large, powerfully developed hind feet. They are moderately specialized for semiaquatic life. They occur near swamps, lakes, and along the wooded banks of streams in tropical America. So far as is known, their nests are built under old logs and brush heaps or in tangled roots and are not provided with special passages or tunnels leading to water. To judge from situations where individuals of the more highly specialized species have been trapped, it seems that these rats may be only slightly dependent upon streams or lakes for foraging or refuge. It is most probable that their swimming modifications are, primarily, adaptations for meeting the exigencies created by the periodic floodings of their habitats.

A total of 452 specimens of *Nectomys* has been examined and classified. This number represents, roughly, one water rat for each 10,000 square miles of the whole area in which the genus is known to occur. The vast majority of the available specimens have been taken in the peripheral parts of the range of the genus. A mere handful of specimens represents the Amazon Valley and coastal states of Brazil. This material, however, has been adequate for resolving most of the taxonomic problems which have been accumulating and making it increasingly difficult to deal with the genus and its subdivisions.

ACKNOWLEDGMENTS

I wish to express my sincere appreciation to the authorities of the various institutions whose co-operation has made this study possible. For the loan of specimens and for their kindness in granting me permission to study and describe the material in their charge I am especially grateful to Dr. H. E. Anthony, Dr. G. H. H. Tate, and G. G. Goodwin, of the American Museum of Natural History; to Dr. W. H. Osgood and C. C. Sanborn, of the Field Museum of Natural History; to Dr. G. M. Allen, of the Museum of Comparative Zoology, Harvard University; and to G. S. Miller, Jr., and Dr. Remington Kellogg, of the United States National Museum; also to Major E. A. Goldman and Dr. H. H. T. Jackson for the loan of *Nectomys* in the U. S. Biological Surveys collection. I am indebted to J. K. Doult for the loan of all specimens of *Oryzomys* in the Carnegie Museum collection; this material was an indispensable adjunct to the present study. I wish to express my admiration of Raymond M. Gilmore's abilities as a field collector. Mr.

Gilmore, as research associate of the International Health Division of the Rockefeller Foundation, collected in Brazil material which is now deposited in the American Museum of Natural History and which provides an almost inexhaustible source for scientific research; it includes the largest and finest single series of *Nectomys* preserved in any institution and merits much more detailed study than time permitted me to make. I am deeply grateful to Grace Eager for skillful preparation of the drawings, and to Elsa K. Hertz for stenographic assistance.

In the preparation of this report, as in all my previous work, the cooperation, guidance, and helpful criticisms of Dr. W. H. Burt have been the most important factors.

TERMINOLOGY AND ABBREVIATIONS

The fur of the dorsum of *Nectomys*, as in practically all thick-furred animals, is composed of three main types of hairs. The terms adopted here to distinguish each of the types are equivalent to those which have been described and classified by Toldt (1935).

1. Guard hair (= *Leithaar*, Toldt; guard hair, and overhair [part] of authors).
Longest hair of dorsum. Basal one-half gray, fine; terminal one-half dark brown, expanded into a blade with a long fine tip.
2. Cover hair (= *Grannenhaar*, Toldt; overhair [part], and underfur [part] of authors).
Shorter and more numerous than the first. Typically agouti; basal one-half gray, terminal one-half divided into a broad brown basal band, a broad ochraceous subterminal band, and a fine brown tip.
3. Wool hair (= *Wollhaar*, Toldt; wool hair, and underfur [part] of authors).
Finest, shortest, and most numerous type; crinkly. Nearly uniformly gray except for a narrow subterminal band of buff or ochraceous and a very fine brown tip.

On the dorsum, the dominant colors are those of the terminal parts of the guard hairs and the subterminal bands of the cover hairs. The wool hairs are completely hidden by the latter. The hairs on the ventrum are less typical in structure; guard hairs shorter, dark gray basally, usually white to ochraceous terminally; crinkly wool hairs nearly uniformly dark gray; cover hairs intermediate in structure and color and difficult to distinguish from the others.

The term "cover hair" has been introduced to avoid "overhair" or "underfur," terms which have been too frequently used without discrimination by various authors.

All capitalized color terms are from Ridgway (1912). A description of each of the measurements used is given in the accounts of the species. Unless otherwise noted, the measurements given in the tables are of all the available adult specimens which are represented at least by crania in fair condition.

The following abbreviations are used for the institutions whose specimens of *Nectomys* were examined: A. M. = American Museum of Natural History; F. M. = Field Museum of Natural History; M. C. Z. = Museum of Comparative Zoology, Harvard University; U. S. N. M. = United States National Museum; U. M. M. Z. = University of Michigan Museum of Zoology; U. S. B. = United States Biological Surveys.

GENERIC GROUP CHARACTERS

The general pattern of the external, cranial, and dental characters of *Nectomys* is common to *Oryzomys* and a small number of related cricetines which together constitute a natural assemblage known as the oryzomyine rodents.¹ The genera (and subgenera) of this group include *Oryzomys*, *Melanomys*, *Oligoryzomys*, *Microryzomys* (= *Thallomyscus*), *Oecomys*, *Nesoryzomys*, *Neacomys*, *Scolomys*, *Nectomys*, and *Sigmodontomys*.²

To facilitate the description of the genus *Nectomys* or of any oryzomyine rodent, it is necessary first to define the group as a whole. The following characters, singly or in combinations of two or more, will serve to distinguish members of the group from all other cricetine genera or generic groups.

Eyes normal; ears usually small but well developed, more or less haired both inside and out, never naked; tail terete, thinly haired, the scales plainly visible; pollex with a nail, never a claw; sole of hind foot with five or six tubercles, naked except sometimes at heel; the three middle digits of hind foot partly, but not always conspicuously, webbed; mammae eight (four pectoral and four inguinal). Proximal parts of nasals somewhat concave mesially with the concavity frequently continued back on the frontals; supraorbital margin of frontal square, beaded, ridged, or produced as a shelf; antorbital foramen open both forward and upward, subcylindrical above, slitlike in front; upper anterior border of zygomatic plate rounded or slightly pointed, but not produced as a conspicuous spine; palate produced posteriorly beyond plane of last molars; a rather well-developed fossa on the posterolateral border of each palatine bone marked with a distinct pit or a reticulation of two or more pits; posterior border of palate square or concave, never V-shaped, and sometimes provided with a short median spine which is never produced forward as a median palatal ridge; parapterygoid fossa, as viewed from the ventral surface, relatively shallow with the lateral wall flattened, the anterior corner not undercut. Incisors more or less recurved, their face smooth, not grooved; anterior and posterior

¹ The "oryzomyine genera of rodents" listed by Tate (1932b: 1) are in part those given above, in part those listed later in this paper as members of the short palate "*Rhipidomys-Thomasomys*" group, part *Zygodontomys*, an akodont rodent, part *Chilomys*, with oryzomyine dentition but otherwise unrelated, and part *Rhagomys*, of doubtful affinities. Thomas (1917: 192) provisionally included *Rhagomys* in his "*Oryzomys-Oecomys* series" from which "it may be readily distinguished by the remarkable modification of both incisors and molars," as well as by having only six mammae. *Rhagomys* is known only from the type specimen, species *rufescens*, and another specimen the dilapidated skull of which is figured by Gyldenstolpe (1932: Pl. 3, Fig. 4-4b).

² I have seen no specimens of *Megalomys*, which, probably, is also a member of this group. It is believed to be extinct now.

cingula present; mesostyle (id) and mesoloph (id) united, always present and well developed; the enamel pattern of the cheek teeth as described below.

REMARKS.—The structure of the palate and the presence in each molar of a fused mesostyle (id) and mesoloph (id) are characters which together are sufficient to distinguish the oryzomyine rodents from any others with which comparison need be made. The differences between each of the genera and subgenera of oryzomyine rodents are entirely within the framework of the general pattern and usually depend upon the recognition of some one extremely developed character of, presumably, an adaptive nature. Thus, the spiny pelage of both *Neacomys* and *Scolomys* represents their chief, if not sole, claim to generic rank; the short, broad hind foot with recurved claws supplemented by the long, penciled tail, designed for an arboreal habitat, is distinctive of *Oecomys*, though it is not clear where the line between it and the *trinitatis* (= *tectus*) group of *Oryzomys* could be drawn. The long-tailed *Microryzomys* and *Oligoryzomys* represent hardly more than size gradations leading to the larger *Oryzomys*, and *Melanomys* includes only the darkest, shortest-tailed species of the group in question. *Nesoryzomys* is characterized chiefly by its short, stout, markedly hairy feet. The cranial and dental characters which distinguish the oryzomyine categories higher than species are merely combinations or marked modifications of structural details common to the group as a whole, but not peculiar to any one species. The distinctive characters of *Nectomys* (and *Sigmodontomys*) are given later.

ENAMEL PATTERN AND DENTAL NOMENCLATURE

(Fig. 1, *a-d*)

In the group under discussion, the greatest play in the modification of the dental pattern appears to be expressed chiefly by the infoldings of the enamel, which form the valleys between the ridges or "lophs" of the main cusps and the cingula and styles. These enamel folds have been given various names by different authors, but in most instances for other or much broader purposes than those intended here. To avoid confusion the simple term "fold" is used here for the same feature which has been given such names as re-entrant angle, valley, fossette or flexus, and lateral groove. The terminology of the crests and ridges adopted here agrees, in the main, with the nomenclature presented by Wood and Wilson (1936).

The following folds may be recognized in the upper molars.

1. Major fold (*mf.*), between protocone and hypocone; it usually retains its communication with the marginal enamel throughout the life of the crown in m^1 and m^2 ; in m^3 it may appear as an island at an early stage in wear. A minute accessory style may be present on the cingulum in the angle of the fold.

2. Minor fold (*nf.*), between protocone and anteroloph when and if the latter is present; well developed in m^1 , reduced or obsolete in m^2 , reduced, obsolete, or absent in m^3 . There may be a minute accessory style on cingulum in the angle of the fold.

3. Primary folds (*pf.*), the first (*pf.* 1) between anterior cingulum and paracone; the second (*pf.* 2) between mesoloph and metacone. The lateral margins of these folds may or may not be continuous with the labial marginal enamel throughout the life of the crown.

4. Secondary folds (*sf.*), the first (*sf.* 1) between paracone and mesoloph, usually short but always distinct; frequently complicated, especially when the paracone and mesostyle are fused into a marginal island and a coronal island, which may be highly irregular in form. The second secondary fold (*sf.* 2) between metacone and posterior cingulum is markedly smaller than the first and may disappear with wear; it may be obsolete or absent in m^3 .

5. Internal folds (*if.*), variable in position but always confined to the occlusal surface of the tooth, hence, always appear as enamel islands. The first (*if.* 1) usually lies in the area between the first primary and first secondary folds; however, it may be joined to, or coalesced with, either of these primary or secondary folds. The second (*if.* 2) is like the first, but is more frequently coalesced with the second primary than with the second sec-

dary fold even though the first internal fold of the same tooth be discrete or joined to the first secondary fold.³

The major, minor, primary, secondary, and internal folds of the lower molars are not essentially different in appearance from those of the upper molars. In general, however, the minor fold of m_{2-3} , if present, is more strongly developed than in the corresponding upper teeth; the primary and, especially, the secondary folds tend more toward isolation from the marginal enamel; the internal fold is more often coalesced with the adjacent primary fold. The same serial enumeration is given to the folds of the lower molars as is given to those of the upper. The homologue of each fold, however, is determined by the corresponding crests.

In the first molar, upper and lower, prominently developed conules of the anterior cingulum tend to duplicate in appearance the structures immediately behind. It is convenient, therefore, to designate the folds which define these conules in approximately the same terminology as the preceding, but under no circumstances is any serial homology implied. Each of these anterior folds is frequently coalesced with an adjacent or opposite fold.

a. An anterior median fold (*amf.*) marks the division between the antero-external and antero-internal conules (and conulids); it appears as a more or less distinct fold in the newly erupted tooth; in an older tooth it may persist either as a fold open to the margin or as an enamel island with or without an indication of its former continuity with the marginal enamel. There may be a small accessory style on the cingulum in the angle of the fold.

b. The anterior internal fold (*aif.*) is practically always united with one or more of the other anterior folds.

c. The anterior secondary fold (*asf.*) is between the antero-external conule and the anterior cingulum; it is usually small and isolated.

d. The anterior labial fold (*alf.*) is between the antero-external conulid and the anterolophid; it is never well defined, rarely open at the margin.

e. The anterior primary fold (*apf.*) is between the antero-internal conulid and the anterior cingulum; it is well defined, either open at the margin or isolated and frequently constricted into two or more islands.

REMARKS.—In the diagram (Fig. 1) of the oryzomyine enamel pattern, all the folds described above are shown in an unmodified condition. A study of a large number of samples representing practically all species of oryzomyine rodents leads to the belief that the enamel pattern of any one species

³ The first internal fold (*if.* 1) is homologous with the island figured by Wood and Wilson (1936: 389, Fig. 1*a*) between protolophules I and II; the second (*if.* 2), with the island between metalophules I and II. The protolophules and metalophules are distinguishable in the oryzomyine dental pattern (more especially pronounced in the "*Rhipidomys-Thomasomys*" group), but need not be discussed here for the purpose of identifying the various folds.

may be derived from the diagram simply by indicating which folds are normally absent (i.e., absence of the corresponding lophs or crests), normally isolated from the marginal enamel (i.e., fusion of the corresponding lophs or crests), or normally coalesced (usually the internal fold) with another. This can be determined with certainty only in unworn teeth. As a result of wear, not necessarily excessive, complications arise in the enamel pattern. Folds primarily open at the margin may become secondarily isolated, coalesce secondarily with other folds, constrict into two or more enamel islands, or disappear entirely. In such instances the true nature of any one fold or island may be determined by its position relative to other folds or islands or, preferably, by tracing it through teeth of successively less wear to its earliest definable stage. Finally, it must be noted, that the enamel pattern, just as any other character composed of numerous structural details, is replete with instances of individual, local, and geographic variations.

Names of cusps	Lower molars (B)
Upper molars (A, C, D)	1. Protoconid
1. Protocone	2. Hypoconid
2. Hypocone	3. Metaconid
3. Paracone	4. Entoconid
4. Metacone	5. Anterolophid
5. Anteroloph	6. Anterior cingulum
6. Anterior cingulum	7. Mesostylid
7. Mesostyle (may be laterad of mesoloph, as shown, or antero- laterad of mesoloph)	8. Posterior cingulum
8. Posterior cingulum	9. Mesolophid
9. Mesoloph	10. Antero-internal conulid
10. Antero-external conule	11. Antero-external conulid
11. Antero-internal conule	[metastylid—not shown, fre- quently present between meso- stylid and metaconid]
Names of folds (all teeth)	AMF. Anterior median fold
NF. Minor fold	ASF. Anterior secondary fold
MF. Major fold	ALF. Anterior labial fold
PF. 1. First primary fold	APF. Anterior primary fold
PF. 2. Second primary fold	AIF. Anterior internal fold
SF. 1. First secondary fold	
SF. 2. Second secondary fold	
IF. 1. First internal fold	
IF. 2. Second internal fold	

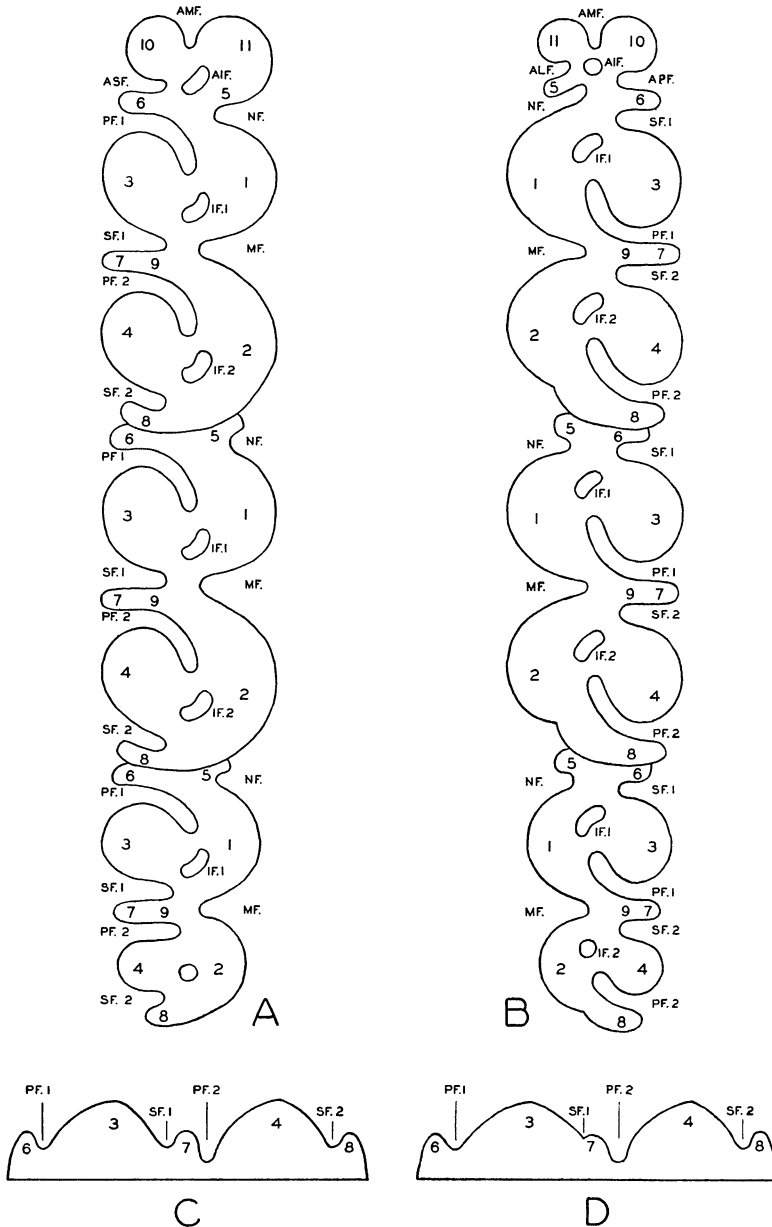


FIG. 1. Diagram of the enamel pattern of the molar teeth of oryzomyine rodents. A, occlusal surface of upper right molar row; B, occlusal surface of lower left molar row; C, labial profile of right upper second molar; D, same as C but with paracone and meso-style fused, the first secondary fold isolated from the marginal enamel. For explanation of labeling see opposite page and text.

GENUS *NECTOMYS* PETERS

(Synonymy under subgenera)

DISTRIBUTION

Tropical zones of South and Central America from Nicaragua in the north, south to a line roughly drawn from the coast of Ecuador on the west through the Amazonian drainage basin of Peru and Bolivia to the coast of Rio Grande do Sul, Brazil, on the east.

GENERIC CHARACTERS

EXTERNAL.—Size, as compared with other oryzomyine rodents, moderately large to extremely large; pelage long or moderately long with the wool hairs and guard hairs well developed; color of upper parts buffy to tawny with a mixture of dark brown, sides paler, undersurface never sharply defined, whitish or grayish with a light to heavy wash of ochraceous at least on belly and chest; ears small, thinly clothed with hair; tail epidermis uniformly brown or slightly paler beneath than on upper surface, never sharply bicolor, bristles of upper surface short, longer beneath, three bristles to each of the imbricated scales; hind foot large and powerfully built, markedly longer than wide and thinly haired above; fifth hind toe, less claw, extends from one-third to three-fourths length of first phalanx of fourth toe; digital tufts thin and short with only a few bristles reaching beyond proximal one-half of claws; webs well developed between first phalanges of the three middle toes, present but reduced between hallux and second toe, reduced or obsolete between fourth and fifth toes.

CRANIAL.—Skull large, heavy, flattened on dorsal surface, rostrum relatively thick, brain case receding; supraorbital ridges well developed and strongly beaded; temporal ridges distinct but less developed, the anterior parts prominent and divergent, posterior portions convergent and extended back to interparietal without deflection at sutures of lateral wings of parietals; a median interparietal suture often present; width of interparietal about equal to, or usually less than, width across ridges at fronto-parietal sutures; lambdoidal crests well developed; hamular, or mastoid, process of squamosal short and broad, the dorsal border slightly, sometimes not at all, excised; zygomatic plate wide and forward projecting, about one-third to one-half its width visible when viewed from above; zygomata heavy, widely expanded behind, convergent anteriorly; posterior border of incisive foramina situated well in front of anterior plane of first molars; postero-lateral palatine fossae well pitted or reticulated and continued forward as lateral palatal gutters to posterior border of incisive foramina; bullae heavy, slightly inflated.

DENTAL (Figs. 4 and 5).—Incisors robust, moderately or strongly recurved; molars large, with high crowns, low crests, their dentine exposed at an early stage in wear; combined width of right and left first upper molars about equal to or greater than the least distance between them; m^1 with the usual three main roots, a small middle outer fourth, and usually a fifth or accessory root which projects from its inner side; m_1 usually with a pair of accessory roots between the two main roots; m^2 and m^3 with three main roots and, frequently, with a fourth, or accessory, root; m_2 and m_3 with two or three well-developed roots each. Mesostyle fused with paracone (Fig. 1, *d*), the mesostylid fused with the entoconid; anterior cingulum of first molars not divided into two distinct conules in adult dentition; anterior cingula of m_{2-3} weakly developed or obsolete. All anterior folds of upper and lower molars isolated from the marginal enamel and may be represented by two or more enamel islands or, frequently, coalesced into a single sub-crescentic or subovate island; primary folds broadly outlined and extended obliquely across crown to enamel of opposite cusp, usually isolated in adult dentition, but open to the margin in the recently erupted or slightly worn m^{1-2} , and often to moderately worn m_{1-2} ; in unworn teeth, the first primary fold is coalesced with the first internal fold in m_{2-3}^{1-2} , the second primary fold with the second internal in m_{1-3}^{1-3} ; secondary folds of upper and lower molars very short, usually isolated in newly erupted teeth or at an early stage in wear; first secondary fold of m_{2-3} minute or obsolete in newly erupted teeth, absent in adult dentition; second secondary fold of m^{1-3} weak (or absent in m^3) and tending to disappear after moderate wear; first internal fold of m_{2-3}^{1-2} and second internal fold of m_{1-3}^{1-3} never discrete, always coalesced with corresponding primary folds, first internal fold of m_1 discrete or coalesced with either first primary, first secondary, or with both; minor fold nearly obsolete or absent in m^{2-3} , present or absent in m_{2-3} .

TAXONOMIC POSITION AND RELATIONSHIP

The position of *Nectomys* within the oryzomyine group has been anticipated in the above description. That typical *Nectomys* has been placed with or near the *Sigmodon*-like *Holochilus* by some authors is due, at least partly, to a confounding of the remarkable extent of parallelism in the external characters of these two forms with a similar degree of genetic affinity between them. In a like fashion, *Sigmodontomys*, the atypical section of the genus *Nectomys*, when first described (Allen, 1897: 38), was compared with *Sigmodon* itself. Ordinarily, a glance at the skull or even a single cheek tooth of the truly sigmodont rodents⁴ suffices to distinguish them from all

⁴ A natural supergeneric group of cricetines comparable to the oryzomyine group; it includes *Sigmodon*, *Sigmomys*, *Holochilus*, *Reithrodon*, and others too little known by me to be assigned here with certainty.

oryzomyine rodents. To Winge (1888: 11) belongs the credit of being the first to recognize and emphasize the wide separation of typical *Nectomys* from *Holochilus*⁵ and the nearness of the former to *Oryzomys* (*sensu lato*).⁶ Subsequently, Goldman (1913: 7) referred *Sigmodontomys* to *Nectomys* and formally (1918: 13) treated the enlarged genus as most nearly related to *Oryzomys*. Finally, Thomas (1928: 260) tardily conceded the truth of Winge's conclusions regarding *Holochilus* and *Nectomys*, but, failing to appreciate Winge's evidence respecting the nearness of *Nectomys* to *Oryzomys*, he suggested that "*Nectomys* shows relationship with *Rhipidomys*." Very probably, *Nectomys* is more nearly related to *Rhipidomys* than to *Holochilus*, but only in the sense that the oryzomyine group may be nearer the short palate "*Rhipidomys-Thomasomys* group" defined by Thomas (1917: 194)⁷ than to the sigmodont group.

Each of the structural details of the external, cranial, and dental characters of *Nectomys* is distributed with little or no modification, allowing for proportional size differences, among the several species of oryzomyine rodents. It is only in the peculiarity of the selection and combination of these details that generic distinction is determined in *Nectomys*. Goldman (1918: 13) referred to the high molar crowns of *Melanomys*, their sculpture, "especially the early exposure of dentine," and the position of the lachrymal, "its attachment being mainly with the maxilla as in that genus [*Nectomys*] instead of about equally with maxilla and frontal as in typical *Oryzomys*," as characters suggesting intergradation of *Melanomys* with *Nectomys*. These, however, are merely similarities of details in the structure of characters which are otherwise grossly different. The position of the lachrymal is a character which I fail to appreciate; the high crowned molars of *Melanomys* differ from those of *Nectomys* in size, outline, and in a number of details of the enamel pattern, notably the short first primary fold of m^2 which never coalesces with the first internal fold, and the usually bipartite first secondary fold in m^{1-3} .

The recognition of community in the details of structure within a common framework does not imply that *Nectomys* intergrades with *Melanomys* or with any other superspecific category of oryzomyine rodent. It emphasizes, rather, the intimate relationship and nearness to a common stock of otherwise divergent forms.

⁵ The *Sigmodon* of Winge.

⁶ The *Calomys* of Winge.

⁷ Included were *Rhipidomys*, *Thomasomys* (= *Aepeomys* and *Inomys*, *vide* Osgood 1933: 161), *Phaenomys*, and *Delomys*, to which may be added the North American *Nyctomys*, *Otonyctomys*, *Megadontomys*, *Peromyscus* (*s.s.*), and *Ochrotomys* (*s.g.*); it would be appropriate to refer to these genera collectively as the peromyseid group were the genus *Peromyscus* disembarassed of the *Akodon*-like *Haplomyiomys* and *Podomys*, which, though frequently retaining the mesostyle and mesostylid, lack the mesoloph and mesolophid. Except for these two, the dental pattern of the group is essentially oryzomyine.

CLASSIFICATION OF THE SPECIES AND SUBSPECIES OF *NECTOMYS*

Thirteen forms have been included in the literature at one time or another as distinct species of *Nectomys*. Representatives of nine of these have been examined and found referable to either *N. squamipes* or *N. alfari*. A tenth, *grandis*, to judge from its description, may be confidently assigned to *squamipes*. The distinctions between the two species, *squamipes* and *alfari*, are considered to be of sufficient importance to warrant subgeneric separation. Hence, *N. squamipes* remains the type of the typical subgenus, while *N. alfari*, originally described as type of the genus *Sigmodontomys*, here remains the type of subgenus *Sigmondontomys*. For the remaining three species, *hammondi*, *saturatus*, and *dimidiatus*, which were not seen, a special section is provisionally established and, insofar as the intrageneric status and interspecific relationships of these species are concerned, denominated the *incertae sedis* group. The characters ascribed to each of the species of this group have not been considered in the subsequent accounts of the recognized subgenera. Although it is probable that one or more of these species may be accommodated by either of the two subgenera of *Nectomys*, it is no less probable that one or more of them are not truly *Nectomys*.

Subgenus *Nectomys*

	<i>Type Locality</i>
<i>Nectomys squamipes squamipes</i> Brants	São Sebastião, São Paulo, Brazil (restricted).
<i>Nectomys squamipes aquaticus</i> Lund	Lagõa Santa, Minas Geraes, Brazil.
<i>Nectomys squamipes olivaceus</i> (nov.)	Therezopolis, Rio de Janeiro, Brazil.
<i>Nectomys squamipes pollens</i> Hollister	Sapucaý, Paraguay.
<i>Nectomys squamipes mattensis</i> Thomas	Chapada, Mato Grosso, Brazil.
<i>Nectomys squamipes amazonicus</i> (nov.)	Tauary, Pará, Brazil.
<i>Nectomys squamipes melanius</i> Thomas	Lower Essequibo River, British Guiana.
<i>Nectomys squamipes apicalis</i> Peters	Tena, Ecuador (redetermined).
<i>Nectomys squamipes napensis</i> (nov.)	San Francisco, Río Napo, Ecuador.
<i>Nectomys squamipes montanus</i> (nov.)	Hacienda Exito, Huanuco, Peru.
<i>Nectomys squamipes garleppii</i> Thomas	Río Oecobamba Valley, Cuzco, Peru.
<i>Nectomys squamipes vallensis</i> (nov.)	Santa Ana, Cuzco, Peru.
<i>Nectomys squamipes magdalenae</i> Thomas	Río Magdalena, Cundinamarca, Colombia.
<i>Nectomys squamipes grandis</i> Thomas	Concordia, Medellín, Colombia.
<i>Nectomys squamipes palmipes</i> Allen and Chapman	Princetown, Trinidad.

Subgenus *Sigmodontomys*

<i>Nectomys alfari alfari</i> Allen	Jiménez, Limón, Costa Rica.
<i>Nectomys alfari efficax</i> Goldman	Cana, Panama.
<i>Nectomys alfari russulus</i> Thomas	Valdivia, Antioquia, Colombia.
<i>Nectomys alfari esmeraldarum</i> Thomas	San Javier, Esmeraldas, Ecuador.

Incertae Sedis

- Nectomys saturatus* ThomasIbarra, Imbabura, Ecuador.
Nectomys hammondi ThomasMindo, Pichincha, Ecuador.
Nectomys dimidiatus ThomasRío Escondido, Nicaragua.

NOTE.—Judging from the original description of *Oryzomys intectus* Thomas (1921b: 356), I see no reason for agreeing with Ellerman (1941: 351, 362) that this species “probably belongs” to the genus *Nectomys*.

SUBGENUS *NECTOMYS* PETERS

Nectomys Peters, 1861: 151 (*squamipes*, *palmipes*); Lilljeborg, 1866: 19 (*squamipes*, *apicalis*); Fitzinger, 1867: 84 (*aquaticus*); Burmeister, 1879: 212 (*squamipes* with synonyms *aquaticus* and *robustus*); Thomas, 1882: 101 (subgenus of *Holochilus*); Winge, 1888: 12, 57; Thomas, 1897a: 496, 7 (*squamipes*, “*Hesperomys rattus*,” *palmipes*, *apicalis*, *grandis*, *magdalenae*, *fulvinus*); Thomas, 1897b: 486; Palmer, 1904: 451 (*squamipes*, *apicalis*); Trouessart, 1905: 412, part (*squamipes*, *rattus*, *apicalis*, *garleppi* [sic], *palmipes*, *grandis*, *magdalenae*, *fulvinus*); Miller, 1912: 180, part (*squamipes*, designated as type); Winge, 1924: 37, 126; Weber, 1928: 293; Gyldenstolpe, 1932: 65, part (*squamipes*, *palmipes*, *apicalis*, *grandis*, *fulvinus*, *garleppi*, *magdalenae*); Tate, 1932a: 6, part (*squamipes*, *aquaticus*, *apicalis*, *robustus*, *rattus*, *palmipes*, *grandis*, *magdalenae*, *garleppi*, *fulvinus*); Ellerman, 1940: 39; 1941: 361, part (*apicalis*, *fulvinus*, *garleppi*, *grandis*, *magdalenae* *palmipes*, *squamipes*).

Hesperomys, Hensel, 1873: 28, part (*squamipes*).

Potamys Liais, 1872: 505 (type *brasiliensis* = *aquaticus*).

Holochilus, Fitzinger 1867: 89, part (*robustus* only, not “*squamipes* Burm.,” *ibid.*, p. 90); Thomas, 1896: 1020 (*Nectomys*, synonym).

TYPE.—*Mus squamipes* Brants (designated by Miller, 1912: 180).

SUBGENERIC CHARACTERS

EXTERNAL.—Largest of the oryzomyine rodents; pelage characterized mainly by the long glossy guard hairs of dorsum; tail three-fourths or more combined length of head and body, the bristles of ventral surface combine to form a more or less distinct keel, a thin but well-defined pencil present; proximal half of tail with 9–12 scale rows per centimeter; hind foot (Fig. 2, *c-d*) with a short but well-developed fringe of bristles; fifth toe, less claw, barely extends to middle of first phalanx of fourth toe; sole, from heel to tips of digits, heavily scutellated; swim membrane of hind foot extremely developed, web extends from second phalanx of hallux to base of first phalanx of second toe, from third phalanx of second and fourth toes to base of third phalanx of middle toe, and from third phalanx of fifth toe to base of first phalanx of fourth toe.

CRANIAL.—Skull largest of the oryzomyine rodents, heavily built; nasals narrowly tapered behind, and usually pointed at their base; supraorbital ridges raised, posterior halves of temporal ridges markedly weaker than anterior halves; incisive foramina well open, broader behind than in front, the posterior borders rounded or square; median border of alveolar part of maxilla behind m^3 not projecting as a ledge over posterolateral palatal fossa, the palato-maxillary suture visible on ventral aspect behind alveolus of m^3 (Fig. 3, *a*); sphenopalatine vacuities small or absent.

DENTAL (Fig. 4, *a-c*; Fig. 5, *a-b*).—Upper and lower second and third molars distinctly longer than wide; m_2 and m_3 each with two roots; antero-

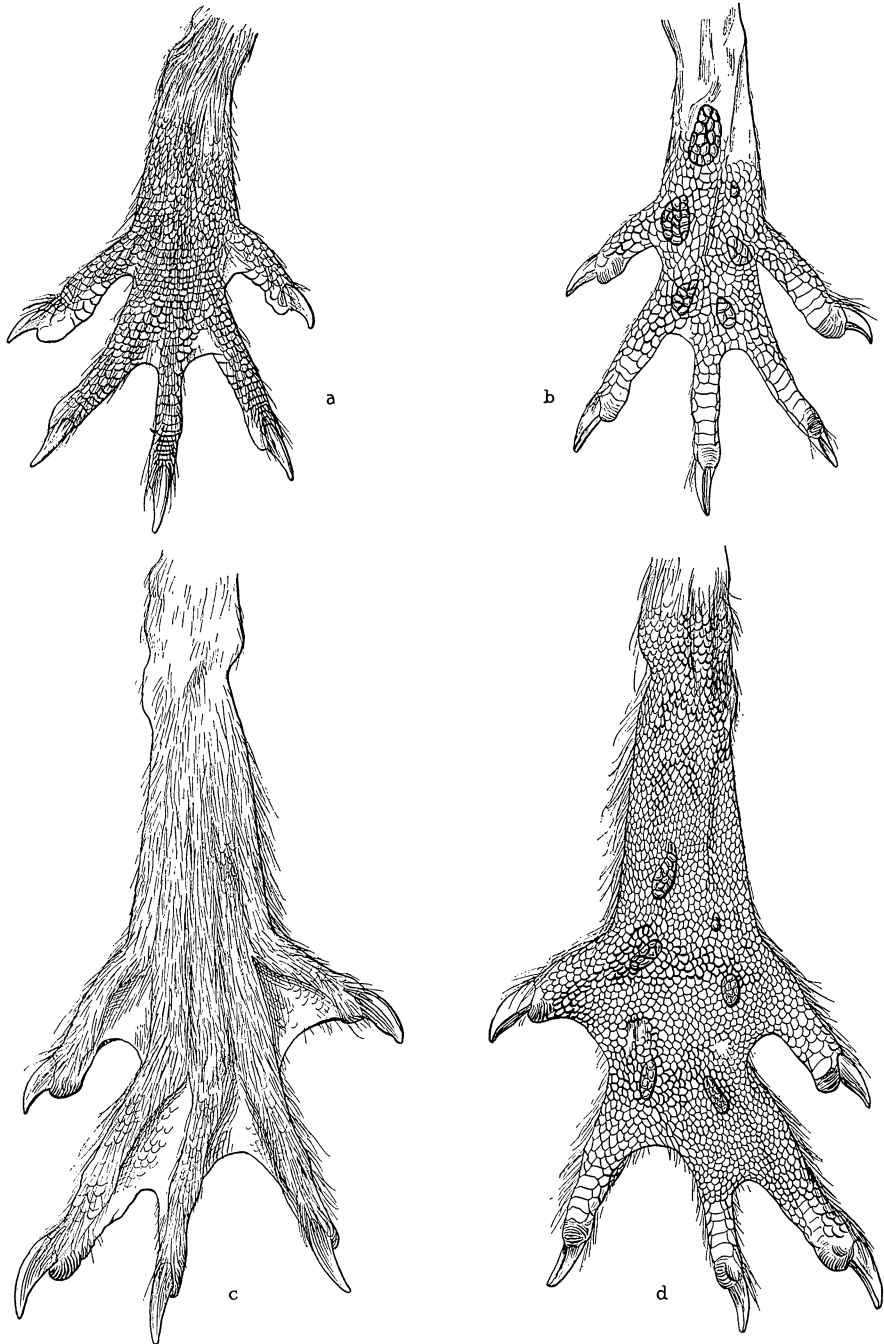


FIG. 2. Dorsal and ventral surfaces of right hind foot of *Nectomys alfarí* (a-b) and *Nectomys squamipes* (c-d).

lophid usually present in m_2 , present or absent in m_3 , sometimes absent in both m_2 and m_3 ; in unworn dentition, anterior cingulum of m_2 nearly obsolete, present but weakly developed in m_3 , the first secondary fold of m_{2-3} correspondingly affected; primary folds usually isolated at a moderate stage in wear (i.e., in adult); second secondary fold of m^3 present in recently erupted tooth and may persist for a short period.

REMARKS.—The subgenus includes but a single species, *N. squamipes*; of the oryzomyine rodents, this is the largest and most highly specialized for aquatic life.

NECTOMYS SQUAMIPES BRANTS

(Complete synonymy under subspecies)

THE SPECIFIC SYNONYMS AND THEIR TYPE LOCALITIES

Apicalis (*Nectomys*), Peters (1861: 152, Pl. 1, Fig. 1, Pl. 2, Figs. 3–3b)

The type of *apicalis*, to judge from the original description, agrees in every respect, except for its aberrant white-tipped tail and white incisors,

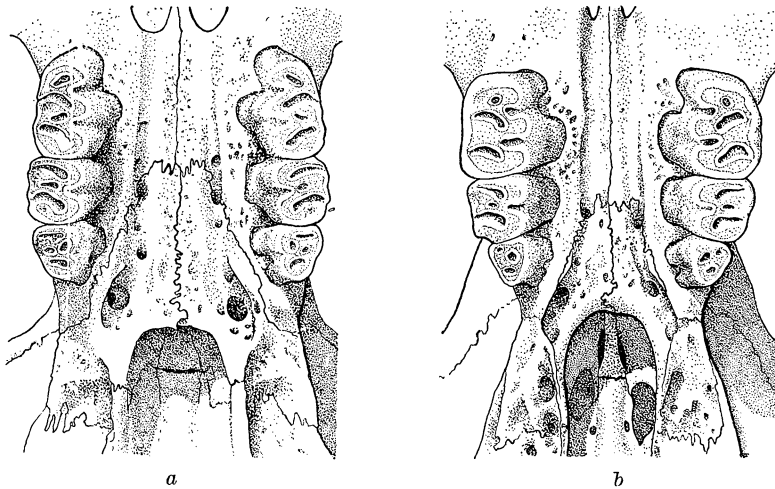


FIG. 3. Palate of *Nectomys* (a) and *Sigmodontomys* (b). Compare position of palato-maxillary suture relative to the posterolateral palatal fossae.

with the large race of *squamipes* of the eastern Andes of Ecuador. In addition to the original color plate and figures of the skull, no better evidence of the identity of the eastern Ecuadorian water rats as representatives of *apicalis* can be afforded than the striking agreement of their measurements with those of the type. Such complete agreement in diagnostic characters (given below) as well as in the more important details of structure cannot be noted elsewhere.

The type locality of *apicalis* was originally given as "Guayaquil," but Peters (1861: 156) qualified this by stating that "das einzige Exemplar ist

mit anderen Naturalien aus Guayaquil von Hrn. Cuming gekauft worden." Obviously, neither the world port, Guayaquil, nor its vicinity could be the natural habitat of *apicalis*, since typical *Nectomys* does not range west of the Andes. The evidence is that the type of *apicalis* was taken in eastern Ecuador, but, like *Nectomys fulvinus* (see below) and many other natural history specimens from eastern Ecuador, was labeled as native to the locality in which it was purchased. It is proposed, therefore, to fix upon Tena (altitude, 512 meters), at the base of the eastern Andes in Ecuador, as the type locality of *apicalis*. The selection of Tena is not altogether arbitrary. Specimens of undoubted *apicalis* are available from Tena and other near-by localities. In addition, Tena is one of the chief terminal posts on the most widely used trail since colonial days from Quito to eastern Ecuador.

Aquaticus (*Mus*), Lund (1841a: 240)

Both Peters (1861: 150) and Winge (1888: 143) examined the type of *aquaticus*, described from Rio das Velhas, Minas Geraes, and referred it to the species *squamipes*. Peters, however, remarked that *aquaticus* was paler than Brant's *squamipes*, though otherwise similar. With the type locality of typical *squamipes* now restricted (see below), the name *aquaticus* is available for the slightly paler race of water rats of the upper Rio São Francisco Valley, Minas Geraes, Brazil.

Brasiliensis (*Potamys*), Liais (1872: 505)

In Minas Geraes, possibly at or near Lagôa Santa, Liais captured an animal which he identified (p. 548) as *Mus aquaticus* Lund. His extensive practice of substituting for well-established names others which he considered more apt led him to describe the animal in question under the new name *brasiliensis*. Furthermore, Liais' generic name *Potamys*, for *brasiliensis* is not only a synonym of *Nectomys* but a homonym of *Potamys Larranhaga* [1823] as well.

Fulvinus (*Nectomys*), Thomas (1897a: 499)

According to Thomas, the type locality is "believed to be Quito. The specimen comes from the collection of the late Sir W. Jardine, for whom a large number of skins were collected in Quito by Mr. Jameson. Sir W. Jardine also had a few specimens from Cayenne; but as we have already seen that the Surinam *Nectomys* appears referable to *N. squamipes*, the Quito locality is no doubt that of the present very different animal." The description of this animal and the fact that it was subsequently assigned to the *squamipes* group by Thomas (1913: 571) leave no doubt as to its position within the genus. It is certain, on the other hand, that Quito is not the habitat of *fulvinus*, since no *Nectomys* of any kind is native to that locality. It is equally certain that *fulvinus* did not originate from the Guianas, for

Jameson, its collector, never visited the Guianas (Anderson-Henry, 1876: 19), nor is there reason for contradicting Thomas by supposing that *fulvinus* bears any color resemblance to *melanius* of the Guianas. Thomas described *fulvinus* as "distinguishable from all others [of the *squamipes* group] by its deep fulvous color which more nearly resembles that of some of the *Couesi* group of *Oryzomys* than that of the other members of the present somber-coloured group." Every detail of the original description of *fulvinus* conforms to specimens of *apicalis* from eastern Ecuador. The emphasis placed by Thomas on the "unusually short" fur of *fulvinus* with "the hairs only about 10–11 millim. in length on the back" as being, presumably, a specific character is a condition not unusual among mature individuals of *apicalis*. Indeed, the dorsal hairs of very old individuals are even shorter. In addition, there is strong evidence that *fulvinus* was taken in the vicinity of the type locality, as redetermined, of *apicalis*. Jameson, who resided for the greater part of his life in Quito, collected natural history specimens from the regions to the east and west of the Ecuadorian Andes as well as in Quito. Many of these specimens were sent to England without precise locality data. In the absence of *Nectomys* from Quito and of members of the *squamipes* group west of the Andes, it is certain that *fulvinus* was collected by Jameson somewhere east of the Andes during his excursion from Quito to the Río Napo via Papallacta, Baeza, Archidona, and Tena (Jameson, 1858: 337). Accordingly, *fulvinus* is here treated as a synonym of *apicalis*.

Garleppii (*Nectomys*), Thomas (1899: 41)

In the original description, the type locality given is "Ocabamba, Cuzco." "Ocobamba, Peru," is the locality written on the original labels accompanying two topotypes (U.S.N.M. No. 86917–18, skulls only) taken by the same collector, Otto Garlepp, at the same place and at approximately the same time (September 18, October 1, 1897). Subsequent to the first description of *garleppii*, some confusion has arisen concerning the exact location and altitude of the type locality. Thomas, in 1921(a), listed the mammals known from the district of Cuzco and included the specimens of *garleppii* from "Ocobamba," collected by Garlepp. Later, Thomas (1928: 260), in recording specimens of water rats from the Río Ucayali, remarked that they "agree very well with the type, which came from Ocobamba on the Apurimac higher up the same river." Evidently, Thomas referred to a similarly named but different locality which is shown on some maps as situated on a tributary of the Río Apurimac in the department of Apurimac. Gyldenstolpe (1932: 68) gave the type locality of *garleppii* as "Central Peru, Ocobamba Valley, Cuzco District. Alt. 9100 feet." In any case, it is obvious from the original announcement by Thomas (1899: 41) as well as from the known itinerary of Garlepp that the type specimen was taken in the dis-

trict of Cuzco. Furthermore, however the precise locality in question, within the district of Cuzco, may have been spelled, it could be no other than Occobamba,⁸ the only village, at least at that time, in the Occobamba Valley.

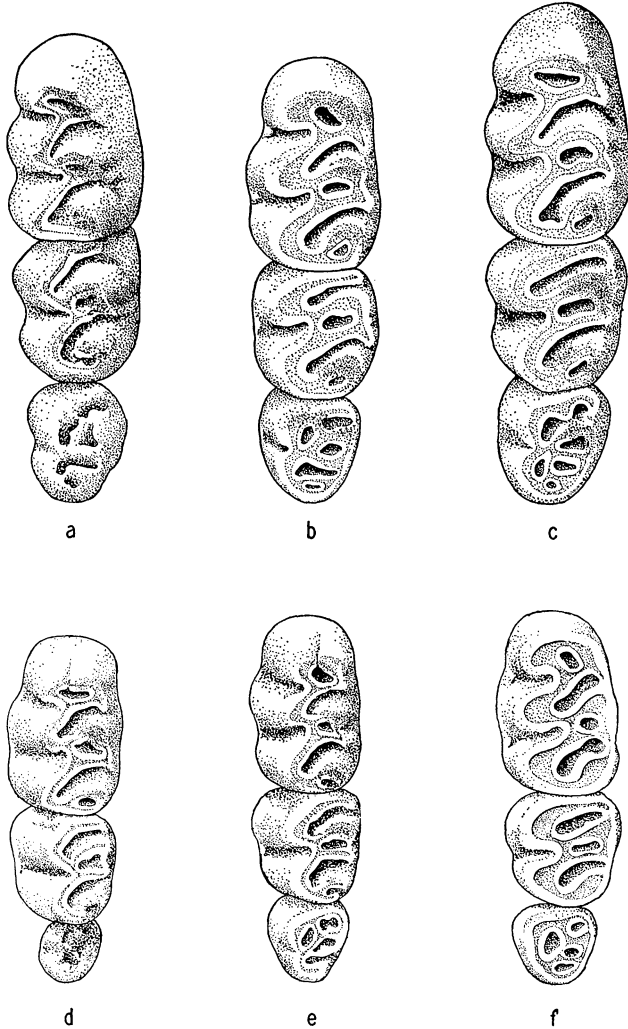


FIG. 4. Left upper molars of *Nectomys squamipes* (a-c) and *Nectomys alfari* (d-f) magnified about eight times. (a) *N. squamipes apicalis*, juvenile, bone removed to expose m^3 ; (b) *N. s. pollens*, subadult; (c) *N. s. apicalis*, young adult; (d) *N. alfari emeraldarum*, juvenile, m^3 uncut; (e) *N. a. efficax*, subadult; (f) *N. a. efficax*, adult.

⁸ A Quichua name derived from *Occo* (also *Hocco*, *Occa*, or *Oco*) meaning humid, and *bamba* (= *pampa*) meaning plain. Hence Occobamba is equivalent to *puna* or *páramo* and, as a name, characterizes the upper border of the Occobamba Valley. Ordinarily, in Spanish orthography one "c" in Occobamba would be dropped.

Marcy (1875: 283-354), who traveled over the same route taken by Garlepp from Cuzco to Occobamba, gave a picturesque description of the trail, the village, and the valley with a map and illustrations. The altitude, 9100 feet, given by Gyldenstolpe exceeds by a considerable amount the altitudinal range of the large *Nectomys*. This figure coincides with the altitude given by Heller (in Chapman, 1921: 18-19), but he is specifically referring to his camp site at Tocopqueyu in the Occobamba Valley. Since this site as well as that of the village of Occobamba, to judge from descriptions, is in the temperate zone, the type specimen of *garleppii* must have been taken at some station farther down the valley, in the subtropical or tropical zone. In this connection it may be noted that in the main valley of the Urubamba itself, water rats are known to occur up to, but not beyond, an altitude of 3500 feet.

Thomas first described *garleppii* as being "similar in most respects to *N. apicalis* but with decidedly shorter feet and broader skull." Present material from southeastern Peru does not bear out these differences or any others of a specific nature. Indeed, Thomas (1903: 238) concluded that *garleppii* "appears to grade into *squamipes*," and, later (1921a: 227), in recording a specimen from Río Comerciato, Peru, he remarked that it was "somewhat intermediate between *N. garleppii* and the North Peruvian *N. apicalis*." Nevertheless, the status of *garleppii* appears to be quite valid as a subspecies of *squamipes*.

Grandis (*Nectomys*), Thomas 1897a: 498

Known only from the type specimen with type locality in the lower Cauca Valley. The water rats of the main valley, the Magdalena, are all typical *Nectomys*, and the original description of *grandis* leads to the conclusion that the large specimens of *Nectomys* of the Cauca are also representatives of *squamipes*. A more complete analysis of the status of *grandis* is given in the subspecies account.

Magdalenae (*Nectomys*), Thomas (1897a: 499)

A skull only from "W. Cundinamarca, in lowlands near Magdalena R.," Colombia, served as basis for the description of *magdalenae*. Thomas categorized this form as a member of the *squamipes* group, all "species" of which "are very closely allied" but "each [is] representative of a distinct geographical district." According to the original description and the measurements of the skull it is clear that the type is a young adult and one of the group of subspecies of *squamipes* with proportionately long interparietals. Specimens of *Nectomys* with similarly long interparietals from localities higher up the Magdalena Valley are well marked externally and appear to represent a race of *squamipes* nearest *apicalis*. It is assumed that this material is not essentially different from the water rats of the type locality, and the subspecific characters of *magdalenae* are based upon it.

Palmipes (Nectomys), Allen and Chapman (1893: 209)

This form, originally described from Princetown, Trinidad, has already been assigned subspecific status by Tate (1939: 198), but in a much broader sense than appears to be warranted. *N. s. palmipes* is here treated as a race restricted to the island of Trinidad.

Rattus (Nectomys), authors (not "*Hesperomys Rattus*" [Natterer] Pelzeln, 1883: 73)

Since Thomas (1897a: 497) stated that "it is possible that '*Hesperomys rattus*, Pelzeln,' from Marabitanas, Upper Rio Negro (which, though the type is too young for certain determination, is clearly a *Nectomys*) may prove to belong to the common species," i.e., *squamipes*, authors have generally accepted *rattus* as a valid specific or subspecific name for the water rats of the Amazonian region west of the mouth of the Rio Negro. There is nothing in the original description of *Hesperomys rattus*, however, to lend substance to this opinion, nor has any evidence confirming it ever been presented. Pelzeln described in detail the hind feet of *Hesperomys rattus*, but made no reference to any webbing between the toes. On the other hand, he clearly pointed out the presence of webs on the hind feet of the *Nectomys*-like *Holochilus brasiliensis*, described on the same page. The measurements of *rattus* in the diagnosis are "*Longit. ad caudae basin* 10 cm., *caudae* 9 cm." In the description, the measurements given are "Ganze Länge 13" 4", Schwanz vom After 6 $\frac{1}{4}$ ", Höhe des Ohres 7", Länge der Tarse der Hinterfüsse von der Ferse bis an die Klauenspitze der längsten Zehe 1 $\frac{3}{4}$ ". I fail to identify the system of measurements employed in the latter description, since, as inches, they do not equal the corresponding ones given first in the metric system. The length of the hind foot reduced to millimeters on the same scale as the other measurements is 25.2, which is very short for an immature *N. squamipes* of comparable body size. It may be added further that the original description gives no grounds for assuming that the name *rattus* was based on an immature animal. Pelzeln meticulously specified the age of the specimens he recorded when these were other than adults. Until the type itself, if still extant, can be examined, *Hesperomys rattus*, if at all identifiable, cannot be identified as a *Nectomys*.

Available specimens of *Nectomys* from stations in southern Venezuela in the vicinity of the type locality of *rattus* are assignable to *melanius*.

Robustus (Hesperomys), Burmeister (1854: 164)

Burmeister described *robustus* from the incorrectly labeled type specimen of Brants' *squamipes* (see *squamipes* below). He declared (1854: 165) that he was unable to supply a more precise locality than Brazil for the specimen. At the same time, Burmeister added that Pictet (1844) had

recorded a like form under the name "*H. brasiliensis*" from Bahia. Undoubtedly, this record prompted Burmeister, in a later publication (1855: 6), to remark that the animal "bewohnt das nordöstliche Brasilien." He also added that *robustus* "ist wahrscheinlich Dr. Lund's *Hesp. aquaticus*." Finally, in 1879 (p. 212), Burmeister, in entire agreement with Peters (see *squamipes* below), stated that "*Mus aquaticus* Lund est un vrai *Nectomys* et identique au *N. squamipes* Licht. (*H. robustus* Burn.)." Though *aquaticus* is here treated as a valid subspecies, *robustus* remains identical

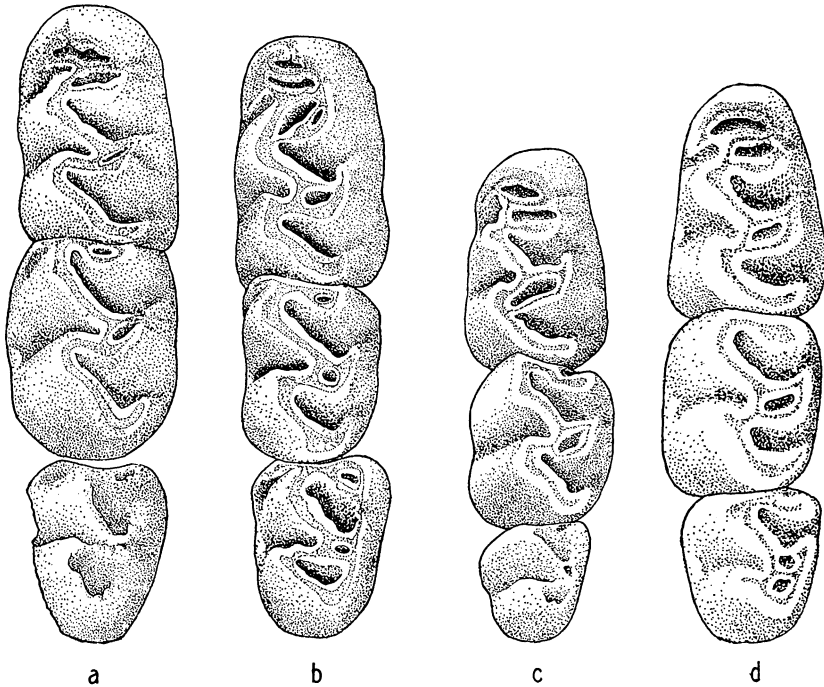


FIG. 5. Left lower molars of *Nectomys squamipes* (a-b) and *Nectomys alfari* (c-d) magnified about nine times. (a) *N. squamipes apicalis*, juvenile, m^3 uncut; (b) *N. s. amazonicus*, subadult; (c) *N. alfari esmeraldarum*, juvenile, m^3 uncut; (d) *N. a. efficax*, subadult.

with typical *squamipes* and is not available as a name for the water rats of northeastern Brazil, i.e., Bahia.

Squamipes (*Mus*), Brants (1827: 138)

This is the first described species of *Nectomys*. The type locality as originally given is "Brasilien." According to Peters (1861: 49), Brants, in an act of courtesy, credited the name *squamipes* to Lichtenstein, then director of the Berlin Museum, where the type was preserved. Lichtenstein, however, was unaware of the true identity of the specimen and labeled

it as a variety of *Mus decumanus* (= *Rattus norvegicus*). Burmeister, in collecting data for his great work, *Systematische Uebersicht der Thiere Brasiliens*, came upon the mislabeled type of Brants' *squamipes*, recognized its distinctiveness, and described it anew, as *Hesperomys (Holochilus) robustus* (1854: 164). He assumed that an unrelated, though superficially similar, animal in the same collection from Brazil which was labeled "*Mus brasiliensis*" (a true *Holochilus*) was the real type of Brants' *squamipes*. Burmeister added (1854: 166) that this specimen (the false *squamipes*) "ist von St. Paulo," Brazil. Since, as Peters further related, the original *squamipes* arrived at the Berlin Museum together with the specimen believed by Burmeister to be *squamipes*, it may be assumed for present purposes that both animals were taken in São Paulo. Gyldenstolpe (1932: 66) gave the type locality of *squamipes* as "Southern Brazil, Sao Paulo Province." In view of the strong tendency of the species to develop local races, it is advisable to restrict further the type locality to the coastal town of São Sebastião, whence originated three of the six available specimens of the typical race.

DISTRIBUTION

(Map 1)

Trinidad, Venezuela, the Guianas, Brazil, Paraguay, Misiones in Argentina; in Bolivia, Peru, Ecuador, areas at an altitude of approximately 2000 meters above sea level in the Amazonian drainage basin system, and in the Magdalena-Cauca Valley, Colombia, to not above 2200 meters. In general, the species is confined to forests—rain forest, gallery forest, or forest types bordering streams of the arid or semiarid parts of Brazil and the Andes. Known from the Pleistocene of Brazil.

The distributional pattern of *squamipes* is typical of many other mammalian species of, presumably, Brazilian or Amazonian origin. Such of these species, including *squamipes*, as have not spread at least as far as Panama in Central America, as a rule, are absent from the west coast and the western slopes of the western Cordillera of South America. Conversely, the Brazilian species which do appear west of the Andes in South America are present also at least in Panama in Central America. The inference is that modern mammalian species of Brazilian origin have probably gained access to the west coast of South America via the northeastern flanks of the Andes in northern Venezuela or eastern Colombia rather than by any direct, more southern trans-Andean routes, or by virtue of a pre-Andean origin and continuity of range. In Peru, species of mammals of Brazilian origin, including *squamipes*, by following the tributaries of the Amazon River, have penetrated deeply into the Andean valleys; but here the western Cordillera, like the eastern Cordillera of Ecuador and the immense plateau of Bolivia, provides no passes with favorable ecological situations for crossing over to the coast.

CHARACTERS

Essential characters those of the subgenus.

COMPARISONS

On the basis of external characters alone, the sigmodont water rat *Holochilus*⁹ could easily be confused with *squamipes*. There is no very appreciable difference between the two forms in size and proportions, character of pelage, or in the swimming modifications. Nevertheless, in *Holochilus* spp. the different color, especially the more clearly white, better-defined, underparts and usually bicolor tail, the well-haired ears, the shorter vibrissae, and the more granular, less scaly plantar surfaces of the hind feet distinguish them from *squamipes*. *Oryzomys ratticeps* is not much smaller than *squamipes*, but is a differently colored animal with a finely scaled tail and a relatively short foot provided with long digital tufts. The skull of *ratticeps* is proportionately large and superficially resembles that of *squamipes*, but is not nearly so heavily built; its nasals are broader behind, the frontals are narrower behind with the posterior sutures more rounded, the ridges are weak, the incisive foramina are considerably longer, and the cheek teeth are comparatively small and weak. Though *Oryzomys palustris* is a much smaller animal with a grossly different cranium, it exhibits external features characteristic of *squamipes*. Its small, comparatively weak, hind foot is fringed, the three middle toes webbed, and the ventral surface of the tail keeled, as in *squamipes*. If more were known of *Nectomys saturatus* (description given beyond) a careful comparison between it and *squamipes* would be in order.

The multirooted condition of the first molar (and often of the second upper molar) noted in *squamipes*, is not rare among other oryzomyine rodents (e.g., *palustris*, *laticeps*, *caliginosus*) and tends to vary individually and locally among them. In *squamipes* at least one accessory root is always present in the first upper molar, and there are two accessory roots in the first lower molar.

INDIVIDUAL VARIATION

EXTERNAL.—In this species it appears that the body and the hind foot grow appreciably in length after maturity and well into old age. Throughout the species, the tail varies from approximately 25 per cent longer to

⁹ It is difficult at present to refer to any one species of *Holochilus*. Thomas, who had added six species to the genus, finally concluded (1928: 260) that he had become "more and more convinced of the essential identity [= *brasiliensis* Desm.?] of all the *Holochilus* water rats of the whole Amazonian drainage area, from Pernambuco to Peru, Guiana to Bolivia and equally that of the Rio San Francisco." It is well to note, however, that Thomas (1897c: 548) spoke of *H. nanus* as having much the same relation of proportions to the large rats of the genus as *alfari* ("russulus") has to *squamipes*. In any case, it is certain that there are two or more well-defined species of *Holochilus*.

approximately 25 per cent shorter than the combined length of head and body. In general, among juveniles the tail, whether longer or shorter in the youngest individuals, grows at a faster rate than head and body combined and tends to exceed them in length. From adolescence to maturity the growth rate of the tail relative to that of head and body diminishes. In the adult their growth continues apace, or head and body combined may grow to exceed, and in old individuals frequently do exceed, the length of the tail. In *palmipes* the tail is shorter than, or sometimes equal to, the combined length of head and body in all adults examined, but in immature individuals the tail is sometimes longer than the combined length of head and body. In some of the races there are five plantar tubercles on each hind foot; in others there are five or six tubercles, with the sixth, a small wartlike modification of one or two scales on the outer posterior border of the sole, present or absent on either or both of the hind feet. In many cases, especially among the Andean races, increase in age after maturity is accompanied by a progressive decrease in the length and thickness of the pelage. The amount of gray, if any, on the keel of the tail is usually more extensive in old than in young individuals.

CRANIAL.—The median angle formed by the fronto-parietal suture varies from a straight angle to nearly a right angle; the outline of the anterior suture of the interparietal may be straight, concave, or convex; a median interparietal suture may be present or absent irrespective of the age of the individual; the outline of the posterior border of the palate varies from semicircular to nearly square and is sometimes provided with a short median spine; in any large series the hamular processes of the pterygoids measured along their ventral edges may be parallel sided or either slightly convergent or divergent, posteriorly, but in those skulls with the processes broken off the mesopterygoid fossa almost invariably appears to the eye broader anteriorly than posteriorly; in most of the races the anterior width of the fossa, measured at the pterygo-palatine suture, varies considerably in any one series, and the posterior width, measured on the basisphenoid behind the lateral walls of the fossa, varies even more and independently of the variation in the anterior width; the length, width, and outline of the incisive foramina vary in similar directions in all series of the species; frequently the incisive foramina are slightly constricted at a point from one-fourth to one-half their length from the anterior border. It appears that concurrent with the increasing length of the skull as age progresses, there is a relative, and perhaps actual, decrease in width of brain case and frontals accompanied by a flattening of their dorsal contours, an increased development of the ridges, particularly the temporal ridges, with a decrease in their divergence; at about the same time, the palatal region becomes correspondingly narrower, the postero-lateral palatal fossae more exca-

vated, the alveolar row relatively, often actually, shorter, and frequently the length of the interparietal shorter. On the other hand, the proportion of the zygomatic width to the condylo-basal length shows slight variation regardless of age or race; similarly, the ratio of the length of the nasals to the condylobasal length is fairly uniform.

DENTAL.—Most variation in the enamel pattern is due to wear alone, but a not insignificant amount appears to be individually inherent and may even be locally constant. Noteworthy is the variable degree of development of the anterolophid of m_{2-3} (defined by the minor fold). It is usually well developed to weakly developed in most of the subspecies, but in two races (*garleppii*, *vallensis*) the anterolophid is often weakly developed or absent. Insofar as can be determined from present material, it cannot be said that the sexes differ with respect to the size of the individual tooth or in the alveolar or crown length of the molar row. In adults the amount of wear of the molar crowns is not a reliable index to the age of the individual.

Practically nothing is known of seasonal variation among the mammals of the tropical and subtropical zones of South America.

REMARKS.—Included among the above individually variable characters are some which, in the past, have been considered significant in distinguishing various of the "species" or subspecies of *squamipes*. Several of these have been mentioned in the discussion of the synonyms of *squamipes*. In addition, apart from those subject to modification as a result of senescence, some of the above characters tend to be fairly constant in certain localities. Of these characters there are a few which, if final judgment were restricted to present, quite inadequate material, may be said to be constant in one or more of the subspecies. Such characters have been included in the subspecies accounts for their descriptive, if not diagnostic, value.

COLORATION AND COLOR PHASES

In all races except *palmipes*, *olivaceus*, and *magdalenae*, the colors of the dorsal surface and sides, exclusive of the basal parts of the hairs, are matched with Ridgway's scale 15', Plate XV. In these races, the sub-terminal bands of the cover hairs range from Ochraceous-Orange to Light Ochraceous-Buff, their tips and the terminal parts of the guard hairs range from Cinnamon-Brown to Prout's Brown. Hence, the differences in color between the various races (with the exceptions noted) are differences in tone and in the relative quantity and distribution of each of the two dominant colors. Thus, for example, in *melanius* the dark color (Prout's Brown) of the terminal parts of the guard hairs predominates on the dorsal surface; in *vallensis*, the pale color (Ochraceous-Buff) of the sub-terminal bands of the cover hairs predominates. In some forms, no one

color may predominate, in others, the dark may be concentrated in a narrow middorsal band or in the facial region. The three exceptions, *palmipes*, *magdalena*, and *olivaceus*, are collectively distinguished from all other races by the more yellow hue of orange of the subterminal bands of the cover hairs. The differences in color between these forms are simply those of tone and the relative quantity and distribution of each of the dominant colors just as in the other races.

In some of the races there are individuals which diverge markedly from the normal in color pattern and appear to represent a distinct color phase.

TABLE I

Comparison of the number of tawny phase individuals with the number of males and females of normal color in that particular series of a subspecies in which the tawny phase appears. The total number of specimens given for each series is exclusive of the individuals in juvenile pelage, all of which appear normal. Localities marked with an asterisk (*) represent two or more collecting stations within a relatively small and uniform area, from which the specimens were taken by the same collector and constitute, for practical purposes, a single series.

Sub-species	Locality	No. of Skins in Adult Pelage	Tawny ♀ ♀	Normal ♀ ♀	Tawny ♂ ♂	Normal ♂ ♂
<i>palmipes</i>	Princetown	9	1 (F.M. No. 4908)	2	0	6
<i>palmipes</i>	Caparo	13	1 (A.M. No. 7689)	6	0	6
<i>squamipes</i>	S. Sebastião	3	1 (F.M. No. 18200)	0	0	2
<i>melanius</i>	*Kartabo Region	13	2 (A.M. No. 42885, A.M. No. 42333)	4	0	7
<i>melanius</i>	Oko Mts.	4	1 (F.M. No. 46217)	1	0	2
<i>melanius</i>	Holmia	1	1 (F.M. No. 18542)	0	0	0
<i>melanius</i>	Oronoque	2	1 (F.M. No. 48409)	0	0	1
<i>melanius</i>	Pto. Indiana	2	1 (A.M. No. 73351)	0	0	1
<i>apicalis</i>	Pindo Yacu	4	1 (F.M. No. 43207)	0	0	3
<i>apicalis</i>	Curaray	10	2 (A.M. No. 7196, A.M. No. 7197)	4	0	4
<i>napensis</i>	*Río Napo	8	1 (U.M.M.Z. No. 80179)	3	0	4
<i>montanus</i>	Pozuzo	8	1 (F.M. No. 24123)	5	0	2
<i>pollens</i>	Annápolis	46	0	14	1 (A.M. No. 134382)	31

NOTE.—In the discussion and characterization of each of the subspecies of *squamipes*, the normal color only is described. Additional data on the above localities and the total number of specimens (including juveniles) from each locality will be found under the heading of "Specimens Examined" in the subspecies account.

In these individuals, the subterminal bands of the cover hairs are a tone or more darker, their tips and the terminal parts of the guard hairs a tone or more paler than usual. The net result of this closer approximation to each other of the two dominant colors is a more uniformly colored, more tawny individual. The closest approximation of the two colors occurs on the sides of the body, the rump, the thighs, and the head from nose to crown. Frequently, in these individuals this tawny color, instead of the

usual Ochraceous-Orange to Light Ochraceous-Buff, extends over the underparts as a wash. In the subspecies, in which normally one color strongly predominates over the other, the tawny phase individuals form striking contrasts to the other members of the series. Tawny phase individuals, as a rule, conform to the same general color pattern of the subspecies to which each belongs and, as such, are distinguishable among themselves. Between these and normal color individuals of either sex there is no apparent difference in other external and cranial characters.

In present material, tawny phase individuals have been noted in seven of the fifteen recognized races of *squamipes*. In six of these, *squamipes*, *melanius*, *apicalis*, *napensis*, *montanus*, and *palmipes*, the tawny phase is restricted to females. In the seventh race, *pollens*, the single tawny phase individual encountered is a male.

MEASUREMENTS

All measurements are in millimeters. Combined head and body length and tail length are the collectors' measurements; hind foot length to the longest claw was taken from the dry skin. Cranial measurements follow.

Condyllo-basal length.—Condyle to prosthion (gnathion of Thomas, 1905*b*).

Zygomatic breadth.—Greatest distance between outer sides of zygomata.

Nasals.—Greatest length.

Brain case.—Greatest distance between outer edges of temporal (parietal) ridges. The brain case proper tends to decrease in size relative to the condyllo-basal length, or the zygomatic breadth, as senescence progresses. In old individuals, however, because of the more heavily developed temporal ridges, the brain case measurement as given here is frequently greater in proportion to the width of the brain case proper than it is in younger individuals.

Alveolar row.—Distance between anterior edge of alveolus of m^1 and posterior edge of alveolus of m^3 .

Interparietal.—The length between the sutures at the median line and the greatest width at the lateral angles formed by the union of the sutures. In measuring the length in a few skulls, an excessive distortion in the outline of the sutures at the median line made it necessary to shift the calipers slightly to one side or to take an average of the median length and one or both of two lengths slightly to either side. In those instances where it was not possible to derive an equitable measurement in this manner, the length at the median line is given, though such measurement proves to be extreme in the series to which the skull belongs.

Percentage.—The proportion of the length to the width of the interparietal. The use of this ratio absorbs much, if not most, of the mechanical

error in measurement and eliminates from consideration the gross differences in the sizes of the skulls compared. Thus, it represents more clearly and compactly than do the actual dimensions the diagnostic character of the interparietal as visible to the eye.

Size.—The condylo-basal length, rather than the combined head and body length, of an average individual is used here as indicative of the size, whether large or small, of any subspecies. Because of the small number of comparable specimens in each of most of the subspecies and the great differences in gross size between young and old adults, as well as the disproportions in characters resulting from senescence, extreme caution must be exercised in referring to the measurements alone as a basis for intraspecific comparisons. In general, the individual here considered representative of the size of any subspecies is that one which has attained a maximum development in those cranial characters which tend to decrease in size, relatively or actually, as a result of senescence. Such characters, notably width of brain case and alveolar length, have already been discussed under "Individual Variation."

Nectomys squamipes squamipes Brants

(Pl. I, Figs. 1 and 2, cranium)

M[us]. squamipes Brants, 1827: 138; Fischer, 1829: 323; Schinz, 1845: 172, BRAZIL.

Mus squamipes, Peters, 1861: 148.

Hesperomys (Holochilus) robustus Burmeister, 1854: 164 (not "*Hesperomys squamipes* Licht.," *ibid.*, p. 165), BRAZIL (type locality); Burmeister, 1855: 6 (not "*H. squamipes* Licht'"); *ibid.* (Said to inhabit "Nordöstliche Brasilien").

H[esperomys]. squamipes, Wagner, 1843: 540, BRAZIL. Goeldi, 1893: 79, BRAZIL (southern coast). Leche, 1886: 690, Rio Grande do Sul (Taquara do Mundo Novo).

Hesperomys (Nectomys) squamipes, von Ihring, 1892: 14 (107), Rio Grande do Sul (Costa da Serra).

Hesperomys squamipes, Hensel, 1873: 34, Figs. 14, 24, Rio Grande do Sul (Porto Alegre).

Nectomys squamipes, Peters, 1861: 152, Pl. 1, Fig. 2, Pl. 2, Fig. 4; Burmeister, 1879: 212 (*robustus* Burm., synonym); Thomas, 1897a: 497 (part), Rio Grande do Sul; Thomas, 1901c: 528, Minas Geraes (Rio Jordão); Thomas, 1902a: 60, Paraná (Roça Nova); Hollister, 1914: 104, São Paulo (São Sebastião); Leuderwaldt, 1929: 28, São Paulo (Ilha de São Sebastião); Cabrera and Yepes, 1940: 208, São Paulo.

Nectomys squamipes squamipes, Gyldenstolpe, 1932: 66, "Type locality: Southern Brazil, São Paulo Province."

TYPE SPECIMEN.—Adult (skin with skull), Zoological Museum, Berlin; acquired, presumably, from Bescke.

TYPE LOCALITY.—São Sebastião, São Paulo, Brazil (restricted).

DISTRIBUTION.—In the states of São Paulo and Paraná, Brazil, from São Sebastião, on the coast, west into the area drained by the Rio Paraná. The range may possibly extend north to the Rio Paranahyba in the southwestern corner of Minas Geraes; west of the Paraná (and the Paranahyba) repre-

sentatives of *pollens* occur. The specimens recorded from eastern Rio Grande do Sul by authors (see above) are provisionally referred to *squamipes*.

CHARACTERS.—Comparatively small; pelage of dorsum long, soft, glossy; Ochraceous-Orange mixed with Prout's Brown; six tubercles usually present on the soles of at least one of the hind feet, sometimes only five tubercles on each; tail epidermis generally monocolour, the brown keel frequently mixed with gray; nasals usually more or less evenly tapered behind; proportion of length to width of interparietal averages 35.6 per cent (32–38 per cent, five specimens).

COLOR.—Back Ochraceous-Orange mixed with Prout's Brown; wool hairs, basal parts of cover hairs and guard hairs Neutral Gray; broad subterminal bands of cover hairs Ochraceous-Orange; extreme tips and terminal parts of guard hairs Prout's Brown; rump like back but with tips of guard hairs frequently gray; upper halves of sides like back but with less dark brown, lower halves nearly uniformly ochraceous; hairs of chest and belly Neutral Gray basally, paling subterminally to Gray, tips Ochraceous-Orange; head from nose to crown Cinnamon Brown or Prout's Brown lightly mixed with ochraceous; narrow orbital ring poorly defined; cheeks like sides; area around mouth, chin, throat, and ventral surface of fore and hind legs Pallid Neutral Gray to nearly white with a faint to medium-heavy wash of ochraceous; ears brown, thinly haired externally, nearly naked internally; vibrissae black at bases, terminally black, brown, or gray; fore and hind feet thinly covered above with white to brown hairs, brown plantar surfaces naked; hind foot fringed with white; tail uniformly brown except for a scattering of gray keel hairs, especially in the terminal one-fourth, in some specimens.

TABLE II

MEASUREMENTS OF *Nectomys squamipes squamipes*

All of the specimens are from the state of São Paulo; none of them is old.

Locality	Sex	Head and Body	Tail	Hind Foot	Condyllo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
S. Sebastião	♂	194	222	50.3	40.6	23.0	17.4	13.3	7.4	3.2 × 10.1	32
S. Sebastião	♀	190	200	49.3	38.7	21.0	16.4	13.6	7.0	4.1 × 10.8	33
S. Sebastião	46.6	38.4	22.0	16.8	13.5	7.4	3.9 × 10.7	36
Ipanema	♀	175	190	46.5	.....	.....	16.5	14.7	7.1	3.6 × 10.5	34
Itararé	♂	40.1	22.4	17.1	14.7	7.1	4.6 × 12.1	38

SPECIMENS EXAMINED.—Six. BRAZIL: São Sebastião, 3 (U.S.N.M., 2; F.M., 1); Ipanema, 1 (M.C.Z.); Rio das Pedras, 1 (M.C.Z.); Itararé, 1 (M.C.Z.).

REMARKS.—The Itararé and Rio das Pedras specimens (M.C.Z. Nos. 25769 and 25770, respectively), both in prime pelage, are quite like one topotype (U.S.N.M. No. 141457) in comparable pelage; the Ipanema specimen (M.C.Z. No. 17845), in old pelage, is practically indistinguishable from the second topotype (U.S.N.M. No. 172962) of like pelage; the third topotype (F.M. No. 18200) is a tawny phase female in old pelage. Apparently, restriction of the type locality of *squamipes* to São Sebastião on the coast in no wise affects the current nomenclature of the water rats from the other side of the Serra do Mar in the Paraná drainage basin of eastern São Paulo. At a comparatively short distance to the northeast, however, in the coastal drainage basin of the state of Rio de Janeiro, occurs the distinctly paler *olivaceus*.

Nectomys squamipes aquaticus Lund

M[us]. *aquaticus* Lund, 1841a: 240; Schinz, 1845: 193, Minas Geraes.

Mus aquaticus, Lund, 1841a: 266; Lund, 1841b: 279, 294; Lund, 1842a: 133; Lund, 1842b: 199; Lund (Damasio), 1935: 138, 162, 173, 190, 208; Wagner, 1843: 544; Peters, 1861: 150, 152 (synonym of *squamipes* Brants); Liais, 1872: 505, 548; Burmeister, 1879: 212 (synonym of *squamipes*).

[?] *Mus brasiliensis*, Pictet (not of Geoffroy), 1844: 53, Pls. 12–14, Pl. 23, Figs. 1, 2, Bahia.

[?] *Hesperomys (Holochilus) robustus*, Burmeister (not of Burmeister), 1854: 164 (part), Bahia (*Mus brasiliensis*, Pictet, listed as synonym, only); Burmeister (not of Burmeister), 1855: 6, “Nordöstliche Brasilien.”

Hesperomys (Holochilus) aquaticus, Burmeister, 1855: 6 (reference).

Potamys brasiliensis Liais, 1872: 505, 548, Minas Geraes (new name and description for *aquaticus*).

Nectomys squamipes, Winge, 1888: 57, 152, Pl. 3, Figs. 12–12a, Minas Geraes (Lagôa Santa).

TYPE SPECIMEN.—Adult male (skin with skull), Lund collection, Zoological Museum, Copenhagen.

TYPE LOCALITY.—Valle do Rio das Velhas, vicinity of Lagôa Santa, Minas Geraes, Brazil.

DISTRIBUTION.—Known only from the type locality. It is probable that *aquaticus* ranges throughout the whole of the Rio São Francisco drainage system in the states of Minas Geraes and Bahia. The specimens recorded from the town of Bahia (= São Salvador) may be referred, for the present, to *aquaticus*.

CHARACTERS.—Similar to *squamipes*, but slightly larger and paler; upper parts between Ochraceous-Buff and Ochraceous-Orange with a more or less uniformly light mixture of Prout's Brown; chest and belly more clearly defined, with less ochraceous; hind foot five- or six-tuberculate; keel brown mixed with gray, or almost entirely gray; proportion of length to width of interparietal averages 31.3 per cent (27–34 per cent, three specimens).

SPECIMENS EXAMINED.—Four. BRAZIL: Rio das Velhas, near Lagôa Santa, Minas Geraes, 4 (F.M.).

REMARKS.—Though the topotype series hardly merits separation from typical *squamipes*, it is advisable to conserve the name *aquaticus*, since the water rats occurring lower down the São Francisco drainage basin may reveal more marked differences. If this proves to be true, the topotype series may be regarded as an extreme approach, both morphologically and geographically, not only to *squamipes* on the south but also to representatives of *olivaceus* on the east and to representatives of *pollens* on the west.

TABLE III
MEASUREMENTS OF *Nectomys squamipes aquaticus*
None of the specimens is old.

Locality	Sex	Head and Body	Tail	Hind Foot	Condylo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
Rio das Velhas	♂	49.8	40.5	22.5	16.4	14.5	7.3	3.0 × 11.2	27
Rio das Velhas	♀	47.3	40.6	23.5	17.6	13.8	7.3	3.6 × 10.7	34
Rio das Velhas	♂	53.7	42.4	23.8	17.7	14.8	7.3	3.9 × 11.8	33

Nectomys squamipes olivaceus, new subspecies

TYPE SPECIMEN.—Adult male (skin with skull), F.M. No. 26574; collected July 8, 1926, by Colin C. Sanborn; original No. 1038.

TYPE LOCALITY.—Five miles north of Therezopolis, Rio de Janeiro, Brazil.

DISTRIBUTION.—In the states of Rio de Janeiro, Espirito Santo, and Minas Geraes, from the coast to the highlands drained by the Rios Parahyba and Doce.

CHARACTERS.—Size as in *aquaticus*, larger than *squamipes*; olivaceous in appearance, with more yellow than either *squamipes* or *aquaticus*; sub-terminal bands of cover hairs of upper parts and sides, and tips of hairs of undersurface Warm Buff; hind foot six-tuberculate; tail uniformly brown; proportion of length to width of interparietal averages 35.6 per cent (31–41 per cent, six specimens including one subadult).

COLORATION OF TYPE.—Dorsal surface Warm Buff mixed with Prout's Brown, the latter most concentrated in middorsal region behind shoulders; sides with less Prout's Brown, the lower halves nearly uniformly Warm Buff; belly and chest entirely Warm Buff, but with gray basal parts of hairs visible at the surface; undersurface of fore and hind legs and throat, except for small white gular patch, Neutral Gray washed with Warm Buff; narrow

mid-line of chin white; cheeks and upper lips like sides; hind foot brown fringed with white, six-tuberculate; tail uniformly brown.

TABLE IV
MEASUREMENTS OF *Nectomys squamipes olivaceus*
All specimens except the last listed are young adults.

Locality	Sex	Head and Body	Tail	Hind Foot	Condylo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
Therezopolis (type)	♂	181	194	50.4	39.8	23.7	17.5	14.3	7.3	4.9 × 12.0	41
Serra Caparaó	♀	187	193	50.9	38.1	21.9	16.2	14.5	7.5	3.9 × 9.7	40
Serra Caparaó	♀	188	202	51.1	38.1	22.6	16.5	14.8	7.7	4.0 × 12.2	33
Serra Caparaó	♀	192	209	52.7	38.5	22.3	16.3	14.6	7.5	3.4 × 11.0	31
Serra Caparaó	♀	187	198	50.0	38.8	22.3	16.6	14.4	7.0	3.7 × 11.2	33
Serra Caparaó	♂	209	210	53.2	42.5	23.7	18.2	14.6	7.2	.....	.....

SPECIMENS EXAMINED.—Seven. BRAZIL: Therezopolis, 1 (F.M.); Fazenda Cardoso, Serra Caparaó, Minas Geraes, 3360 feet, 6 (A.M.).

REMARKS.—The chief distinctive character of *olivaceus* lies in the more yellow hue of the subterminal band of the cover hairs of the upper parts and sides. These Warm Buff bands, together with the dark brown tips, give the animal an olivaceous appearance. In one specimen (A.M. No. 61859) of the Serra Caparaó series, however, the subterminal bands approach the ochraceous color of *squamipes* and *aquaticus*.

Nectomys squamipes pollens Hollister

Nectomys squamipes pollens Hollister, 1914: 104; Gyldenstolpe, 1932: 67, Pl. 7, Figs. 1-1b, PARAGUAY (Sapucay); Cabrera and Yepes, 1940: 208.

Nectomys squamipes, Thomas, 1903: 239 (part), PARAGUAY; Bertoni, 1914: 73, PARAGUAY (Alto Paraná).

TYPE SPECIMEN.—Adult male (skin and skull), U.S.N.M. No. 121399; collected July 27, 1902, by William Foster; original No. 800.

TYPE LOCALITY.—Sapucay, Paraguay; a station on the railroad line about halfway between Villa Rica and Asunción, in the region drained by the Tevicuarhy, a tributary of the lower Paraguay.

DISTRIBUTION.—In Paraguay from the southern half of the Río Paraguay east to the Río Paraná and Misiones, Argentina, thence north between the Paraná and the area drained by its western tributaries in Paraguay and the states of Mato Grosso and Goyaz, Brazil. East of the Paraná *pollens* probably grades into *squamipes*; west of the divide, in the upper Río Paraguay region in Mato Grosso, the range of *pollens* gives way to that of *mat-*

TABLE V
MEASUREMENTS OF *Nectomys squamipes pollens*

Cranial measurements of the Annápolis and Maracajú series were taken from imperfectly cleaned skulls; the measurements of the hind feet (*c.u.*) from which the bones have been removed, are those of the collector and not comparable to hind foot lengths of the other series listed. Of a total of seventy-one specimens collected by Gilmore at Annápolis, only forty-nine were examined. The weights (in grams) of the Maracajú and Annápolis series were taken by the collector and are the only known records of the kind. All measurements given are of adults.

Locality	Sex	Head and Body	Tail	Hind Foot	Weight	Condyllo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
Sapucay	♂	192	198	48.3	.....	37.0	21.2	16.2	14.6	7.1	4.2 × 11.5	37
Sapucay	♂	209	200	49.7	.....	38.9	22.6	16.5	15.4	7.2	5.1 × 12.6	40
Sapucay	♂	210	218	51.5	.....	39.1	22.9	17.5	15.2	7.5	4.7 × 11.2	42
Sapucay	♂	228	204	52.4	.....	40.7	23.6	18.0	14.5	7.3	4.7 × 11.5	41
Sapucay	♂	209	221	49.1	.....	41.7	24.1	18.2	15.2	7.3	4.8 × 11.7	41
Sapucay	♀	219	210	48.5	.....	42.0	24.2	18.7	15.2	7.2	4.6 × 12.1	38
Sapucay	♂	232	228	53.5	.....	43.0	24.1	18.6	14.2	7.4	4.0 × 11.3	35
Sapucay (type)	♂	252	245	53.0	.....	43.2	26.0	18.0	15.3	7.2	4.4 × 12.3	36
Rio Yuqueri	♂	210	.....	.....	.....	39.3	21.9	17.1	14.5	7.1	3.3 × 10.9	30
Caraguatay	♀	181	209	49.4	.....	38.2	22.4	16.2	14.7	7.2	3.9 × 10.5	37
Caraguatay	♂	190	205	51.0	.....	.....	22.3	.....	14.1	6.7	4.2 × 10.9	38
Caraguatay	♂	192	210	51.2	.....	39.6	23.6	16.9	14.4	6.8	4.1 × 10.6	39
Caraguatay	♀	191	211	53.1	.....	39.7	22.9	17.4	15.5	7.3	3.5 × 11.2	31
Caraguatay	♀	193	203	49.5	.....	40.2	23.5	16.8	.....	7.2	.....	.....
Caraguatay	♀	191	219	50.3	.....	.....	23.3	17.1	.....	7.4	.....	.....
Caraguatay	♀	214	214	51.3	.....	.....	23.6	18.2	14.1	7.4	.....	.....
Maracajú	♂	200	205	54	170	38.5	21.7	17.4	14.7	7.1	3.7 × 12.2	30
Maracajú	♂	210	40.1	22.6	17.8	14.8	7.0	3.2 × 11.5	28
Maracajú	♂	195	205	54	180	40.3	22.7	16.7	15.2	7.1	3.9 × 10.9	36
Maracajú	♂	205	220	57	220	41.6	22.9	17.9	15.0	7.0	4.1 × 10.9	38
Maracajú	♂	200	220	54	230	41.6	23.1	16.7	14.7	7.0	3.6 × 11.4	31
Maracajú	♂	213	235	55	220	41.7	22.5	17.3	14.0	7.1	3.4 × 11.2	30
Maracajú	♂	215	235	58	265	42.3	23.1	19.0	14.1	7.3	4.1 × 11.2	37
Maracajú	♂	235	215	56	240	42.6	23.4	17.9	15.6	7.1	4.6 × 11.8	39
Maracajú	♂	210	230	56	260	42.6	23.8	17.3	15.2	7.0	3.0 × 11.6	26
Maracajú	♂	210	230	55	270	42.9	24.7	18.9	15.9	7.2	3.9 × 13.2	29
Maracajú	♂	230	235	56	350	43.8	25.0	19.3	14.8	7.0	4.1 × 12.4	33
Maracajú	♂	230	240	55	350	44.3	.....	19.3	15.4	7.0	4.3 × 12.8	34
Maracajú	♂	225	.....	55	320	44.6	24.9	18.6	15.3	6.8	4.3 × 13.2	33
Maracajú	♂	225	240	56	290	44.8	.....	18.9	15.1	7.0	3.1 × 11.6	27
Maracajú	♂	220	245	57	250	45.3	24.1	19.8	14.2	7.1	4.6 × 11.2	41
Maracajú	♂	210	210	57	315	45.4	24.6	18.8	15.8	7.0	4.5 × 13.1	34
Maracajú	♂	230	.....	54	280	45.4	26.7	20.8	15.3	7.4	4.3 × 13.3	32
Maracajú	♀	190	210	50	215	38.6	21.9	17.3	15.6	6.7	3.6 × 10.1	36
Maracajú	♀	190	205	52	160	38.8	21.2	16.2	14.2	6.8	2.4 × 10.6	23
Maracajú	♀	189	208	52	180	39.1	22.1	15.0	15.2	7.1	3.8 × 11.7	32
Maracajú	♀	178	222	55	160	39.7	22.1	16.2	14.7	7.0	3.6 × 12.3	29
Maracajú	♀	205	195	50	220	40.0	21.6	17.1	15.2	7.0	4.2 × 12.5	34
Maracajú	♀	195	205	53	220	40.5	22.5	17.5	13.7	7.1	3.4 × 10.9	31

TABLE V—(Cont.)

Locality	Sex	Head and Body	Tail	Hind Foot	Weight	Condyllo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
Maracajú	♀	210	215	51	240	40.8	.....	18.0	15.5	6.6	3.4 × 11.6	29
Maracajú	♀	195	215	54	200	41.4	22.9	17.8	15.0	7.1	3.9 × 11.2	35
Maracajú	♀	205	230	50	210	41.4	22.9	16.6	14.7	7.0	3.6 × 11.7	31
Maracajú	♀	210	220	53	220	41.4	23.5	18.0	14.9	7.4	4.3 × 12.6	34
Maracajú	♀	220	230	53	220	42.4	.....	18.4	14.1	6.9	4.3 × 10.9	39
Maracajú	♀	210	225	52	255	43.2	24.4	17.9	15.3	7.1	4.5 × 13.6	33
Maracajú	♀	230	220	53	210	43.8	23.6	17.8	15.5	6.6	3.8 × 12.7	30
Maracajú	♀	215	235	55	240	43.8	23.8	17.9	15.0	7.0	3.8 × 11.8	32
Annápolis	♂	210	225	54	230	39.2	22.9	18.0	13.6	7.5	2.7 × 12.0	23
Annápolis	♂	185	225	53	200	39.3	22.6	17.4	14.4	7.7	.....	.....
Annápolis	♂	195	225	50	235	40.2	22.4	17.9	14.7	7.0	3.8 × 12.1	31
Annápolis	♂	220	220	56	270	41.8	24.0	19.0	14.4	7.2	3.9 × 11.4	34
Annápolis	♂	225	225	55	300	43.0	25.0	19.1	13.9	7.3	3.5 × 11.5	30
Annápolis	♂	230	230	55	300	43.2	24.1	19.0	14.3	7.1	3.7 × 12.4	30
Annápolis	♂	215	220	55	340	44.0	24.7	19.5	14.5	7.1	3.4 × 12.3	28
Annápolis	♂	225	230	52	350	44.1	24.9	18.5	13.7	7.6	3.7 × 12.1	31
Annápolis	♂	230	215	55	330	44.2	24.7	18.6	14.4	7.2	4.0 × 12.1	33
Annápolis	♂	240	245	54	.....	44.3	24.7	19.0	14.6	7.8	3.3 × 12.1	27
Annápolis	♂	220	240	55	360	44.5	25.0	19.6	14.0	7.3	3.9 × 12.3	32
Annápolis	♂	230	250	56	370	44.5	25.3	19.4	14.1	7.3	3.1 × 11.1	28
Annápolis	♂	233	230	55	310	44.6	25.2	19.8	14.5	7.0	3.7 × 10.6	35
Annápolis	♂	230	240	55	390	45.0	25.2	18.6	13.8	7.3	2.9 × 11.5	25
Annápolis	♂	250	225	58	350	45.2	25.6	19.8	14.6	7.3	4.0 × 12.7	31
Annápolis	♂	235	230	57	335	45.4	25.3	21.0	14.0	7.3	3.9 × 11.6	34
Annápolis	♂	230	240	55	340	45.4	25.8	21.0	14.7	7.3	4.1 × 12.2	34
Annápolis	♂	236	240	55	400	45.4	25.7	21.3	15.5	7.6	3.6 × 12.6	29
Annápolis	♂	240	225	58	360	46.0	26.3	19.5	14.8	7.8	3.5 × 12.7	28
Annápolis	♂	235	240	55	320	46.2	25.7	20.3	14.9	7.6	4.2 × 12.3	34
Annápolis	♂	238	242	56	400	47.0	25.7	20.3	14.3	7.7	3.6 × 12.6	29
Annápolis	♂	240	.....	56	400	47.8	26.2	21.5	14.6	7.3	2.4 × 12.8	19
Annápolis	♂	245	.....	55	420	47.8	26.6	21.1	14.4	7.7	3.7 × 12.3	30
Annápolis	♂	215	205	48	280	39.9	23.7	17.4	15.2	7.4	3.1 × 11.6	27
Annápolis	♀	195	225	52	.....	40.3	23.3	19.0	14.8	7.6	3.7 × 11.8	31
Annápolis	♀	205	235	51	.....	42.3	.....	19.9	13.4	6.8	2.4 × 11.2	21
Annápolis	♀	210	230	51	290	43.0	.....	18.6	14.2	7.3	3.1 × 12.1	26
Annápolis	♀	220	240	53	260	43.1	24.4	19.6	14.3	7.1	3.8 × 11.5	33
Annápolis	♀	220	230	52	320	44.4	25.3	20.3	14.4	7.3	3.8 × 11.6	33
Annápolis	♀	220	240	54	320	45.7	.....	19.5	13.9	7.4	3.9 × 11.6	34

tensis; and north of the divide (Serra das Divisões) in the Amazonian region occur representatives of *amazonicus*.

CHARACTERS.—Largest Brazilian race; color paler throughout than that of *squamipes*, nearly the same as in *aquaticus* but with a heavier concentration of dark brown middorsally; subterminal bands of cover hairs on back and tips of hairs on belly and chest Ochraceous-Buff with other parts of ventral surface more nearly white than in *squamipes*; tail uniformly brown, or with keel mixed with gray, or entirely gray at terminal one-

fourth; hind foot five- or six-tuberculate; proportion of length to width of interparietal averages 32.2 per cent (19-42 per cent, seventy-three adult specimens).

SPECIMENS EXAMINED.—One hundred and thirteen. PARAGUAY: Sapucay, 8, including the type (F.M., 5; U.S.N.M., 2; M.C.Z., 1); Río Yuqueri, 4 (M.C.Z.); ARGENTINA: Caraguatay, Río Paraná, Misiones, 11 (F.M., 10; U.S.N.M., 1); BRAZIL: Maracajú, Rio Brillhante tributary of Rio Paraná, southern Mato Grosso, 500 meters, 41 (A.M.); Annápolis, southern Goyaz, 1000 meters, 49 (A.M.).

REMARKS.—Its larger size alone is sufficient to distinguish *pollens* from *squamipes*, *aquaticus*, and the more northern *amazonicus*. In color, *pollens* is slightly, though consistently, paler than *squamipes* but is not very appreciably different from *aquaticus*. Final determination of the status of *pollens* requires further comparison with specimens of *mattensis* from the upper Rio Paraguay, Brazil, of which none have been available.

The topotype series from the lower Paraguay drainage area is comparatively small; the original measurements of the type specimen are of an extremely large individual. The series from Caraguatay on the Paraná in Misiones is approximately the same size as the topotypes, but with a proportionately shorter interparietal. Higher up the Paraná, *pollens* becomes progressively larger with paler underparts, its interorbital region becomes broader, its brain case longer, and its interparietal proportionately shorter. A comparison of the proportion of length to width of the interparietal of the different series of *pollens* is made in Table VI.

TABLE VI
COMPARISON OF FOUR POPULATIONS OF *Nectomys squamipes pollens*

Locality	Number of Adult Specimens	Percentage of Length to Width of Interparietal	
		Average	Extremes
Sapucay	8	38.8	35-42
Caraguatay	4	36.2	31-39
Maracajú	31	32.5	23-41
Annápolis	29	29.6	19-35

The cranial differences between the Annápolis and Sapucay series, though bridged by the intermediate Maracajú series, are strongly marked. A more detailed and careful study of this material and a comparison with undoubted representatives of *mattensis* may result in subspecific separation of the Annápolis water rats from *pollens* and/or *mattensis*.

The great majority of the Annápolis and Maracajú specimens are in old pelage. This condition, involving a thinning of the cover hairs and a large

exposure of the wool hairs, imparts a dark tone to the coloration. Though specimens of both series were taken in all months of the year, no seasonal correlation with the change in pelage is apparent.

As has been already noted (Table I) the tawny phase individual from Annápolis is the only male of its kind. The contrast in color between this specimen and other members of the series is not as great as it would be in more saturate forms, such as *melanius*. The keel hairs of this individual are unusually well defined; proximally, they are Light Ochraceous-Buff becoming gradually paler distally to nearly white at the tip.

Nectomys squamipes mattensis Thomas

Nectomys squamipes mattensis Thomas, 1903: 238; Cabrera and Yepes, 1940: 208.

Nectomys squamipés [*sic*], Ribeiro, 1914: 36, Mato Grosso (Tapirapoan).

TYPE SPECIMEN.—Adult male (skin with skull), British Museum (Natural History) No. 3.7.7.71; collected July 30, 1902, by Alphonse Robert; original No. 1050.

TYPE LOCALITY.—“Chapada, a village situated at an altitude of about 800 m., on the Serra do Chapada, some thirty miles N.E. of Cuyabá,” Mato Grosso, Brazil.

DISTRIBUTION.—The upper Rio Paraguay drainage, Mato Grosso, Brazil.

CHARACTERS.—No specimens of undoubted *mattensis* were available for examination. The original description, based on eleven specimens, is reproduced:

External characters as in true *squamipes* and in *garleppi* [*sic*]; the latter also appears to grade into *squamipes*.

Skull rather shorter and more rounded, less slender and elongated than in true *squamipes*. Nasals as usual narrow and elongate. Supraorbital edges with a marked raised bead, more developed than in *squamipes*, much more than in *garleppi* [*sic*]. Interparietal small, narrow antero-posteriorly, its anterior edge generally directly transverse. Palatal foramina long, widely open, with a slight angular constriction at the junction of their anterior and middle thirds. Opening of posterior nares wide, the edge of the palate squarely transverse, the median pterygoid fossa broader anteriorly than posteriorly, its breadth in front greater than the length of m^1 . Lateral pterygoid fossae proportionally narrow and sharply pointed anteriorly. (In *N. squamipes* the median fossa is narrow anteriorly, broadening backwards, with a rounded anterior border.)

Dimensions of the type, measured in the flesh:—

Head and body 200 mm.; tail 200; hind foot (s.u.) 47 (extremes 44–47), (c.u.) 50; ear 24.

Skull—greatest length 43 mm.; basilar length 34.6; zygomatic breadth 22.2; interorbital breadth 7; interparietal 3.4×11.5 ; palate length 20.4; palatal foramina 7.5×3.2 ; breadth of posterior palatal fossa anteriorly 3.8; length of upper molar series 6.3.

The difference in the structure of the pterygoid fossae, perfectly uniform throughout the series, seems to make it necessary to give a special name to the Matto Grosso Water-rat; but as lower down the same river, in Paraguay, specimens agreeing with the true *N. squamipes* occur, I only distinguish it as a subspecies.

It may be noted as a curiosity that a very large proportion of the skulls of *Nectomys*, even when quite old, have their median interparietal suture open, a characteristic very rare in mammals generally.

REMARKS.—Apparently, the chief distinction of *mattensis* from water rats “lower down the same river, in Paraguay,” later described as *pollens*, is based on the structure of its mesopterygoid fossa which is “broader anteriorly than posteriorly.” Among specimens here assigned to *pollens*, the pterygoid fossa is predominantly parallel-sided, sometimes narrower, less frequently broader, anteriorly than posteriorly. The nature of this character has already been discussed under “Individual Variation.” None of the other characters mentioned in the original description of *mattensis* indicates anything with which to support the subspecific status of *pollens*.

Nectomys squamipes amazonicus, new subspecies

(Pl. II, Figs. 3 and 4, cranium)

Nectomys squamipes, Thomas, 1912: 87, Pará (Benevides).

Nectomys squamipes subspecies, Allen, 1916b: 571, 597, Mato Grosso (Urupá).

TYPE SPECIMEN.—Adult male (skin with skull), M.C.Z. No. 30820; collected January 23, 1934, by A. M. Olalla; original No. 7312.

TYPE LOCALITY.—Tauary, on the east bank of the lower Rio Tapajóz about fifteen kilometers below Aveiros, state of Pará, Brazil.

DISTRIBUTION.—Brazil south of the Rio Amazonas and east of the Rio Madeira in the states of Amazonas, Pará, Maranhão, and the parts of Mato Grosso and Goyaz in the Amazonian drainage system.

CHARACTERS.—Smaller and darker than *pollens*; size similar to that of *aquaticus* and *melanius*, but dorsum with more dark brown than in the former and less than in the latter; upper parts Ochraceous-Buff to nearly Ochraceous-Orange with an even mixture to a moderately heavy overlay, usually middorsally, of Prout's Brown; belly, chest, and throat usually with a moderate to heavy wash of ochraceous; hind foot five- or six-tuberculate; keel uniformly brown or brown mixed with gray; proportion of length to width of interparietal averages 30.5 per cent (18-38 per cent, sixteen specimens including three subadults).

COLORATION OF TYPE.—Dorsal surface from tip of nose to rump Ochraceous-Buff, with a more or less even mixture of Prout's Brown; sides with less Prout's Brown, the lower halves more uniformly Ochraceous-Buff, but with gray basal parts of hairs visible at the surface; underparts nearly white with belly, mid-line of chest, and throat moderately, and chin, fore and hind legs faintly, washed with Ochraceous-Buff; tail brown, the keel with a mixture of gray hairs along entire length.

SPECIMENS EXAMINED.—Twenty-eight. BRAZIL: Tauary, Rio Tapajóz, Pará, 3 (M.C.Z.); Aramanahy, just below and opposite Boim, Rio Tapajóz,

3 (A.M.); Igarapé Amarim, enters Tapajóz opposite Aramanahy, 3 (A.M.); Limõatuba, near mouth of Igarapé Amarim, 3 (A.M.); Piquiatuba, above Aramanahy, 1 (A.M.); Cameté, near mouth of Rio Tocantins, 2 (M.C.Z.); Ilha do Taiuna, opposite Cameté, Rio Tocantins, 4 (A.M.); Benevides, about 30 kilometers northeast of Belem, Pará, 1 (A.M.); Santo Antonio de Uayasa, Rio Madeira, Amazonas, 1 (A.M.); Urupá, Rio Gy-Paraná, upper Rio Madeira, Mato Grosso, 1 (A.M.); Canna Brava, Goyaz, 4 (M.C.Z.); Tranqueira, near Santa Philomena, upper Rio Parnahyba, Maranhão, 400-600 meters, 2 (F.M.).

TABLE VII

MEASUREMENTS OF *Nectomys squamipes amazonicus*

The first specimen of each of the Rio Tapajóz and Canna Brava series is a young adult.

Locality	Sex	Head and Body	Tail	Hind Foot	Condylo-basal Length	Zygomatic Breadth	Nasals, Breadth	Brain Case	Alveolar Row	Interparietal	Percentage
R. Tapajóz	♀	175	165	43.5	36.8	21.9	16.1	13.8	6.7	4.0 × 10.5	38
R. Tapajóz	♂	176	194	49.8	38.4	21.3	16.9	14.1	6.7	3.5 × 10.6	33
R. Tapajóz	♂	187	206	50.9	39.2	21.1	17.9	14.2	7.0	3.8 × 11.9	32
R. Tapajóz (type)	♂	193	195	48.7	40.5	24.7	18.5	14.1	6.8	2.5 × 10.1	25
R. Tapajóz	♂	195	200	50.8	40.9	22.2	17.9	13.9	6.7	3.0 × 11.7	26
R. Tapajóz	♂	202	203	49.6	42.2	23.4	19.7	14.4	6.5	3.5 × 12.4	28
R. Tapajóz	♂	209	193	50.0	42.3	24.2	19.3	13.6	7.3	4.2 × 11.1	38
R. Tocantins	♂	196	204	50.7	38.9	22.6	17.6	14.0	6.9	3.6 × 10.7	34
R. Tocantins	♀	176	190	47.2	39.3	21.3	18.0	13.6	6.9	4.0 × 10.6	38
Benevides	♂	183	200	47.6	38.7	21.5	18.0	13.9	6.8	3.5 × 11.7	30
Tranqueira	♂	187	209	50.5	42.1	24.8	18.9	14.9	7.1	3.7 × 12.2	30
Canna Brava	♂	182	184	44.8	37.1	.....	16.5	14.1	6.8	3.2 × 11.7	27
Canna Brava	♂	180	185	48.5	40.2	22.6	17.8	12.5	7.1	2.0 × 10.9	18

REMARKS.—Variation in color among the available specimens of *amazonicus* may be summed up as follows. From west to east along the Amazon there is a progressive increase in the dark brown pigmentation of the upper parts and of the ochraceous of the underparts; the single specimen from Benevides, near the coast, is the darkest, and it is nearly as dark as an average *melanius*. Specimens from the southern extremes of the range of *amazonicus* are comparatively pale, the dark brown of the upper parts is more diffuse, the underparts less heavily washed with ochraceous, the series from Canna Brava, upper Tocantins, being the palest. This last suggests the probability that *amazonicus* becomes progressively paler from the Amazon south along the Tocantins to the divide. Such a gradient, if present, supplements that of *pollens*, which becomes paler from south to north along the Paraná to the same divide. A similar trend, though it transgresses the

geographical limits of *amazonicus*, is evident along the Rio Madeira. The single adult specimen of *amazonicus* from Urupá, high up the Rio Madeira drainage system in Brazil, is quite like the specimens of the Tapajóz in color, but higher up in Peru and Bolivia (Ríos Madre de Dios, Beni, and Mamoré) there occurs the distinctly paler *garleppii*.

There are no known records of water rats from the area east of the range of *amazonicus* in Maranhão (Tranqueira), and north of the hypothetical range of *aquaticus* in Bahia. Similarly, nothing is known of the *Nectomys* of the state of Pará north of the Amazon, where specimens surely occur. Farther north, in the Guianas near the Brazilian boundary, are blackish water rats, unmistakably *melanius*. These dark forms are also present on the upper Rio Negro in Brazil and on the lower Marañon in Peru.

Nectomys squamipes melanius Thomas

(Pl. III, Figs. 3 and 4, cranium)

Nectomys squamipes melanius Thomas, 1910: 185; *ibid.*, BRITISH GUIANA (Supinaam River), SURINAM; Anthony, 1921: 275, BRITISH GUIANA (Kartabo; Kalacoon; Kyk-over-al; Saimiri Island, Mazaruni River); Pittier and Tate, 1932: 261, VENEZUELA (Lower Orinoco region), BRITISH GUIANA (Demerara); Cabrera and Yepes, 1940: 208.

Holochilus (*Nectomys*) *squamipes*, Thomas, 1887: 151, BRITISH GUIANA (Pen Hope).

Nectomys squamipes, Thomas, 1897a: 497 (part), SURINAM; Beebe, 1919: 223, BRITISH GUIANA.

Nectomys fulvinus, Osgood (not of Thomas), 1914: 160, PERU (Lagunas and Yurimaguas, Loreto).

[?] *Nectomys apicalis*, Thomas (not of Peters), 1927a: 369 (part), PERU (Yurac Yacu, San Martín, only).

Nectomys rattus, von Ihring (not *Hesperomys rattus* Pelzeln), 1904: 421, BRAZIL (Upper Rio Juruá).

Nectomys squamipes rattus, Tate (not *Hesperomys rattus* Pelzeln), 1939: 197, VENEZUELA (Mt. Duida and Casiquiare Canal).

Nectomys squamipes palmipes, Tate (not of Allen), 1939: 198, BRITISH GUIANA (Mt. Roraima), VENEZUELA (Mt. Auyan-tepui).

TYPE SPECIMEN.—Adult male (skin with skull), British Museum (Natural History), No. 6.4.8.32; collected March 10, 1906, by S. B. Warren; original No. 60.

TYPE LOCALITY.—Lower Essequibo River, twelve miles above mouth, Demerara, British Guiana; altitude, 40 feet.

DISTRIBUTION.—British Guiana, Dutch Guiana, southern Venezuela in the departments of Bolívar and Amazonas, south to the north bank of the Amazon River in the state of Amazonas, Brazil, west to the lower Huallaga in northeastern Peru. North of the Marañon, in Ecuador, the range of *melanius* grades into that of *apicalis*; higher up the Huallaga and Ucayali in Peru, *melanius* gives way to *montanus*.

CHARACTERS.—Size as in *amazonicus*; smaller than *apicalis* and with glossier pelage; color markedly darker than in all races except *napensis*; back Ochraceous-Buff to Ochraceous-Orange moderately suffused to heavily overlaid with dark brown; head from nose to crown nearly uniformly dark brown; ochraceous wash over gray underparts ranges from dilute and restricted to belly and chest to heavy and covering nearly entire ventral sur-

TABLE VIII

MEASUREMENTS OF *Nectomys squamipes melanius*

Except for one subadult from Georgetown and another from the Oronoque River, the measurements given are of fully adult specimens each with skin and skull. The series from Kartabo, Kyk-over-al, and Saimiri Island, all near-by localities in the Kartabo region, about forty miles inland up the Essequibo, is here considered, for practical purposes, as topotypical. Measurements of the type are from the original description; greatest length of its skull, 45 mm.

Locality	Sex	Head and Body	Tail	Hind Foot	Condyllo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
(Type)	♂	244	200	46 (<i>s.u.</i>)	.....	24.0	17.7	.....	6.2	.....	.....
Kartabo	♀	189	170	46.4	37.5	22.3	17.0	14.2	7.1	3.7 × 10.5	35
Kyk-over-al	♂	190	185	.....	38.3	21.0	17.2	13.8	6.4	3.6 × 9.7	37
Kartabo	♂	50.5	40.1	22.6	17.6	14.7	6.9	4.3 × 11.0	39
Kyk-over-al	♂	203	202	.....	40.8	22.0	18.5	13.7	6.5	3.8 × 10.3	37
Kartabo	♀	22.7	18.6	14.4	7.0	3.9 × 12.9	30
Oko Mts.	♀	173	189	47.5	37.1	21.5	17.1	14.8	7.1	3.3 × 10.6	31
Oko Mts.	♀	213	215	52.6	.....	.....	.....	14.4	7.3	3.6 × 10.6	34
Oko Mts.	♂	234	230	54.9	44.1	.....	19.8	14.9	7.1	3.4 × 12.3	28
Rockstone	♀	205	195	45.1	38.7	22.0	17.0	14.4	7.1	3.3 × 9.8	34
Rockstone	♂	205	205	49.6	40.9	24.8	19.5	14.9	7.0	3.5 × 10.7	33
Rockstone	♂	210	195	50.4	41.3	23.6	18.6	14.4	7.1	3.7 × 9.9	37
Minehaha Cr. ...	♂	240	225	51.1	.....	.....	.....	13.7	7.0	3.5 × 10.7	33
Holmia	♀	175	200	46.9	38.0	21.8	17.4	12.9	6.9	3.8 × 11.2	34
Georgetown	♂	42.7	34.9	19.2	15.3	13.1	6.3	2.7 × 10.7	25
Hyde Park	♂	178	184	45.4	39.3	.....	18.3	13.1	6.7	2.2 × 11.3	19
Oronoque R.	♂	35.7	19.6	15.6	13.8	6.9	3.3 × 9.7	34
Auyan-tepui ...	♂	190	.....	51.7	40.7	23.1	17.8	14.1	7.0	2.3 × 10.9	21
Auyan-tepui ...	♀	213	200	48.7	41.1	23.2	18.9	14.1	6.6	2.9 × 11.1	26
Mt. Duida	♂	171	191	45.0	36.2	20.6	15.4	13.8	6.9	3.4 × 11.1	31
Mt. Duida	♂	182	178	47.8	37.2	20.8	17.2	13.3	6.9	3.5 × 11.3	31
R. Casiquiare ...	♂	189	203	49.5	.....	.....	16.4	.....	6.9	.....	.....
R. Casiquiare ...	♀	203	205	51.5	39.4	22.9	17.8	15.3	7.3	3.9 × 11.3	35
Sarayacu	♀	38.6	22.3	.....	14.6	6.9	3.7 × 10.0	37
Sarayacu	♂	41.5	23.8	19.1	14.8	6.6	3.9 × 12.0	33
Sarayacu	♀	43.1	23.6	19.0	14.4	7.2	3.5 × 9.8	36
Lagunas	♂	182	178	47.0	37.8	22.6	16.5	14.3	6.7	3.5 × 10.0	35
Lagunas	♂	183	170	47.5	38.1	22.6	17.3	14.0	6.7	3.3 × 10.4	32
Lagunas	♂	220	210	52.7	41.6	24.3	18.4	15.0	7.1	3.0 × 11.6	26
Yurimaguas	♀	185	175	46.2	37.7	21.7	17.3	13.4	6.4	3.9 × 10.1	39
Yurimaguas	♂	186	184	50.5	38.3	22.1	17.7	13.6	7.1	3.9 × 10.8	36
Pto. Indiana ...	♂	40.6	.....	18.2	.....	7.4	.....	.....
Pto. Indiana ...	♀	44.9	26.1	19.2	14.2	7.8	3.9 × 10.5	37

face; hind feet five- or six-tuberculate; tail uniformly brown, but keel mixed with gray hairs in extremely old individuals; proportion of length to width of interparietal averages 32.4 per cent (19–39 per cent, thirty-eight specimens, including six subadults).

SPECIMENS EXAMINED.—Seventy-nine. **BRITISH GUIANA:** Kartabo, 10 (A.M.); Kyk-over-al, 12 (A.M.); Saimiri Island, Mazaruni River, 4 (A.M.); Oko Mountains, Essequibo, 8 (F.M.); Rockstone, Essequibo, 100 feet, 4 (A.M.); Minehaha Creek, Essequibo, 500 feet, 1 (A.M.); Holmia, Potaro Highlands, 451 meters, 1 (F.M.); Hyde Park, Demerara River, Demerara, 16 feet, 1 (F.M.); Hyama Creek, Demerara River, Demerara, 60 feet, 1 (M.C.Z.); Georgetown, Demerara, 1 (F.M.); Oronoque River, Courantyne, 2 (M.C.Z., 1; F.M., 1). **DUTCH GUIANA:** No locality data, 2 (A.M.). **VENEZUELA:** Auyan-tepui, 1100 feet, 6 (A.M.); Arabupu, Mt. Roraima, 4200 feet, 1 (A.M.); "Stream between Towashing and Kukenam ridges," Mt. Roraima, 1 (A.M.); Valle de los Monos, Mt. Duida, 725 feet, 1 (A.M.); Middle Camp, Mt. Duida, 500 feet, 1 (A.M.); Esmeralda, upper Río Orinoco, 325 feet, 2 (A.M.); Buenavista, Río Casiquiare, 1 (A.M.); El Merey, Río Casiquiare, 2 (A.M.). **BRAZIL:** Yavanari, upper Rio Negro, 1 (A.M.). **PERU:** Sarayaacu, lower Río Ucayali, Loreto, 8 (A.M.); Lagunas, above mouth of Río Huallaga, Loreto, 500 feet, 3 (F.M.); Puerto Arturo, Yurimaguas, Río Huallaga, Loreto, 600 feet, 3 (F.M.); Puerto Indiana, Río Marañon, above mouth of Río Napo, 2 (A.M.).

REMARKS.—With surprisingly few individual exceptions, *melanius* maintains throughout its enormous range a high degree of uniformity in essential characters and is readily distinguished from neighboring forms. Some evidence of intergradation between *melanius* and *apicalis* of Ecuador and *montanus* of the Peruvian Andes is noted; but none is apparent between *melanius* and the Trinidad *palmipes*, though these had been considered identical by Tate (1939: 198). The single adult of two specimens from near the coast of Venezuela, opposite the island of Trinidad and, presumably, the same assigned to *palmipes* by Pittier and Tate (1932: 261), is quite different from both *palmipes* and *melanius*, but most nearly resembles the water rats of eastern Colombia. It appears, then, that the range of *melanius* does not extend north of the lower Orinoco in Venezuela. The range may include all of the Guianas, but nothing is known of the water rats of French Guiana. Nevertheless, the extremely dark specimens of *amazonicus* from Benevides suggest that *melanius* may range along the whole of the Guianan coast to the Amazon itself. From the area in Brazil south of the Amazon (Solimões) and west of the Madeira there is a single record of *Nectomys* from the upper Juruá (von Ihring, 1904: 421), which is here provisionally assigned to *melanius*.

The darkest specimens of *melanius* are from the lower Demerara River. Specimens from the Oko Mountains, about twenty miles west of Kartabo,

between the Mazaruni and Cuyuni rivers are similar to the series from the Kartabo region, but include larger individuals. The specimens from Mount Duida, the Casiquiare Canal, and the Río Negro are more richly pigmented on the ventral surface, but otherwise are practically indistinguishable from the topotype series. Of two skins from Mount Roraima, the one from Arabupu is not as dark as usual and resembles an average *amazonicus*. The series from Auyan-tepui represents a strongly marked local population, but each specimen can be matched in color with others from throughout the range of *melanius*. Specimens from Sarayacu on the lower Río Ucayali and from Lagunas, near the mouth of the Huallaga, Peru, resemble each other closely, are slightly larger than the topotypes, and are nearly as dark on the dorsum as are the Demerara specimens, but they are more ochraceous on the ventral parts. The Yurimaguas specimens are most similar to those from Lagunas, but suggest intergradation with the upper Huallaga *montanus* in color as well as in cranial characters. The specimens recorded by Thomas as *Nectomys apicalis* (1927a: 369) from Yurac Yacu, on the Río Mayo, a tributary of the lower Huallaga, Peru, were described as "a dark-coloured series." I provisionally include them with *melanius*, thereby drawing attention to their evident similarity and geographical proximity to the Yurimaguas series.

Specimens from north of the Marañón, at and above the mouth of the Río Napo, indicate intergradation, notably in cranial characters, between *melanius* and the comparatively pale, larger *apicalis* of Ecuador. Two individuals assigned to *melanius*, from Puerto Indiana, north bank of the Marañón just above the mouth of the Napo, agree with other Peruvian representatives of *melanius* in all respects except in the length of the cheek teeth. In the younger of these two, the alveolar length (7.4 mm.) is maximum for specimens of *melanius* found elsewhere; in the other, the alveolar length (7.8 mm.) is as in *apicalis*. Higher up the Napo, at its junction with the Curaray, the water rats assume more definitely the characteristics of *apicalis*, but show some traits of *melanius* as well.¹⁰

Nectomys squamipes apicalis Peters

(Pl. II, Figs. 1 and 2, cranium)

Nectomys apicalis Peters, 1861: 152, Pl. 1, Fig. 1, Pl. 2, Figs. 3-3b; Cabrera and Yepes, 1940: 208.

N[ectomys]. apicalis, Thomas, 1897a: 498 (part; description); Thomas, 1899: 41 (comparison).

Holochilus (Nectomys) apicalis, Thomas, 1882: 101 (part; comparisons, taxonomy).

H[esperomys]. cephalotes, Tomes (not of Desm., *vide* Thomas, 1882: 101), 1858: 548, ECUADOR (Gualaquiza).

H[esperomys]. squamipes, Tomes, 1858: 548, ECUADOR (Gualaquiza); Leche, 1886: 690 (*apicalis*, synonym).

¹⁰ See page 55, footnote 13.

Nectomys fulvinus Thomas, 1897a: 499, ECUADOR (Quito, original description).

[?] *Holochilus (Nectomys) apicalis*, Thomas, 1882: 101 (part), PERU (Tambillo, Cajamarca).

[?] *Nectomys apicalis*, Thomas, 1926: 159, PERU (Molinopamba, Amazonas); Thomas and St. Leger, 1926: 346, PERU (Yambra, Amazonas).

TYPE SPECIMEN.—Adult male (skin with skull), Zoological Museum, Berlin, received from Mr. Cuming.

TYPE LOCALITY.—Tena, Napo-Pastaza Province, Ecuador; altitude, 512 meters (redetermined).

DISTRIBUTION.—Foothills of eastern Andes; in Ecuador from the upper Río Napo region east to near the mouth of the Coca, and from the head of

TABLE IX
MEASUREMENTS OF *Nectomys squamipes apicalis*

The external measurements of the type are from the original description. Those of the type skull are taken directly from the original figure drawn in natural size. In the text of the original description (p. 155), Peters gave the length of the molar row as 6 mm. This measurement coincides with the crown length in the figure; its alveolar length is given below. Each of the specimens listed is fully adult.

Locality	Sex	Head and Body	Tail	Hind Foot	Condyllo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
(Type)	♂	225	245	51	43.1	25.2	19.1	14.0	7.6	4.2 × 9.1	46
Tena	♂	224	222	(s.u.)	.....	25.3	19.5	.....	7.4	.....	.....
San José abajo	♂	49.1	.....	22.6	17.5	13.9	7.6	4.1 × 9.8	42
San José abajo	♂	50.6	43.3	24.9	19.7	13.5	7.4	4.5 × 8.1	55
R. Pindo Yacu	♂	195	220	54.0	40.8	23.4	17.3	14.8	8.0	4.7 × 9.9	47
R. Pindo Yacu	♂	213	240	53.0	44.4	25.5	19.4	14.5	8.0	5.1 × 10.6	48
R. Pindo Yacu	♀	240	230	51.1	45.2	.....	20.0	13.5	7.8	4.7 × 9.1	52
R. Pindo Yacu	♂	240	240	53.7	46.3	25.3	20.0	14.0	7.4	5.3 × 10.6	50
R. Bobonaza	♀	200	230	.....	41.2	23.3	17.5	14.2	7.3	4.3 × 9.8	44
R. Bobonaza	♀	215	230	50.8	43.0	24.1	17.7	13.2	7.5	4.3 × 9.4	46
R. Bobonaza	♀	225	235	51.4	45.7	25.1	19.2	13.6	7.5	5.3 × 10.1	52
R. Curaray, mouth	♀	40.5	23.2	17.6	13.8	7.6	4.3 × 10.2	42
R. Curaray, mouth	♀	41.2	23.0	18.1	14.1	7.8	4.8 × 9.8	49
R. Curaray, mouth	♀	41.3	23.4	17.2	14.4	7.6	4.7 × 8.8	53
R. Curaray, mouth	♀	41.8	23.9	18.6	14.0	7.6	4.4 × 9.7	45
R. Curaray, mouth	♂	42.3	24.4	18.7	13.7	7.5	4.0 × 8.5	47
R. Curaray, mouth	♂	43.2	23.8	17.7	13.7	7.5	3.6 × 8.6	42
R. Curaray, mouth	♂	43.7	25.4	20.1	14.1	7.1	4.5 × 10.1	45
R. Curaray, mouth	♂	43.8	25.0	19.6	13.8	8.1	3.9 × 10.1	39
R. Curaray, mouth	♀	44.6	25.1	19.4	13.9	8.1	4.1 × 9.7	42

the Río Curaray to its junction with the Napo, thence west, in a line, to the junction of the Río Chinchipe with the upper Marañon. South of this line, to the lower Marañon, *apicalis* gives way to the dark *melanius*; in the middle Río Napo region between the mouths of the Ríos Coca and Aguarico, *apicalis* is replaced by *napensis*. Higher up the Río Marañon drainage system, in the Peruvian departments of Amazonas and Cajamarca, rats agreeing externally, at least, with *apicalis* have been recorded (see above) and are provisionally included here. Altitudinal range approximately 100 to 1800 meters.

CHARACTERS.—Larger than *melanius*, paler throughout, pelage shorter and coarser; back Ochraceous-Buff with a mixture, rarely with a heavy overlay, of Cinnamon Brown or Prout's Brown; a dark middorsal band narrowly defined or absent; nose to crown of head not markedly different from middorsal region of back; underparts of body Pallid Neutral Gray moderately washed with ochraceous; inner surface of forearm from wrist to elbow usually brown with a mixture of ochraceous; tail brown, keel entirely brown or mixed with gray to entirely gray; hind foot usually with five plantar tubercles. Skull larger, alveolar length of molar row relatively longer, individual teeth heavier, and nasals more attenuate behind than in *melanius*; proportional length to width of interparietal averages 46.6 per cent (39–55 per cent, nineteen adult specimens).

SPECIMENS EXAMINED.—Thirty-nine. ECUADOR: Tena, 1 (U.M.M.Z.); Río Jollín [= Jondache], near Archidona, 700 meters, 2 (M.C.Z.); "Near the River Napo, 2400 feet," 2 (U.M.M.Z., 1; M.C.Z., 1); Río Suno, tributary of upper Napo, 1 (M.C.Z.); San José Abajo, Río Suno, 4 (A.M.); Jatun Yacu, 700 meters, 1 (M.C.Z.); Río Pindo Yacu, tributary of upper Tigre, 4 (F.M.); Canelos, Río Bobonaza, 500 meters, 1 (M.C.Z.); Montalvo, Río Bobonaza, 3 (F.M.); Sarayacu, Río Bobonaza, 450 meters, 1 (A.M.); Río Bobonaza, 500 meters, 2 (M.C.Z.); Zamora, Río Zamora, 1250 feet, 1 (A.M.); Río Curaray, at junction with Napo, 12 (A.M.); Río Oyacachi below Chaco (i.e., on the Quijos, a tributary of the Coca), 1 (A.M.); "Hacienda Chaupi Cruz, north of Quito, 9400 feet,"¹¹ 1 (A.M.). PERU: San Ignacio, Río Chinchipe, Cajamarca, 2 (A.M.).¹²

REMARKS.—In the available material, not one specimen of those assigned to either *apicalis* or *melanius* combines the external appearance of the former with all the essential cranial characters of the latter. On the other hand, a few specimens from Ecuador are *melanius*-like in color, but their

¹¹ A native made skin "collected" by the late Consul Ludovic Söderström. The locality quoted was definitely not the habitat of the specimen examined. It would be absurd to cite this record as additional evidence for the identification of *fulvinus* with *apicalis*.

¹² On some maps this locality is indicated in the province of Loja, Ecuador.

cranial and other external characters assure their identification with *apicalis*. An old female (F.M. No. 41466, collected by Olalla) from Montalvo, Río Bobonaza, a tributary of the Pastaza, is similar to *melanius* in color. Its interparietal is defective, but, so far as I can judge, the length is 52 per cent of the width—a proportion far higher than appears in *melanius* but not prohibitively high for *napensis*. The series of twelve specimens, from the junction of the Curaray with the Napo, ranges in color from typically pale to nearly as dark as the Puerto Indiana *melanius*. Cranially, the series as a whole conforms to the pattern of *apicalis* from the more elevated, more western, localities. The individual from the Curaray (A.M. No. 71910 ♂) with the extremely short interparietal (39 per cent) is pale. Apparently, the transition along the Río Napo from the Andean *apicalis* to representatives of *melanius* from the Marañon southward is affected via the comparatively slow flowing Río Curaray, the only important tributary of the Napo entering from the right.¹³

In a subadult from Sarayacu, with an alveolar row of 8.1 mm., the length of the interparietal is only 35 per cent of the width. In general, in *apicalis*, the proportion of the length to the width of the interparietal averages less in the young than in adults. A skin only of a juvenile taken at "Río Oyacachi Abajo Chaco," and at an altitude which could be anywhere between 1000 and 1500 meters, is unusually long-furred and has six plantar tubercles on the hind foot. All other representatives of *apicalis* are five-tuberculate. Skins of two immature individuals from San Ignacio, Río Chinchipe, may be referred to *apicalis*. Identification of material from the upper Marañon cannot be made with certainty without reference to cranial characters.

The definition of *apicalis*, both as originally presented by Peters and as interpreted and restricted here, excludes all the water rats I have examined from the Peruvian Andes south and east of the Marañon as well as some of those from Peru which have been recorded as *apicalis* by Thomas in various publications. I retain Thomas' identifications for the specimens he recorded from localities on tributaries of the upper Marañon (Molinopamba, Tambillo, and Yambra). On the other hand, those recorded from the region of the

¹³ Some reservation must be exercised in the analysis of the Curaray series (and the specimens from Puerto Antonio assigned to *melanius*). The specimens in question are "native made" skins without original data "collected" by Olalla y Hijos. There may be reason to doubt that the localities of some of these specimens are correct and that some of the skins and skulls are properly associated. Generalizations based on the available data to account for the present distributional pattern of *apicalis*, and the direction of intergradation between *apicalis* and *melanius*, on the one hand, and *apicalis* and *napensis* (see beyond), on the other, may require revision when the actual facts are ascertained. In any case, the validity of the subspecies concerned does not depend on the disposition of the specimens in question.

Huallaga and its tributaries fall within the range of the superficially similar, but cranially distinct, *montanus*.

Nectomys squamipes napensis, new subspecies

TYPE SPECIMEN.—Adult male (skin with skull), U.M.M.Z. No. 80178; collected April 5, 1936, by Philip Hershkovitz; original No. M532.

TYPE LOCALITY.—Site "San Francisco," left bank of Río Napo above the mouth of the Río Challuacocha; latitude and longitude approximately 0° 47' S., 76° 25' W., Parish of La Coca, Napo–Pastaza Province, Ecuador; altitude, about 200 meters.

DISTRIBUTION.—Of the specimens examined, three are from the type locality, four from the island of Llunchi, about 50 kilometers upstream, and one from the site "Intillama," approximately midway between, on the Río Napo. All localities lie between the mouth of the Río Coca and the mouth of the Río Aguarico. West of the junction of the Coca with the Napo, in the foothills of the eastern Andes of Ecuador, *napensis* is replaced by *apicalis*; lower down the Napo, at the mouth of the Curaray, representatives of *apicalis* appear again. Altitudinal range approximately 150 to 300 meters.

CHARACTERS.—Size between *apicalis* and *melanius*; upper parts more uniformly dark than in *melanius*, underparts with less ochraceous; inner side of forearm from wrist to elbow brown; hind foot with five plantar tubercles; tail uniformly brown; cranial characters essentially as in *apicalis*; proportion of length to width of interparietal averages 42.4 per cent (39–48 per cent, five specimens).

COLORATION OF TYPE.—Dorsal surface Ochraceous-Buff heavily overlaid with Prout's Brown; sides of body with less Prout's Brown, the lower halves, and cheeks, nearly uniformly Ochraceous-Buff; underparts pale Neutral Gray with a light wash of ochraceous; a pure white chin patch

TABLE X
MEASUREMENTS OF *Nectomys squamipes napensis*
All specimens are adults, none is old.

Locality	Sex	Head and Body		Tail	Condyllo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
Llunchi	♀	162	199	38.6	21.9	.....	12.8	7.4	4.2 × 8.8	48
S. Francisco	♀	199	200	39.7	23.3	.....	14.4	7.9	4.1 × 9.4	44
S. Francisco (type)	♂	190	224	40.6	23.9	18.0	14.1	7.7	3.9 × 10.1	39	
Llunchi	♂	193	204	40.8	22.9	.....	13.5	7.5	3.5 × 8.3	42
S. Francisco	♀	195	227	41.8	24.7	19.0	14.8	7.6	4.1 × 10.5	39	

present; upper surface of fore and hind feet with a mixture of white and brown hairs, fringe white, palms light brown, soles black; tail uniformly brown.

SPECIMENS EXAMINED.—Nine. ECUADOR: San Francisco, 4 (U.M.M.Z.); Llunchi, 4 (U.M.M.Z.); Intillama, 1 (U.M.M.Z.).

REMARKS.—In all characters, save its extremely dark color, *napensis* closely agrees with *apicalis*. The occasional occurrence of dark individuals in series of *apicalis* has already been noted. In *napensis* all the specimens are dark except an immature male (U.M.M.Z. No. 80176) in which the guard hairs are not developed. The darkness of *napensis* may not be the direct result of intergradation with *melanius*, as has been suggested in the case of the series of *apicalis* from lower down the Napo at its junction with the Curaray. This series, though it averages darker than specimens of *apicalis* from higher up the Andes, is still much paler, on an average, than is *napensis*. It will be noted that the Curaray has its source in the same general region where typical *apicalis* occurs and enters the Napo from the right. The Ríos Coca and Aguarico, between which *napensis* is found, originate high in the Andes and enter the Napo from the left. Present data make it appear that *napensis* is a highly localized race, its darkness having arisen independently or, possibly, having been derived indirectly from *melanius* through *apicalis*.¹⁴

Nectomys squamipes montanus, new subspecies

(Pl. I, Figs. 3 and 4, cranium)

Nectomys apicalis, Thomas (not of Peters), 1927b: 599, PERU (Chinchavita and Tingo María, Huanuco); Neveu-Lemaire and Grandidier, 1911: 9, PERU ("Pérou central").

Nectomys garleppi [sic], Thomas (not of Thomas), 1928: 259 (part), PERU (San Jerónimo, Loreto).

[?] *Holochilus* (*Nectomys*) *apicalis*, Thomas (not of Peters), 1882: 101 (part), PERU (Chirimoto and Huambo, Amazonas).

[?] *N*[*ectomys*]. *apicalis*, Thomas (not of Peters), 1897a: 498 (part), PERU (Chirimoto and Huambo).

[?] *Nectomys apicalis*, Thomas (not of Peters), 1927a: 369 (part), PERU (San Nicolás, Amazonas).

TYPE SPECIMEN.—Adult male (skin with skull), F.M. No. 24128; collected July 31, 1922, by Edmund Heller; original No. 6394.

TYPE LOCALITY.—Hacienda Exito, on the Río Cayumbá, a small stream which enters the Huallaga next below the Río Chinchao, department of Huanuco, Peru; altitude, 3000 feet.

DISTRIBUTION.—The Montaña of the central and eastern Andes of Peru drained by the upper Huallaga and Ucayali rivers in the departments of Huanuco and Loreto. The range may extend lower down the Huallaga basin into the department of San Martín and the eastern part of Amazonas.

¹⁴ See footnote 13.

Higher up the Ucayali, in Junín and Loreto, the range meets that of *garleppi*. Altitudinal range approximately 300 to 1500 meters.

CHARACTERS.—Smaller than *apicalis*; pelage and color as in *apicalis* except dark dorsal color not concentrated into a middorsal band; underparts slightly paler, and inner sides of forearms from wrist to elbow gray (not brown) washed with ochraceous; tail as in *apicalis*; soles of hind feet five- or six-tuberculate; skull slightly larger than in *melanius*, smaller than in *apicalis*; proportional length to width of interparietal averages 36.1 per cent (29–41 per cent, thirteen specimens, including four subadults).

COLORATION OF TYPE.—Dorsum Ochraceous-Buff mixed with Prout's Brown; head from tip of nose to crown paler than middorsal region of back; area around lips and chin whitish; cheeks and sides of body Ochraceous-Buff; underparts Pallid Neutral Gray with an ochraceous wash on belly and chest; tail brown, terminal three-fourths of keel gray; hind foot brown, fringed with white, five-tuberculate.

TABLE XI

MEASUREMENTS OF *Nectomys squamipes montanus*

The first specimen of the Pozuzo series is a subadult, the second and third are young adults.

Locality	Sex	Head and Body	Tail	Hind Foot	Condylar-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
Pozuzo	♀	37.4	20.3	17.0	14.2	7.5	4.0 × 11.4	35
Pozuzo	♂	162	194	46.5	38.9	20.2	18.2	13.6	7.0	3.3 × 8.7	38
Pozuzo	♂	195	198	49.5	39.4	21.5	17.6	14.0	7.5	4.0 × 9.7	41
Pozuzo	♀	190	218	47.8	40.0	21.8	18.0	13.2	7.4	3.8 × 9.3	41
Pozuzo	♂	208	206	48.4	41.4	22.3	18.5	14.6	7.4	4.1 × 10.0	41
Pozuzo	♀	222	211	49.7	.....	.....	.....	13.9	.....	3.8 × 10.5	36
Pozuzo	♀	220	217	49.5	.....	.....	20.2	.....	7.3	.....	.....
Pozuzo	♂	44.2	.....	19.6	14.3	7.7	3.1 × 10.2	30
S. Jerónimo	♀	176	182	49.9	38.2	22.3	16.7	13.9	6.9	3.6 × 9.6	37
Vista Alegre	♂	199	194	48.8	38.3	22.4	16.6	14.5	7.4	3.0 × 9.0	33
Hda. Exito (type)	♂	200	204	51.8	39.5	22.5	16.8	13.6	7.7	3.5 × 9.8	36
Tingo María	♀	184	212	49.5	.....	21.7	.....	13.6	7.1	.....	.....
Tingo María	♀	207	225	50.5	.....	.....	18.1	.....	7.5	.....	.....

SPECIMENS EXAMINED.—Twenty. PERU: Hacienda Exito, 3 (F.M.); Tingo María, Huanuco, 2000 feet, 2 (F.M.); Chinchavita, Río Huallaga, Huanuco, 3000 feet, 1 (F.M.); Hacienda Buenavista, Río Chinchao, Huanuco, 3500 feet, 1 (F.M.); Hacienda San Antonio, Río Chinchao, Huanuco, 3000 feet, 1 (F.M.); Vista Alegre, Río Chinchao, Huanuco, 4100 feet, 1 (F.M.); Pozuzo, Huanuco, 10 (F.M.); San Jerónimo, Río Ucayali, Loreto, 1000 feet, 1 (F.M.).

REMARKS.—Superficially, *montanus* is almost indistinguishable from *apicalis*. Its cranial characters, however, show *montanus* to be most nearly related to *melanius*, from which it most certainly has been derived. Whether the transition in color from the pale *montanus* to the dark *melanius* is gradual or abrupt cannot be determined from present material. Nevertheless, of two adult specimens from Yurimaguas, referred to *melanius*, one is quite as dark as are those lower down the Huallaga, and the other is nearly as pale as are specimens of *montanus* from higher up the Huallaga. It is of interest to note that the relationship of *montanus* to *melanius* is about the same, in an inverted order, as that between the dark *napensis* and the pale *apicalis*.

Thomas, in identifying the central Peruvian water rats as *apicalis*, was guided by their superficial resemblance to the original colored figure of the type as well as by geographical considerations. Present material includes two specimens recorded by Thomas as *apicalis* (Tingo María), and one as *garleppii* (San Jerónimo). The Tingo María specimens are nearly topotypes and are indistinguishable from the type. The San Jerónimo specimen is similar to *garleppii* externally, but cranially it is characteristic of *montanus*, to which it is best referred. The specimens identified by Thomas as *apicalis*, from Chirimoto, Huambo, and San Nicolás, localities in the Huallaga drainage area, are probably representatives of *montanus*.

Nectomys squamipes garleppii Thomas

Nectomys Garleppii Thomas, 1899: 41; Thomas, 1901a: 189, PERU (Inambari River); Neveu-Lemaire and Grandidier, 1911: 9.

Holochilus (Nectomys) apicalis, Thomas (not of Peters), 1884: 451, PERU (Amable María and Maraynioc, Junín).

Nectomys Garleppi [sic], Thomas, 1902b: 129, BOLIVIA (Charuplaya, Cochabamba).

Nectomys garleppi [sic], Thomas, 1921a: 227 (part), PERU (Río Comerciato, Río Cosireni; Río San Miguel); Thomas, 1928: 259 (part), PERU (Chicosa, Junín).

Nectomys garleppii, Allen, 1900: 222, PERU (Juliaca [sic]); Allen, 1901: 42, PERU ("Juliaca" corrected to Inca Mines, Puno); Gyldenstolpe, 1932: 68, Pl. 17, Fig. 17.

TYPE SPECIMEN.—Adult, sex not recorded (skin with skull), British Museum (Natural History), No. 98.11.6.21; collected by Otto Garlepp.

TYPE LOCALITY.—A station somewhere in the tropical or subtropical zone of the Río Occobamba Valley, department of Cuzco, Peru.

DISTRIBUTION.—Andes of southeastern Peru and northeastern Bolivia; from the Río Perené in the department of Junín, Peru, south into the department of Cuzco along the Río Urubamba to the Río Yantili and its affluent, the Occobamba, east into the drainage area of the upper Río Madeira in the Cordillera de Carabaya (Río Madre de Dios) and the Bolivian departments of La Paz (Río Beni) and Cochabamba (Río Mamoré). Lower down,

in the upper Madeira, *garleppii* is replaced by *amazonicus*. In the upper Ucayali, the range of *garleppii* meets that of *montanus*.

CHARACTERS.—Larger than *montanus* or *amazonicus*, pelage more hispid than in *montanus*; paler throughout than *amazonicus*, more nearly as in *montanus*, but more uniformly ochraceous on upper parts of head and body, more white and more heavily washed with ochraceous beneath; upper parts of head and body Ochraceous-Buff with a mixture of Cinnamon-Brown not concentrated into a middorsal band; cheeks and sides of body Ochraceous-Buff; area around lips and chin nearly white, other ventral parts Pallid Neutral Gray to nearly white with a heavy wash of ochraceous on belly, chest, and throat; tail brown, keel brown or partly to completely gray; soles of hind feet five-, rarely six-tuberculate; cranial characters more nearly as in *apicalis* than as in *montanus* or *amazonicus*; proportion of length to width of interparietal averages 43.4 per cent (37–50 per cent, eleven specimens, including five subadults).

TABLE XII
MEASUREMENTS OF *Nectomys squamipes garleppii*

Measurements of the type are from the original description which include "basilar length (c.) 36; occipito-nasal length, 45." The topotypes and the first four specimens of the Santo Domingo series are subadults to young adults.

Locality	Sex	Head and Body	Tail	Hind Foot	Condylo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
Occobamba (type)	205	200	45 (<i>s.u.</i>)	.....	23.7	18.8	16.0	6.9	.....	.....
Occobamba	36.7	20.1	16.6	13.5	6.8	4.3 × 10.6	41
Occobamba	38.4	.....	17.6	13.6	7.2	3.9 × 9.5	41
R. Comerciati	♂	220	230	50.5	42.4	23.5	17.7	13.7	7.5	4.6 × 9.8	47
Perené	♂	214	236	53.0	41.5	24.0	19.3	14.1	7.2	4.4 × 9.6	46
Sto. Domingo	♀	168	195	46.0	37.1	22.5	15.9	14.4	7.4	4.2 × 9.7	43
Sto. Domingo	♀	171	191	48.5	37.3	21.7	15.5	13.9	7.5	3.7 × 10.1	37
Sto. Domingo	♀	170	199	47.3	37.5	21.6	16.5	13.9	7.6	3.7 × 9.0	41
Sto. Domingo	40.7	23.5	16.9	14.4	7.9	4.6 × 9.2	50
Sto. Domingo	♂	229	241	52.3	44.4	.....	.....	15.0	7.6	5.0 × 10.6	47
Inca Mines	♂	242	241	49.9	46.0	25.6	19.6	14.2	7.5	5.0 × 11.1	45
Inca Mines	♀	254	241	49.2	43.3	24.2	18.6	14.4	.....	3.9 × 9.9	39

SPECIMENS EXAMINED.—Twenty-five. PERU: Occobamba, 2 (U.S.N.M.); Río Comerciati, Cuzco, 2100 feet, 1 (U.S.N.M.); Yuvini, near Río Cosireni, Cuzco, 3000 feet, 1 (U.S.N.M.); San Fernando, Río San Miguel, Cuzco, 4500 feet, 5 (U.S.N.M.); Chanchamayo, Junín, 1200 meters, 1 (U.M.M.Z.); Perené, Junín, 2 (A.M.); Santo Domingo, Carabaya, Puno, 6500 feet, 6 (F.M., 2; A.M., 1; U.M.M.Z., 1; U.S.N.M., 1; M.C.Z., 1); Río Huacamayo,

Carabaya, Puno, 1 (U.S.N.M.); Inca Mines, Puno, 6000 feet, 4 (A.M.).
 BOLIVIA: Charuplaya, Río Securé, Cochabamba, 1350 meters, 1 (A.M.);
 Mapiri, Río Camata, La Paz, 2000 meters, 1 (A.M.).

REMARKS.—The individuals from the Cordillera de Carabaya and Bolivia may have been derived from the Brazilian *amazonicus*, which ranges into the upper Río Madeira region in Brazil. Those from the Urubamba-Apurimac drainage area may have originated from the same stock which gave rise to *montanus*, viz., *melanius*. Present material, however, consisting largely of immature individuals, does not reveal any important differences between the water rats of the two areas in question.

In general, each of the Andean races of water rats is larger, paler, has a heavier skull, larger teeth, and a longer interparietal than has its geographically nearest lowland, or Amazonian, relative. Indeed, so markedly uniform is the tendency for the Andean races, as a group, to be distinguished in these respects, that it is difficult to separate them one from another. Thus, the absence of any differences between the upper Río Ucayali and the upper Río Madeira representatives of *garleppii* recalls a lack of important differences between *garleppii*, as a whole, and *apicalis* of eastern Ecuador. In the latter, however, subspecific distinction is premised chiefly on the superficially similar, but cranially distinct, *montanus*, which occupies the long stretch of the Peruvian Andes between the ranges of *garleppii* and *apicalis*. It may be added that the anterolophid of m_{2-3} tends to be weakly developed or obsolete in *garleppii* but is, as a rule, well developed in *apicalis*.

Nectomys squamipes vallensis, new subspecies

Nectomys garleppi [*sic*], Thomas (not of Thomas), 1921a: 227 (part), PERU (Santa Ana, Cuzco).

TYPE SPECIMEN.—Adult male (skin with skull), U.S.N.M. No. 194911; collected December 17, 1914, by E. C. Erdis; original No. 12 (specimen No. 577, of the Yale University-National Geographic Society's Peruvian expedition 1914-15, Edmund Heller, collector).

TYPE LOCALITY.—Santa Ana, a semiarid, tropical pocket in the Río Urubamba Valley, department of Cuzco, Peru; altitude, 3480 feet.

DISTRIBUTION.—Known only from the type locality. The canyon-like nature of the Urubamba Valley, though comparatively wide and gently sloping at Santa Ana, restricts the spread of *vallensis* to a short distance downstream, where intergradation with *garleppii* (Ríos Cosireni and Comerciato) undoubtedly occurs, and an equally short distance upstream, where the altitudinal limits of the range of the species are reached.

CHARACTERS.—Size the same as in *garleppii*; pelage coarse; color paler throughout than in *garleppii*, the pale color of the dorsum due mainly to the comparatively shorter, sparser Cinnamon-Brown tipped guard hairs and the

comparatively broader Ochraceous-Buff bands of the cover hairs; soles five-tuberculate; tail as in *garleppii*; cranial and dental characters similar to those of *garleppii*; proportion of length to width of interparietal averages 44.9 per cent (39–51 per cent, seven specimens).

COLOR OF TYPE.—Back Ochraceous-Buff mixed with Cinnamon-Brown; crown and forehead with more brown; sides of body and cheeks paler than back; underparts nearly white with throat, chest, and belly washed with ochraceous; fore and hind feet pale brown above, darker beneath, tail uniformly brown.

TABLE XIII
MEASUREMENTS OF *Nectomys squamipes vallensis*

Collector's measurements of head and body and of tail originally given in inches, here converted to millimeters; the first specimen is a subadult.

Locality	Sex	Head and Body	Tail	Hind Foot	Condylar-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
Sta. Ana	♀	176	190	44.2	.....	.....	16.7	.....	6.5	4.3 × 8.8	49
Sta. Ana	♂	203	49.0	39.7	22.1	17.1	14.1	7.5	.....	.....
Sta. Ana	♂	203	200	46.4	40.0	22.5	17.0	14.4	7.5	3.8 × 9.3	41
Sta. Ana (type)	♂	218	203	47.0	40.1	22.4	17.4	13.8	7.2	3.6 × 8.8	41
Sta. Ana	♂	196	213	50.5	41.3	.....	18.0	14.5	7.1	4.9 × 9.6	51
Sta. Ana	♂	219	215	48.2	41.3	22.8	18.0	14.4	7.0	3.7 × 7.9	47
Sta. Ana	♂	191	200	46.2	41.5	22.8	18.4	14.6	7.0	3.9 × 10.0	39
Sta. Ana	♂	236	.....	51.4	42.2	23.1	18.3	13.4	7.3	3.7 × 8.1	46

SPECIMENS EXAMINED.—Twelve (including four in alcohol), all paratypes (U.S.N.M.).

REMARKS.—Palest of the eastern Andean water rats. This is apparently a localized form. No water rats were taken by members of the Yale University–National Geographic Society's expeditions in the many localities in the Urubamba Valley above Santa Ana where large scale collecting was done.

Nectomys squamipes grandis Thomas

Nectomys grandis Thomas, 1897a: 498; Cabrera and Yepes, 1940: 208.

Holochilus (Nectomys) apicalis, Thomas (not of Peters), 1882: 101 (part), COLOMBIA (Concordia).

TYPE SPECIMEN.—Adult male (skin with skull), British Museum (Natural History), No. 73.11.5.3; collected by J. K. Salmon.

TYPE LOCALITY.—Concordia, western slope of the lower Cauca Valley, Medellín, Antioquia, Colombia; altitude, 1790 meters.

DISTRIBUTION.—Known from the type locality only.

CHARACTERS.—No specimens have been seen, the original description follows:

Size large. General colour coarsely mixed black and dull yellow, the resulting tone not unlike that of *N. squamipes*, although the mixture is rather coarser. Sides dull brownish yellow, gradually passing into the yellowish buff of the belly. Belly hairs slaty grey basally, as usual. Hands and feet dark brown, edged with closely-set whitish bristles; soles naked, scaly, with five pads, all rather larger than in *N. apicalis*, especially the large proximal one, which is both longer and broader than in the allied species. Tail long, coarsely scaled, uniformly blackish, the under surface with a few whitish hairs intermixed with the black.

Skull large and heavily built. Nasals long, slightly constricted about the middle, evenly tapering backwards, neither so long nor so narrow as in *N. apicalis*. Frontal flattened; supraorbital edges evenly divergent, straight, not bowed until they have reached the parietals; fronto-parietal suture forming nearly a right angle at the centre, instead of being nearly transverse. Palatal foramina parallel-sided, not broader behind than in front. Posterior edge of palate square.

Dimensions of the type (an adult male measured in skin):—

Head and body (c.) 290; tail (c.) 270; hind foot (moistened) 56; length of last foot-pad 11.

SKULL.¹⁵—Lambda to nasal tip, 42.2; greatest breadth, 26; nasals, length, 19.8, breadth anteriorly, 5.1, behind the constriction, 4.2; interorbital breadth, 7.2; greatest distance between temporal ridges, 12.8; length of frontal suture, 15.1; length of parietal suture, 8.2; interparietal breadth, 9; palate length from henselion, 22.4; diastema, 13.2; palatine foramina, 7.3 by 3.1; length of upper molar series, 7.6.

SPECIMENS EXAMINED.—None.

REMARKS.—In an introductory statement, Thomas (1897a: 498) characterized *grandis* as “the largest species [of *Nectomys*] as yet known.” It will be noted that the original measurements of the imperfect skull of the type, compared as they are in tabulated form with those of *magdalenae* and *fulvinus*, are not significantly greater than those of, and are not excessive for, a full-grown individual of any race of *squamipes*. The description of the skin is patently that of a *squamipes* (*sensu lato*). The measurements of head and body and of the tail, which exceed by far those of any known water rat, were admittedly approximations taken from the dry skin; the length of the plantar tubercle is not distinctive, that of the hind foot (56 mm., presumably without claw) is very large for the species, but practically equaled in some specimens of *pollens*. Finally, the type specimen of *grandis* is the same individual that Thomas in 1882 (p. 101) could not distinguish specifically from other water rats (his *apicalis*) of northern Peru.

The taxonomic problem presented by *grandis* is not that of its quite evident specific identity with *squamipes*, but rather its page priority over *magdalenae*, should these two prove to be the same.

¹⁵ In the original description, the above cranial measurements are presented in tabular form with those of *magdalenae* and *fulvinus*. Since this arrangement is not conserved here, I have added necessary punctuation and omitted quotation marks.

Nectomys squamipes magdalenae Thomas

Nectomys magdalenae Thomas, 1897a: 499; Tate, 1939: 197 (reference).

Nectomys garleppi [sic], Allen (not of Thomas), 1916a: 217 (part), COLOMBIA (San Agustín and Andalucía, Huila; Florencia, Caquetá).

TYPE SPECIMEN.—A skull only, British Museum (Natural History), No. 97.3.17.1; collector and date of capture not recorded.

TYPE LOCALITY.—“W. Cundinamarca, in lowlands near Magdalena R.,” Colombia.

DISTRIBUTION.—The upper Magdalena Valley, Colombia, in the departments of Cundinamarca, Tolima, and Huila to an altitude of at least 5000 feet, thence east over the Magdalena-Caquetá divide to the upper Caquetá drainage area on the eastern slope of the eastern Andes.

CHARACTERS.—Size as in *apicalis*; olivaceous in appearance, with more yellow than in *apicalis*; upper surface Warm Buff mixed with Dresden Brown or Mummy Brown; gray underparts washed with Warm Buff; hind foot with five plantar tubercles; tail epidermis brown, the keel brown, or gray from one-fourth of terminal part (including pencil) to entire length; proximal part of nasals less tapered, their ends more rounded than in *apicalis*; proportion of length to width of interparietal averages 50.7 per cent (49–53 per cent, four adult specimens, including the type).

TABLE XIV
MEASUREMENTS OF *Nectomys squamipes magdalenae*

Measurements of all the available adults are given. Cranial measurements of the type are from the original description which includes basilar length, 36.5; lambda to nasal tip, 39.7; “length of upper molar series,” 7.1, which may not be comparable, as it appears, to the alveolar length measurement given here.

Locality	Sex	Head and Body	Tail	Hind Foot	Condyllo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
(Type)	25.0	18.2	14.5	.....	5.6 × 11.5	[49]
S. Agustín ...	♂	190	230	52.2	40.2	23.0	17.2	13.1	7.8	5.2 × 10.6	49
S. Agustín ...	♀	43.7	24.7	18.6	13.3	7.7	5.1 × 9.6	53
S. Agustín ...	♂	220	250	54.6	.....	.....	.....	.....	.....	.....	.....
Andalucía ...	♀	190	220	49.6	.....	23.3	17.7	13.6	7.9	.....	.....
Andalucía ...	♂	44.4	26.5	20.1	13.6	7.8	5.0 × 9.6	52
Florencia	230	240	54.6	.....	.....	.....	.....	.....	.....	.....

SPECIMENS EXAMINED.—Ten. COLOMBIA: Near San Agustín, Huila, 5000 feet, 3 (A.M.); Andalucía, Huila, 5000 feet, 3 (A.M.); Río Chili, southeast of Ibagué, Tolima, 2 (A.M., 1; U.S.N.M., 1); Florencia, Río Orteguaza, tributary of upper Caquetá, Caquetá, 675 feet, 2 (A.M.).

REMARKS.—The present characterization of *magdalenae* is based on four adult specimens from San Agustín and Andalucía, both localities in the

Magdalena Valley above the type locality. In essential details, the skulls of these specimens conform to the type, a skull only, to judge from its description by Thomas.

Any extended discussion of the relationships and distribution of *magdalenae* based on present scanty and imperfect material is hazardous. It is certain, however, that the water rats of the Magdalena Valley have been derived from those of the eastern slope of the eastern Andes of Colombia; indeed, two skins, such as they are, from Florencia on a tributary of the upper Caquetá, appear best included with *magdalenae*. If the crania of water rats from this region confirm subspecific identity with water rats of the Magdalena Valley, a trans-Andean continuity in the range of *magdalenae* may be indicated. According to Leo E. Miller (in Chapman, 1917: 47), who collected the three available specimens of *magdalenae* below Andalucía, at an altitude of 5000 feet on the western side of the eastern Andes, the forest extends to "Andalucía, altitude 7000 feet, which is practically the top of the range . . . and is continuous over the eastern side" to Florencia (and the Amazon), where the two available skins of, apparently, *magdalenae* were taken. Though the species has been recorded elsewhere at an altitude nearly as high as that of Andalucía itself (*cf. garleppii*, at Mapiri, 2000 meters), continuity in the distribution of the water rats of both slopes of the eastern Andes through the Magdalena-Caquetá divide is probably maintained at lower, more congenial, elevations. Nothing is known of the large water rats from the lower part of the Magdalena Valley. In any event, representatives of them (*grandis*) have penetrated into the branch valley of the lower Cauca.

Nectomys squamipes subspecies I

Nectomys magdalenae, Allen (not of Thomas), 1916a: 217 (part), COLOMBIA (Buenavista, near Villavicencio).

Present material from several near-by localities on tributaries of the upper Río Meta, eastern Colombia, is too sketchy to be classified with assurance. Of fourteen specimens, nine are adults. Of these, two from Guaicaramo and one each from Villavicencio, Medina, and Mambita are represented by both skin and skull. They agree with *apicalis* of Ecuador in size, color (none of the skins is darkened on the back as in *melanius*), and proportional length of the interparietal; they differ slightly in average length of the alveolar row and in the lesser attenuation of the nasals behind. In this last respect, they are more nearly like *melanius* than is either *apicalis* or *magdalenae*. More perfect material, including specimens from the llanos between the localities mentioned and the Orinoco in Venezuela, may reveal constant differences in some characters not now considered to be of much importance. The series differs from the two skins from Florencia,

Caquetá, which have been referred to *magdalenae*, in practically the same respects that *apicalis* differs from *magdalenae*. It is obvious, hence, that no continuity of range between *apicalis* and the upper Río Meta specimens can be implied.

TABLE XV
MEASUREMENT OF *Nectomys squamipes*, SUBSPECIES I

No external measurements are recorded on the label of any of the specimens.

Locality	Sex	Head and Body	Tail	Hind Foot	Condyllo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
Medina	♂	49.5	40.5	24.3	18.7	13.8	7.6	4.3 × 9.5	45
Guaicaramo	♂	49.8	40.6	23.9	.....	13.5	7.3	4.7 × 10.1	47
Guaicaramo	♂	49.4	40.8	23.9	17.6	13.3	7.4	4.5 × 9.8	46
Villavicencio	♂	39.4	23.0	17.1	14.0	7.4	4.7 × 9.3	50
Villavicencio	♂	54.6	42.8	24.6	19.1	13.5	7.6	4.4 × 10.2	43
Villavicencio	♂	43.3	24.7	18.9	14.5	7.4	4.3 × 10.6	41
Villavicencio	♂	43.3	24.7	19.0	13.7	7.2	4.4 × 10.5	42

SPECIMENS EXAMINED.—Fourteen. COLOMBIA: Villavicencio, Meta, 470 meters, 6 (A.M.); Guaicaramo, northeast of Villavicencio, Meta, 4 (A.M., 2; U.S.N.M., 2); Medina, eastern Cundinamarca, 2 (A.M., 1; M.C.Z., 1); Mambita, eastern Cundinamarca, 2 (A.M.).

REMARKS.—I failed to find any specimen of *Nectomys* from Buenavista as recorded by Allen (1916a: 217). This locality is just west of Villavicencio, in the same region in which all the other specimens of subspecies I were taken.

Nectomys squamipes subspecies II

Nectomys palmipes, Pittier and Tate (not of Allen), 1932: 261, VENEZUELA (Sucre).

A single adult female (A.M. No. 69899) from San Antonio, southeast of Mount Turumiquire, Venezuela, altitude, 1800 feet, differs markedly from both *palmipes* and *melanius*, its nearest geographic allies. It appears to be more nearly related to the eastern Colombian water rats tentatively designated as subspecies I.

CHARACTERS.—Color similar to that of the eastern Colombian form (subspecies I); dorsal surface Ochraceous-Orange with a more or less even mixture of Prout's Brown; underparts gray, the belly and chest washed with ochraceous; left hind foot with five, right hind foot with six, plantar tubercles; tail uniformly brown, longer than combined length of head and body; interparietal as in subspecies I; alveolar row shorter; nasals behind as in the eastern Colombian water rats and *melanius*.

MEASUREMENTS.—Length of head and body, 180; tail, 200; hind foot (dry), 48.0; condyllo-basal length, 39.1; zygomatic breadth, 22.2; length of

nasals, 17.5; width of brain case (across parietal ridges), 14.4; alveolar length of molar row, 7.1; interparietal, 4.3 by 9.1 (47 per cent).

REMARKS.—In many respects the San Antonio specimen appears to stand between subspecies I of Colombia and *melanius* of Venezuela. It has the long interparietal of the former, the short tooth row of the latter; the proximal ends of the nasals are shaped alike in all three; externally, it has the hues common to both, but with the distribution of the ochraceous and dark brown as in the Colombian form, the tone of ochraceous, however, is nearer that of *melanius*; thus, among individuals of *melanius*, the specimen resembles, superficially, the one from Arabupu (Mount Roraima). Compared with *palmipes*, its nearest geographic ally, subspecies II agrees in all cranial characters except in the shape of the proximal ends of the nasals; externally, the two are quite different—the island form has diverged to a marked extent from the general pattern common to the Venezuelan and Guianan water rats.

This specimen probably represents a well-defined race which ranges throughout northern Venezuela. It is also possible that this form and subspecies I represent the extremes of but a single, wide-ranging race.

A juvenile from Latal on the northwestern side of Mount Turumiquire is, no doubt, subspecifically the same as the San Antonio specimen.

Nectomys squamipes palmipes Allen and Chapman

(Pl. III, Figs. 1 and 2, cranium)

Nectomys palmipes Allen and Chapman, 1893: 209; Allen and Chapman, 1897: 17, TRINIDAD (Caparo; Caura); Elliot, 1907: 243, TRINIDAD (Caura; Princetown; Savannah Grande); Vesey-Fitzgerald, 1936: 4, TRINIDAD (St. Michael's Valley, N. Range).

N[ectomys]. palmipes, Thomas, 1897a: 498 (reference).

[?] *Mus pilorides*, Ledru (not of Pallas, *vide* Thomas, 1893: 8), 1810: 257.

Holochilus squamipes, Thomas, 1893: 8, TRINIDAD.

Nectomys squamipes palmipes, Tate, 1939: 198 (part), TRINIDAD (Princetown).

TYPE SPECIMEN.—Adult male (skin with skull), A.M. No. $\frac{5928}{4658}$; collected April 10, 1893, by Frank M. Chapman.

TYPE LOCALITY.—Princetown, Victoria County, Trinidad.

DISTRIBUTION.—Island of Trinidad.

CHARACTERS.—Slightly larger than *melanius*; pelage shorter, less glossy; color paler throughout, with more yellow, than in *melanius* or subspecies II; underparts more clearly defined than in any other race; back Cinnamon-Buff with a mixture, rarely a heavy concentration, of Cinnamon-Brown or Prout's Brown; nose and crown nearly uniformly Cinnamon-Brown; cheeks and sides of body nearly uniformly Cinnamon-Buff; the comparatively well-defined underparts nearly white with a light wash of Pinkish-Buff to Cinnamon-Buff on chest and belly; tail usually shorter than combined length

of head and body, the epidermis brown above, paler beneath from basal one-fourth to entire length; keel uniformly brown or brown mixed with gray; hind foot with five plantar tubercles; nasals usually narrowly constricted at level of antero-lateral angle of fronto-nasal suture and terminated behind in a V-shaped point; proportion of length to width of interparietal 51.0 per cent (43-59 per cent, fourteen specimens, including one subadult).

TABLE XVI
MEASUREMENTS OF *Nectomys squamipes palmipes*
The first Princetown specimen is a subadult.

Locality	Sex	Head and Body	Tail	Hind Foot	Condyllo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal	Percentage
Princetown	♂	189	196	41.6	38.3	22.3	16.4	14.1	7.1	4.8 × 9.2	52
Princetown	♂	210	195	47.1	40.0	23.8	18.4	13.8	.....	4.4 × 9.2	48
Princetown	♀	205	175	44.4	40.8	22.6	16.9	14.0	7.0	4.4 × 8.3	53
Princetown	♀	198	192	47.1	40.8	.....	17.9	13.3	7.3	4.3 × 8.8	49
Princetown (type)	♂	210	210	48.1	41.6	23.6	18.4	14.1	7.1	4.6 × 9.5	48
Princetown	♂	42.9	23.7	19.1	13.5	7.1	4.9 × 8.3	59
Princetown	♂	223	210	.....	43.8	24.0	19.4	14.3	7.4	4.3 × 9.6	45
Caura	♀	185	.....	46.6	.....	.....	16.1	13.6	.....	4.8 × 8.5	56
Caura	♀	230	205	48.5	42.5	.....	18.9	13.9	7.4	4.6 × 8.2	56
Caparo	♂	200	172	45.5	.....	21.1	17.0	13.3	7.1	4.4 × 8.1	54
Caparo	♂	214	206	49.1	.....	.....	17.4	.....	7.2	.....	.....
Caparo	♂	49.1	40.9	23.8	18.3	13.9	7.4	5.2 × 10.1	51
Caparo	♂	240	200	49.3	42.5	24.0	18.2	14.2	7.1	4.7 × 9.0	52
Caparo	♀	42.8	24.1	.....	14.3	7.2	4.6 × 10.8	43
Caparo	♀	211	209	46.6	.....	.....	19.0	.....	7.1	.....	.....
Caparo	♂	247	209	51.2	44.3	25.2	19.5	14.1	6.9	4.5 × 9.3	48

SPECIMENS EXAMINED.—Forty-two. TRINIDAD: Princetown, Victoria, 13, including the type (A.M., 11; F.M., 2); Savana Grande, Victoria, 1 (F.M.); Caparo, Caroni, 21 (A.M., 18; U.S.N.M., 2; F.M., 1); Caura, St. George, 4 (A.M., 1; F.M., 1; M.C.Z., 2); Caroni Marshes, Caroni, 1 (A.M.); Heights of Aripo, 1 (A.M.); Heights of Orepouche, St. Andrew, 1 (A.M.).

REMARKS.—Notwithstanding the proximity of Trinidad to the mainland and the aquatic habits of the species, the strongly marked characters of *palmipes* indicate an isolation from its nearest geographic allies of a higher degree than obtains in any other subspecies of water rats. The period of independent development thus implied obscures the relationship of *palmipes* to its mainland relatives. Nevertheless, in the shape of its interparietal, *palmipes* can be traced to subspecies II, which is also nearest geographically. Through subspecies II, *palmipes* can be related to subspecies I of the llanos of eastern Colombia, with which it agrees in all respects except in the shape

of the nasals behind, in color, and, perhaps, in the relative length of the tail—a measurement, unfortunately, not available for subspecies I.

Nearly all of the specimens are from the three west central counties which border on the Gulf of Paria. There is comparatively little variation in color among them. One old individual from Caparo, in old pelage, is unusually dark on the dorsal surface; in an even darker specimen (skull missing) from the Caroni marshes, the guard hairs are exceptionally long and fine, the subterminal bands unusually broad and ochraceous. Among the forty-two specimens examined, the collectors' measurements show that in only two individuals, neither of which is adult, is the tail longer than the combined length of head and body. The measurements of these specimens with their localities are: Princetown, 189: 196; Heights of Aripo, 169: 184. In the type specimen, the tail is as long as head and body combined.

SUBGENUS *SIGMODONTOMYS* ALLEN

- Sigmodontomys* Allen, 1897: 38 (type *alfari*); Elliot, 1904: 254 (*alfari*); Trouessart, 1905: 427 (*alfari*); Elliot, 1905: 191 (*alfari*).
- Nectomys*, Trouessart, 1905: 412, part (*russulus*, *esmeraldarum*); Goldman, 1913: 7 (*Sigmodontomys alfari* = *Nectomys alfari*); Elliot, 1917: 55, part (*alfari*); Goldman, 1920: 104 (*alfari*); Miller, 1924: 367, part (*alfari*); Gyldenstolpe, 1932: 65, part (*russulus*, *esmeraldorum* [sic]); Tate, 1932a: 6, part (*russulus*, *alfari*, *esmeraldarum*, *ochraceus*); Ellerman, 1941: 361, part (*alfari*, *esmeraldorum* [sic], *russulus*).
- Oryzomys*, Miller, 1912: 171, part (*ochraceus*); Elliot, 1917: 58, part (*ochraceus*).

TYPE.—*Sigmodontomys alfari* Allen.

SUBGENERIC CHARACTERS

EXTERNAL.—Smaller than *Nectomys*, about the size of a moderately large *Oryzomys*; pelage characterized mainly by the long dense covering of wool hairs; tail always longer than combined length of head and body, without ventral keel of stiff hairs, or pencil; proximal half of tail with 14–19 scale rows per centimeter; hind foot (Fig. 2, *a-b*) without distinct fringe; fifth toe, less claw, extends from more than halfway to three-fourths length of first phalanx of fourth; distal one-half of sole scutellated as in *Nectomys*, proximal one-half smooth or slightly granular, swim-membrane of hind foot moderately developed, the webbing between the three middle digits extended one-half to three-fourths length of first phalanges, between fourth and fifth toes from the metatarsals to the first respective phalanges, nearly obsolete between first and second toes.

CRANIAL.—Skull moderately large, robust, more heavily built than in *Nectomys* or any other oryzomyine rodent; nasals broadly tapered behind, their bases truncate or obtusely pointed; supraorbital ridges heavier and more projecting than in *Nectomys*; posterior halves of temporal ridges nearly as well developed as anterior halves; incisive foramina as in *Nectomys*, or narrower and pointed behind; median border of alveolar part of maxilla behind m^3 projecting as a ledge over posterolateral palatine fossa, the palato-maxillary suture at this place courses on internal wall of fossa and is hidden from the ventral aspect (Fig. 3, *b*); spheno-palatine vacuities present, variable in size.

DENTAL (Fig. 4, *d-f*, Fig. 5, *c-d*).—Cheek teeth proportionately larger with lower crests than in *Nectomys*; upper and lower second and third molars approximately as wide as long; m_2 and m_3 each with three roots, two anterior and one posterior; anterolophid absent in m_{2-3} but sometimes weakly indicated in the recently erupted teeth; anterior cingulum of m_2 absent, of m_3 obsolete or absent; primary folds tend to become completely

isolated at an early stage (preadult) in wear; m^3 with second secondary fold absent.

REMARKS.—The characters which separate *Sigmodontomys* from *Nectomys* are fewer in number and are less marked than those which distinguish either form from other oryzomyine rodents. The apparent relationship of *Sigmodontomys* to *Nectomys* however, is probably attributable to an independent development, along parallel lines, of certain characters derived from the common oryzomyine stock rather than to a divergence from a necessarily more recent *Nectomys*-like stock. Externally, *Sigmodontomys* has not attained as much aquatic specialization as has *Nectomys*; cranially, it has gone even farther than *Nectomys* in the greater simplification of the molar crowns, and the greater complication of the molar roots, in the stronger development of the cranial ridges, and, generally, in the heavier, more sturdily built skull.

Other than *N. alfari* no species can be assigned with certainty to *Sigmodontomys*.

NECTOMYS ALFARI ALLEN
(Synonymy under subspecies)

DISTRIBUTION

(Map 2)

Though the distributional records for *N. alfari* are few and scattered, they conform to the distributional pattern of other, better-known species of Neotropical origin the ranges of which are restricted to forested habitats in Central America and northwestern South America. From the northernmost point in Nicaragua where *alfari* has been recorded, into southern Panama, the characters alone of the available specimens suggest no disruption to a continuous distribution. Here the general ecological uniformity of the Atlantic coastal strip, the low altitude and broken nature of the mountain ranges, and the disposition of the streams, notably the Tuyra and its principal affluent, the Chucunaque, are geographical aids which need hardly be appealed to when the morphological characters can be studied in tracing the spread of the species from northwest to southeast from Atlantic to Pacific drainage. The range of the species, from the Tuyra (*efficax*) to the Atrato basins, must be practically continuous through deep passes of the low lying Serranía del Darién. Thence, the dispersion into the Cauca-Magdalena Valley (*russulus*) and along the west coast and western slope of the western Cordillera into northern Ecuador (*esmeraldarum*) has produced no important changes in the characters of the species. It appears that the desert region which extends along the coast from western Peru into Manaví Province, Ecuador, and the arid part of the western Cordillera in northern Peru and southern Ecuador combine to limit

the southern spread of the species. In northern Colombia, on the other hand, representatives of *alfari* have crossed the Sierra de Perijá and are present in the Lake Maracaibo basin. The species is not known from the eastern slope of the eastern Cordillera.

The range of each of the races as given in the subspecies account is based entirely upon the localities of the specimens examined or recorded. It may safely be assumed that from the range of *N. a. alfari* in the north to that of *esmeraldarum* in the south, the distribution is a continuous one.

CHARACTERS

Pelage of dorsum long, dense and glossy, the individual hairs 11–15 mm. long; pelage of underparts, shorter and silky in texture. Back Ochraceous-Orange to nearly Ochraceous-Buff mixed with Prout's Brown to Cinnamon-Brown, basal parts of hairs Neutral Gray, subterminal bands of cover hairs Ochraceous-Buff, points and terminal parts of guard hairs Prout's Brown to Cinnamon-Brown; sides of body like back, but with the Prout's Brown of the guard hairs gradually disappearing toward the undersurface; underparts gray to nearly pure white with a light to heavy wash of Ochraceous-Buff, the Neutral Gray parts of the hairs showing through; head from nose to crown like back, but colors more evenly mixed and hairs much shorter; cheeks like sides or slightly paler; area around mouth whitish with or without an ochraceous wash; a narrow but well-defined orbital ring usually present; ears nearly uniformly brown exteriorly, brown mixed with ochraceous interiorly; fore and hind feet sparsely covered with short, gray to brown bristles; digital tufts silvery to brown; tail uniformly grayish brown or slightly paler beneath than above. Other essential external and cranial characters those of the subgenus.

COMPARISONS

As compared with extra-generic forms, the cranial, especially the dental, characters of *N. alfari* are too well marked to permit any confusion. A few oryzomyine rodents, until subjected to closer scrutiny, may be said to bear a superficial resemblance to *alfari*. *Oryzomys albigularis*, known as *devius* in Central America and, commonly, as *meridensis* in northern South America,¹⁶ is externally not unlike *alfari*. Its pelage is not quite as long or as "fluffy," its tail is usually clearly bicolor, the soles of its hind feet are entirely smooth except for the plantar tubercles, the well-developed digital tufts extend well beyond the tips of the claws; the vibrissae, though long in *alfari*, are even longer in *albigularis*. Cranially, *O. albigularis* is quite distinct; its long, narrow rostrum, its large and well-rounded brain case, its

¹⁶ Other specific synonyms of *albigularis* include *O. pirrensis*, *childi*, *o'connelli*, *pectoralis*, *maculiventer*, *auriventer*, *keaysi*, *obtusirostris*, and *levipes*.

slender interorbital region without projecting ridges, and its smaller cheek teeth with open primary folds and open, well-marked anterior median fold are distinguishing characters. Species of the *trinitatis* (= *tectus*)¹⁷ group of *Oryzomys* are of about the same size as *Nectomys alfari*, with similarly fluffy fur and long tail. They are distinguished principally by their broad and markedly shorter hind feet provided with long digital bristles which project beyond the short, recurved claws; cranium less heavily built, rostrum relatively shorter and narrower, zygomatic plate only slightly projecting, short zygomata nearly parallel-sided, interparietal much larger, molars smaller and more complicated in structure, palato-maxillary suture between m^3 and palatine pit as in typical *Nectomys*. In dorsal view the skull of a young individual of *alfari* in which the rostrum and dorsal ridges have not yet assumed their typically heavy structure, resembles an ordinary *Oryzomys* (s.s.). Here again, in *alfari*, the large size of the molars and their comparatively simple enamel pattern form the most conspicuous differences. There is a superficial resemblance between adults in old pelage and juveniles of *alfari* to adults and juveniles, respectively, of *O. (Melanomys) caliginosus*.¹⁸ The short tail and small hind foot of the latter are the most prominent external differences. The most striking resemblance to *alfari* is noted in the atypical *Oryzomys aphantus*. Externally, it is distinguished from *alfari* by its darker color, finer pelage, the greater length of its tail (extreme for an oryzomyine rodent), and by the longer fifth hind toe which reaches to base of second phalanx of the fourth toe. Cranially, *aphantus* is distinguished chiefly by its narrower interorbital region, the greater attenuation of the nasals posteriorly (quite as in *N. squamipes*), the weaker, narrower zygomatic plate, and, especially, by the even larger size of its cheek teeth, which attain here a maximum in size and complexity among oryzomyine rodents. In *aphantus*, the greatest width of m^1 is nearly equal to the shortest distance across the palate between each of the first molars.

INDIVIDUAL VARIATION

To judge from the external measurements taken by the various collectors, the combined head and body length varies from 65 per cent to 95 per cent of the tail length without any apparent relation to the age of the individual as was noted in *N. squamipes*. The number of plantar tubercles varies from five to six with no constant number in any one series. As in

¹⁷ Includes at least *O. trinitatis* (= *palmaris* and *fulviventer*, *fide* Tate, 1939: 190), *flavicans* (with subspecies *tectus*, *frontalis*, *illectus* [= *trichurus*, *fide* Tate, 1939: 190]), *subluteus*, *helvolus* (= *vicencianus*, *fide* Tate, 1939: 190), and *klagesi*.

¹⁸ In addition to the Central American forms referred to *caliginosus* by Goldman (1918), the following described species from South America are synonyms of *caliginosus*: *phaeopus*, *obscurior*, *columbianus*, *affinis*, *lomitensis*, *buenavistae*, and *robustus*. Sub-specific distinction between some of them is doubtful.

N. squamipes, there may be five tubercles on one foot and six on the other of the same individual. Notable changes in the skull concurrent with senescence are a greater thickening of the rostrum and the incisors and a greater projection of the dorsal ridges. Unlike *N. squamipes*, the length of the skull does not continue to increase for an indefinite period after maturity. Instead, during senescence, there frequently ensues a marked curvature of the longitudinal axis which has the effect of limiting the cranial length as measured in a straight line. The upper incisors curve backward from where their points barely reach a line perpendicular to the posterior border of the alveoli to a distance behind them which is in excess of their greatest thickness; the color of the incisors, notably of those of the lower jaw, varies from deep orange to nearly pure white; the crown surfaces of the cheek teeth exhibit considerable wear even in subadults and, except in extremely old individuals, are not indicative of the age of the specimen. No special sexual differences are apparent in the species.

THE SUBSPECIES

Though the species of *N. alfari* exhibits a high degree of individual and local variability, it shows little evidence of geographic variation. Two large series of *efficax* from near-by localities, Cana and Tacarcuna, vary almost as much as does the species throughout its entire range. The chief claim of *efficax* to subspecific status is the lack of specimens of *alfari* from intermediate localities and of specimens of *russulus* with which to compare it. Goldman (1913: 7), in describing *efficax*, admitted that it "may not be very unlike *N. russulus* . . . specimens of which I have not seen." In addition, material which has since accumulated shows that *efficax*, especially as represented by the Tacarcuna series, is subspecifically indistinguishable from specimens, including topotypes, of *esmeraldarum* from the southern limits of the range in Ecuador. Nevertheless, I am inclined to retain both *efficax* and *esmeraldarum* as nominal subspecies on the basis of the trivial characters herein ascribed to them until undoubted representatives of the earlier named *russulus* are available for comparison.

NOTE ON MEASUREMENTS

Combined head and body length and tail length are the collectors' measurements; hind foot length, to the longest claw, was taken from the dry skin. Cranial measurements are the same as those given for *N. squamipes*; the measurement of the interparietal is much more simple in *alfari*. The remarks on size for *squamipes* do not apply to *alfari*.

Nectomys alfari alfari Allen

Sigmodontomys alfari Allen, 1897: 39, Pl. 1, Figs. 8-14; Elliot, 1904: 255 (description).
Sigmodontomys alfari [sic], Thomas, 1901b: 251.

Sigmodontomys Alfari [sic], Thomas, 1905a: 587 (reference).

Oryzomys ochraceus Allen, 1908: 655, NICARAGUA (Río Grande, type locality); Elliot, 1917: 60 (description).

Nectomys alfari alfari, Goldman, 1913: 7; Goldman, 1916: 127 (*ochraceus* = *alfari*); Goldman, 1920: 105 (reference).

TYPE SPECIMEN.—Adult male (skin with skull), A.M. No. $\frac{12436}{10744}$; collected by Anastasio Alfaro; original number, 3.

TYPE LOCALITY.—Jiménez, upper Río Jiménez, province of Limón, Costa Rica; altitude, 700 feet.

DISTRIBUTION.—Atlantic drainage areas of Nicaragua and Costa Rica.

CHARACTERS.—Externally as in the species, but with an even mixture of the ochraceous and brown colors of the dorsum; sides not conspicuously paler than back; nasals obtusely pointed behind; brain case and interparietal large; incisive foramina comparatively widely open and narrowly rounded behind; width of mesopterygoid fossa approximately equal to crown length of first molar.

TABLE XVII
MEASUREMENTS OF *Nectomys alfari alfari* ALLEN

External measurements of the type (a young adult) are from the original description, the type specimen itself is without collector's measurements.

Locality	Sex	Head and Body	Tail	Hind Foot	Condylar-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal
Jiménez (type)	♂	123	155	37.0	32.3	.....	14.6	.....	6.0	3.4 × 10.3
El Sauce Peralta	♂	130	185	.....	34.6	19.7	15.2	13.3	5.8	3.6 × 9.4
Río Grande	♂	130	150	36.0	30.5	.....	13.0	12.2	5.9	3.8 × 9.3
Río Grande	♂	170	36.7	32.3	18.2	13.7	13.4	6.0	4.4 × 9.8
Río Grande	♂	140	170	36.0	32.6	19.2	.....	13.2	5.8	4.0 × 9.8
Río Grande*	♂	120	180	40 †	33.6	19.6	14.6	13.0	5.4	3.2 × 9.8
Río Tuma	♂	150	190	.....	35.1	20.5	15.9	12.7	5.9	3.7 × 10.3

* Type specimen of *Oryzomys ochraceus* Allen.

† Collector's measurement.

SPECIMENS EXAMINED.—Eight. COSTA RICA: Jiménez, 1, the type, (A.M.); El Sauce Peralta, 1 (A.M.). NICARAGUA: Río Grande, south of Tuma, 4, including type of *ochraceus*, (A.M.); Río Tuma, 1 (A.M.); Río Siquía, 1 (U.M.M.Z.).

Nectomys alfari efficax Goldman

(Pl. IV, Figs. 5-8, cranium)

Nectomys alfari efficax Goldman, 1913: 7; Anthony, 1916: 369, PANAMA (Tacarcuna); Elliot, 1917: 55 (description); Goldman 1920: 105, Pl. 23, Figs. 6, 6a, PANAMA (Cana and Tacarcuna).

TYPE SPECIMEN.—Adult male (skin with skull), U. S. Biological Surveys collection No. 178627; collected March 12, 1912, by E. A. Goldman; original No. 21498.

TYPE LOCALITY.—Cana (Santa Cruz de Cana), upper Río Tuyra, south-eastern Panama; altitude, 1800 feet.

DISTRIBUTION.—Known only from the northwestern slope of the Serranía del Darién, Panama.

CHARACTERS.—Externally as in *alfari*; nasals behind truncate or with a slight point, brain case and interparietal smaller than in *alfari*; incisive foramina narrowly open and usually as pointed behind as in front; width of mesopterygoid fossa averages less than crown length of first molar; molar row slightly shorter than in *alfari*.

TABLE XVIII

MEASUREMENTS OF *Nectomys alfari efficax* GOLDMAN

All specimens of the Cana series are fully adult; the first four of the Tacarcuna series are young adults.

Locality	Sex	Head and Body	Tail	Hind Foot	Condyllo-basal Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal
Cana	♂	129	163	34.2	31.3	18.1	13.5	11.2	5.5	2.9 × 7.7
Cana	♂	135	170	35.4	32.0	.....	13.5	11.3	5.6	3.0 × 7.1
Cana	♂	135	171	33.8	32.0	17.5	14.1	.....	5.5	3.3 × 8.9
Cana	♂	127	171	33.8	33.0	18.8	14.0	12.5	5.5	3.3 × 8.4
Cana	♂	145	180	36.0	33.3	20.1	14.6	11.3	5.7	2.8 × 7.9
Cana	♂	136	168	35.2	33.5	.....	14.0	11.7	5.5	2.6 × 8.9
Cana (type)	♂	126	179	36.7	33.6	19.2	14.1	12.2	5.7	3.3 × 8.1
Cana	♂	131	186	35.4	33.8	18.7	14.4	11.7	5.8	3.5 × 8.5
Cana	♂	146	169	35.5	.....	19.0	14.4	.....	5.5	.....
Cana	♂	141	179	36.0	33.9	19.1	14.6	11.4	5.7	3.3 × 9.5
Tacarcuna	♂	132	170	34.8	30.9	17.8	12.6	11.8	5.4	2.7 × 8.0
Tacarcuna	♀	136	157	35.1	31.0	18.4	13.1	12.0	5.8	3.7 × 8.2
Tacarcuna	♂	145	162	34.8	31.2	18.3	12.7	12.3	5.6	3.2 × 9.1
Tacarcuna	♂	140	168	35.0	31.3	18.0	13.2	12.0	5.6	3.4 × 9.1
Tacarcuna	♂	122	162	.....	31.7	17.7	14.2	11.5	5.5	2.4 × 7.6
Tacarcuna	♂	142	166	36.2	31.9	18.8	13.7	12.1	5.9	3.0 × 8.2
Tacarcuna	♂	145	158	.....	32.0	18.4	13.6	11.5	5.8	3.1 × 7.8
Tacarcuna	♀	146	165	35.1	32.1	18.4	13.5	12.2	6.0	3.2 × 9.6
Tacarcuna	♂	142	153	35.1	32.4	18.1	14.0	12.1	5.4	3.2 × 7.9
Tacarcuna	♂	139	173	36.1	32.7	.....	13.1	12.4	6.0	3.7 × 8.4
Tacarcuna	♂	152	.....	35.2	32.8	19.0	14.2	11.5	5.7	2.6 × 8.5
Tacarcuna	♂	150	170	36.5	33.1	19.0	13.5	11.7	5.6	2.1 × 8.0
Tacarcuna	♂	146	169	36.1	34.0	19.6	14.1	11.8	5.4	3.1 × 7.8

SPECIMENS EXAMINED.—Twenty-six. PANAMA: Cana, 1800–2000 feet, 13, including the type, (U.S.B.); Tacarcuna, 2650 feet, 12 (A.M.), 1 (M.C.Z.).

REMARKS.—The specimens from Tacarcuna are, on the whole, younger

than the topotypes; they average larger and are darker on back and head with the sides better defined.

Nectomys alfari russulus Thomas

Nectomys russulus Thomas, 1897c: 547; Thomas, 1901b: 251 (reference); Thomas 1905a: 587 (reference); Thomas, 1913: 571 (comparison); Goldman, 1913: 7 (reference); Ellerman, 1941: 362.

TYPE SPECIMEN.—Adult female (skin with skull), British Museum (Natural History), No. 98.10.3.13. (*vide* Gyldenstolpe, 1932: 68); collected July 7, 1897, by A. E. Pratt.

TYPE LOCALITY.—Valdivia, lower Cauca Valley, Antioquia, Colombia; altitude, 1200 meters.

DISTRIBUTION.—Known only from the type locality.

CHARACTERS.—Known only from the original description:

Size considerably smaller than in the known species of *Nectomys* [of the *squamipes* group], the general appearance being more that of a large clumsily-built *Oryzomys*. Fur straight, thick, and glossy; hairs of back about 13 or 14 millim. in length, the underfur less woolly and less markedly different from the longer fur than in the other species. General colour dark russet-brown, very uniform in tone, without special markings anywhere, the light-coloured rings of the hairs dark fulvous. On the sides, as usual, the fulvous becomes rather clearer and the general tone lighter. Belly not sharply defined, little paler than the sides, its hairs slaty basally, dull buffy or clay colour terminally. Ears rather small, thinly haired, practically naked. Upper surface of hands and feet brownish. Tail long, excessively finely scaled, very thinly clothed, dull brownish above and below.

Skull heavily built, very much like that of an ordinary *Nectomys* in miniature. Nasals evenly narrowing backwards, not contracted at their centres. Interorbital region broad and flat, its edges very strongly ridged, the ridges well developed right across the parietals to the outer corners of the interparietal, at which point they turn abruptly downwards and outwards. Anterior palatine foramina rather small, ending about 1.5 millim. in front of the level of *m*¹. Posterior nares very broad, open and rounded.

Teeth very stout and heavy. Incisors thick and strong. Molars broad and rounded, twice the bulk of those of an average *Oryzomys* of the same size, and but little smaller than those of *Nectomys squamipes*.

Dimensions of the type (an aged female, measured by collector in the flesh):

Head and body 150 millim.; tail 180; hind foot 35; ear 19.

Skull: greatest length 36, basilar length 29.1; greatest breadth 19.7; nasals 14.6 × 4.5; interorbital breadth 6.6; interparietal 3.8 × 8.5; length of zygoma-root 4.7; palate length from henselion 17; diastema 10.4; anterior palatine foramina 6 × 2.6; length of upper molar series 6; width of posterior nares 3.2.

Nectomys alfari near *russulus*

(Pl. IV, Figs. 1 and 2, cranium)

An adult male specimen from La Azulita, Río Guachi, south end of Lake Maracaibo, Venezuela, altitude, 3500 feet, collected April 29, 1920, by W.

H. Osgood and H. B. Conover (F.M. No. 21829; original No. 5324), is slightly different from *efficax* and, presumably, nearest *russulus*.

CHARACTERS.—Nasals more narrowly pointed behind than in either *alfari* or *efficax*; interparietal small; incisive foramina more widely open than in *alfari* or *efficax*, the posterior border nearly square; mesopterygoid fossa wider than crown length of first molar; other cranial and external characters as in *efficax*.

MEASUREMENTS.—Head and body, 146; tail, 170; hind foot, 37; condylo-basal length, 31.2; zygomatic width, 18.1; nasals, 13.5; brain case, 12.0; least interorbital width, 5.8; alveolar row, 5.8; interparietal, 2.3 by 8.1.

REMARKS.—The cranial characters of this specimen are sufficiently marked to merit subspecific distinction from *efficax* (and *esmeraldarum*), but its status must remain unclarified until comparisons can be made with representatives of the earlier named *russulus* from the Cauca Valley. This specimen is of great interest in that its locality is within the zone where an interchange between the trans-Andean mammalian fauna and that of the Colombian-Pacific faunal area defined by Chapman (1917: 106) may take place.

Nectomys alfari esmeraldarum Thomas

(Pl. IV, Figs. 1 and 2, cranium)

Nectomys esmeraldarum Thomas, 1901b: 250; Thomas, 1913: 571 (comparison); Goldman, 1913: 7 (comparison); Goldman, 1920: 105.

Nectomys esmeraldarum [sic], Gyldenstolpe, 1932: 68; Ellerman, 1941: 362.

TYPE SPECIMEN.—Adult male (skin with skull), British Museum (Natural History), No. 1.3.19.8.; collected July 11, 1900, by G. Fleming.

TABLE XIX

MEASUREMENTS OF *Nectomys alfari esmeraldarum* THOMAS

Measurements of the type are from the original description; the topotype is a sub-adult; all the Carolina specimens are old individuals.

Locality	Sex	Head and Body		Tail	Hind Foot	Condylo-basal Length	Basilar Length	Zygomatic Breadth	Nasals, Length	Brain Case	Alveolar Row	Interparietal
San Javier (type)	♂	141	149	36	.....	27.0	18.2	14.0	.....	5.3	2.9 × 8.0	
San Javier	♂	130	163	33.7	.....	.....	.....	12.7	.....	5.8	.....
Carolina	♂	115	171	35.9	31.5	26.5	18.8	.....	11.6	5.6	3.2 × 7.4	
Carolina	♂	121	153	36.5	33.8	28.0	19.8	14.0	11.7	5.5	3.3 × 8.9	
Carolina	♀	141	182	36.6	35.1	29.5	19.9	14.2	11.5	6.0	3.5 × 9.4	

TYPE LOCALITY.—San Javier, near Concepción, lower Río Cachaví, Esmeraldas Province, Ecuador; altitude, 20 meters.

DISTRIBUTION.—Known from the Río Santiago-Cayapas drainage area in Esmeraldas Province and the Río Mira drainage area of western Imbabura Province, Ecuador.

CHARACTERS.—As in *efficax*, but pelage shorter and coarser.

SPECIMENS EXAMINED.—Seven. ECUADOR: San Javier, 3 (U.S.N.M.); Carolina, Río Mira, Imbabura Province, 900 meters, 4 (U.M.M.Z.),

REMARKS.—The topotypes examined include two juveniles and one subadult in old pelage. Three adult specimens from Carolina, about 50 kilometers up (east) the trail from San Javier are indistinguishable, except as noted, from Tacarcuna specimens of *efficax*.

INCERTAE SEDIS

Nectomys, Trouessart, 1905: 412, part (*saturatus*); Elliot, 1917: 55, part (*dimidiatus*); Miller, 1924: 367, part (*dimidiatus*); Gyldenstolpe, 1932: 65, part (*hammondi*, *saturatus*); Tate, 1932a: 6, part (*saturatus*, *dimidiatus*, *hammondi*); Ellerman, 1941: 361, part (*dimidiatus*, *hammondi*, *saturatus*).

The three species included here have been described by Thomas. One is from Nicaragua, the other two are from Ecuador (Map 2). Beyond the descriptions of the type specimens, reproduced below, and some vague or casual references, nothing is known concerning them.

Nectomys dimidiatus Thomas

Nectomys dimidiatus Thomas, 1905a: 586; Thomas, 1913: 570; Elliot, 1917: 55; Goldman, 1920: 105; Ellerman, 1941: 362.

TYPE SPECIMEN.—Adult male (skin with skull), British Museum (Natural History), No. 5.3.4.2; collected November 5, 1904, by W. G. Palmer.

TYPE LOCALITY.—Escondido River, seven miles below Rama, Nicaragua.

DISTRIBUTION.—Known only from the type locality.

CHARACTERS.—The original description states:

A diminutive species with the glossy fur of the typical S.-American members of the genus.

Size immensely less than in any hitherto known member of the typical glossy-furred *Nectomys*, rather smaller even than in *N. esmeraldarum*, the smallest of the fluffy-furred species. Fur obviously modified for an aquatic life, close and glossy, with a thick velvety underfur; hairs of back about 6 mm. in length. General colour of back rather lighter than "clove-brown," the sides becoming more "bistre." A dull buffy line edging the dark colour on the flanks, and running down the inner side of the hind limbs. Belly dull clay-colour, deadened by the slaty bases of the hairs showing through. Outer side of arms greyish brown. Upper surface of hand and feet dull white. Tail of medium length, finely scaled, 15 rings to the centimetre, slaty greyish above, dull white below.

Skull, in correlation with its smaller size, much more lightly built than in ordinary *Nectomys*; supraorbital ridges little developed, the brain-case broad, smooth, and rounded. Zygomata widely and evenly spread. Nasals not markedly narrowed behind. Palatal foramina much larger than in any other species, narrowed in front, widely open and rounded behind, where they extend to the level of the front edge of m^1 .

Molars much worn in the type, but apparently with the complicated structure of those of true *Nectomys*, with which their shape and general proportions agree.

Dimensions of the type (measured in the flesh):

Head and body 125 mm.; tail 115; hind foot, s.u. 26, c.u. 28; ear 13.

Skull: greatest length 30; basilar length 23.4; zygomatic breadth 17; nasals 11.2×3.2 ; interorbital breadth 4.8; breadth of brain-case 13; palate length 12.8; diastema 7.6; palatal foramina 5.7×2.3 ; length of upper molar series 4.4.

This remarkable species, not half the bulk of any hitherto known member of the true glossy-furred *Nectomys*, is the first of the group found in Central America. Allen's *Sigmodontomys Alfari* and the closely allied *Nectomys russulus* of Colombia are forms with more *Oryzomys*-like fur; but their exact generic position is not at present easy to

define, owing to want of specimens with unworn teeth. Although the same difficulty exists with the type of *N. dimidiatus*, its general characters are so much like those of typical *Nectomys* that I have no hesitation in assigning it to that genus, of which it forms the most diminutive member.

“Caught in banana-plantation, on very wet red clay.”

Nectomys saturatus Thomas

Nectomys saturatus Thomas, 1897c: 546; Thomas, 1913: 571.

TYPE SPECIMEN.—Adult male (skin with skull), British Museum (Natural History), No. 97.11.7.40 (*vide* Gyldenstolpe, 1932: 68); collected May 19, 1897, by W. F. H. Rosenberg.

TYPE LOCALITY.—Ibarra, capital of Imbabura Province, north central Ecuador; altitude, 2225 meters.

DISTRIBUTION.—Known only from the type locality in the semiarid subtropical zone of the inter-Andean plateau.

CHARACTERS.—From the original description:

General size as in the larger species of the genus, such as *N. grandis*, but the head, judged by the skull, seems to be larger and heavier. Colour above dark smoky grey-brown, much darker than in any of the other species, especially along the centre of the back, where it approaches black, owing to the very large number of shiny black-tipped hairs mixed with the fur. Sides clearer grey, not unlike the dorsal colour of *Mus decumanus*. Belly rather more sharply defined than usual, pale buffy, the bases of the hairs slate. Centre of face blackish, continuous with the dorsal dark colour. Ears rather short, their hairs blackish. Hands and feet brown above, a few whitish hairs intermixed, the digits nearly naked; claws whitish. Tail long, uniformly blackish and thinly hairy above; below, the longer swimming-hairs along the middle line are white.

Skull very stout and heavily built. Nasals broad in front, evenly tapering backwards to a point barely as far back as the level of the lacrymals, and but little surpassing the premaxillary processes behind. Interorbital region broad, almost parallel-sided, the ridges strong, but becoming almost obsolete as they pass the fronto-parietal suture, then thickening again as they pass along the parietals. Interparietal large. Anterior palatine foramina of about the usual length, but, owing to the great size of the molars, their hinder end is only just in front of the level of *m*¹. Incisors broad and strong. Molars excessively large and heavy, more so than in any other species.

Dimensions of the type (an adult male, measured in flesh by collector):

Head and body 205 millim.; tail 238; hind foot [*s.u.*] 54; ear 23.

Skull: greatest length 47.5, basilar length 38.5; greatest breadth 26; nasals 18.5 × 6; interorbital breadth 9; interparietal 5.5 × 11.8; palate length from henselion 22.2; diastema 12.5; palatine foramina 8.2 × 3.4; length of upper molar series 8.7.

This fine species may be readily distinguished from all others by its broad heavy skull, large molars, and sombre coloration.

Nectomys hammondi Thomas

Nectomys hammondi Thomas, 1913: 570; Ellenman, 1941: 362.

TYPE SPECIMEN.—Adult female (skin with skull), British Museum (Natural History), No. 13.10.24.58; collected July 4, 1913, by Gilbert Hammond, original number 168. “Two specimens obtained.”

TYPE LOCALITY.—Mindó (0° 5' S, 78° 50' W), on the Río Mindó, a tribu-

tary of the Río Blanco, Pichincha Province, northwestern Ecuador; altitude, 4312 feet.

DISTRIBUTION.—Known only from the type locality in the upper Río Esmeraldas drainage system, subtropical zone, western slope of the western Cordillera.

CHARACTERS.—From the original description :

A glossy brown species related to *N. russulus*.

Size rather less than in the common grey forms of *Nectomys*, such as *N. squamipes*, *garleppi* [*sic*], and their allies, markedly smaller than in *saturatus*, larger than in *russulus*. General colour "tawny olive," strongly lined and darkened with black, the dorsal area markedly darker than the sides. Flanks clearer tawny. Under surface not sharply defined, dull greyish, the bases of the hairs dark slaty, their tips dull whitish slightly tinged with tawny (more strongly tawny in the second specimen). Forearms and metacarpels dark brown, digits paler brown, thinly haired. Hind legs tawny olive; upper side of feet uniformly greyish brown, the scaling of the skin unusually clearly marked; fifth hind toe, without claw, reaching to the end of the first phalanx of the fourth.

Skull slender; upper profile strongly bowed at fronto-nasal suture, concave in interorbital region, convex again on brain-case. Nasals unusually broad anteriorly, and not strikingly narrowed behind. Supraorbital ridges fairly well developed, but not rising vertically, continued back to the outer corners of the interparietal. Outer plate of zygomatic root but little projected forwards in front of the upper bridge. Palatal foramina rather short, widely open. Lateral pits and foramina on each side of the posterior palate but little developed. Bullae small.

Dimensions of the type (measured in the flesh) :

Head and body 203 mm.; tail 251; hind foot 32; ear 18.

Skull: greatest length 43; condylo-incisive length 39; greatest breadth 21.5; nasals 16×5.6 ; interorbital breadth 7.7; breadth between ridges on parietals 13.7; zygomatic plate 4.6; palatilar length 19; diastema 12; palatal foramina 6.7×4 ; upper molar series 6.8.

The genus *Nectomys* falls into two groups, firstly, the common widely spread and dominant species related to *N. squamipes* (*N. apicalis*, *garleppi* [*sic*], *fulvinus*, &c., &c.), all of which are approximately of the same size and general character of coloration, and, secondly, a few isolated species differing widely in size and general characters, but none the less showing their relationship to the ordinary *Nectomys* by their glossy fur and heavily ridged skulls. Of these *N. russulus* is the nearest in size to *N. hammondi*, but is still a good deal smaller, while *N. esmeraldarum* and *N. dimidiatus* are again conspicuously smaller. On the other hand, *N. saturatus*, from Ibarra, Ecuador, is altogether a larger and heavier animal.

It is probable that such species as the present are rather less aquatic in their habits than the members of the *squamipes* group.

REMARKS.—Ellerman (1941: 362) noted that "*N. hammondi* does not appear to be at all typical of the genus dentally, and may belong elsewhere; the cusps appear to show no tendency to become suppressed." In addition, the extremely long fifth hind toe, the surprisingly short hind foot for so large an animal identified as a *Nectomys*, the weakly developed posterolateral palatine pits, and the little forward-projecting zygomatic plate are other characters in the description of *hammondi* which conflict with the definition of the genus.

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PLATE I

- FIGS. 1 and 2. Dorsal and ventral aspects of cranium of *Nectomys squamipes squamipes* (U.S.N.M. 141457 ♂, adult, topotype, × 2, São Sebastião, Brazil).
 FIGS. 3 and 4. Dorsal and ventral aspects of cranium of *Nectomys squamipes montanus* (F.M. 24128 ♂, adult, type, × 2, Hacienda Exito, Peru).

PLATE I

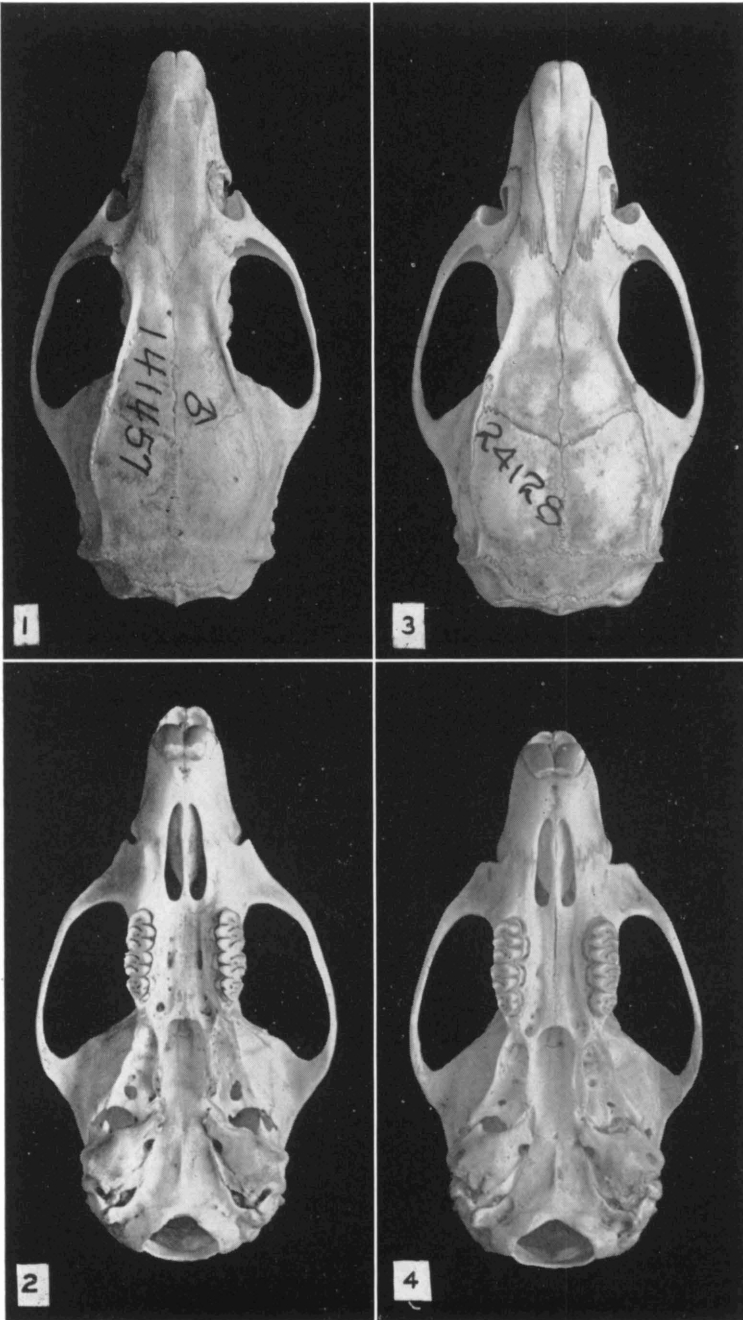
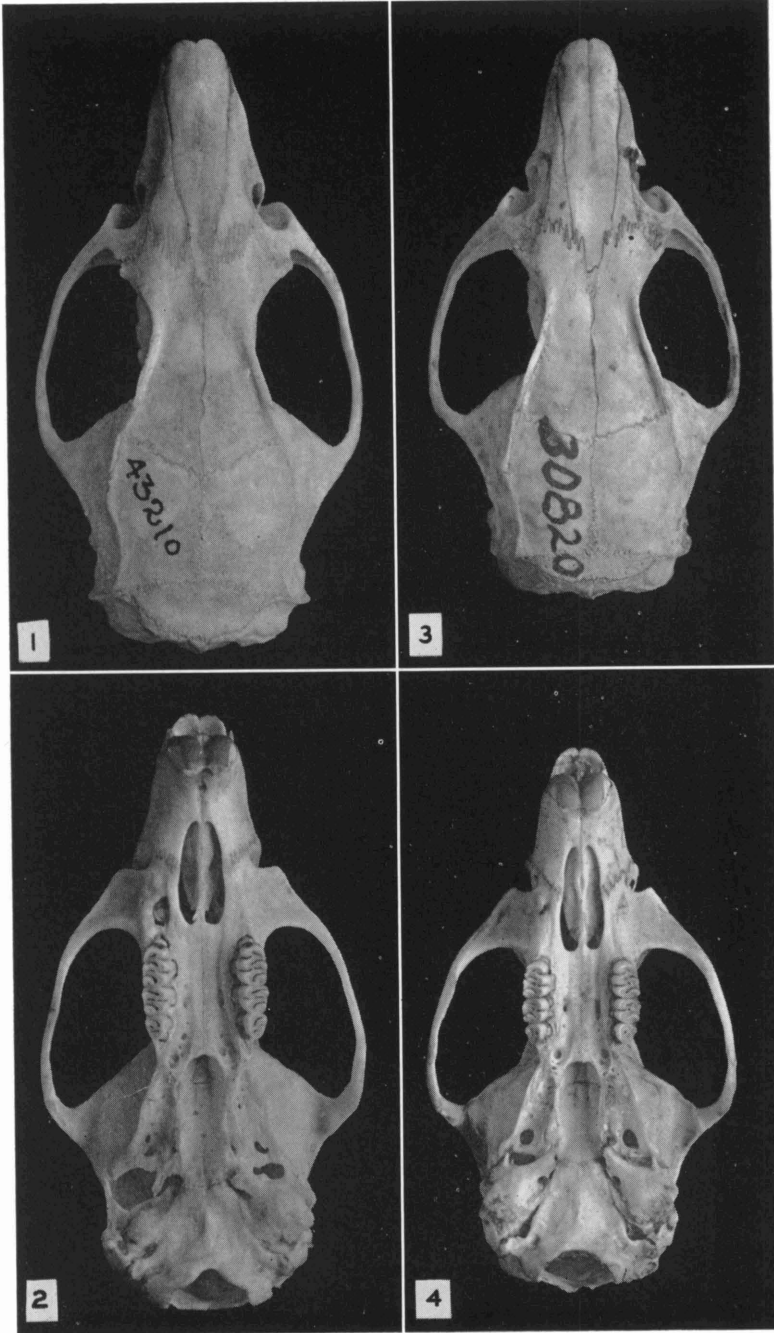


PLATE II

- FIGS. 1 and 2. Dorsal and ventral aspects of cranium of *Nectomys squamipes apicalis*
(F.M. 43210 ♂, adult, ×2, Río Pindo Yacu, Ecuador).
- FIGS. 3 and 4. Dorsal and ventral aspects of cranium of *Nectomys squamipes amazonicus*
(M.C.Z. 30820 ♂, adult, ×2, type, Tauary, Brazil).

PLATE II



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PLATE III

FIGS. 1 and 2. Dorsal and ventral aspects of cranium of *Nectomys squamipes palmipes*
(U.S.N.M. 85559 ♂, adult, ×2, Caparo, Trinidad).

FIGS. 3 and 4. Dorsal and ventral aspects of cranium of *Nectomys squamipes melanius*
(F.M. 19648 ♂, adult, ×2, Lagunas, Peru).

PLATE III

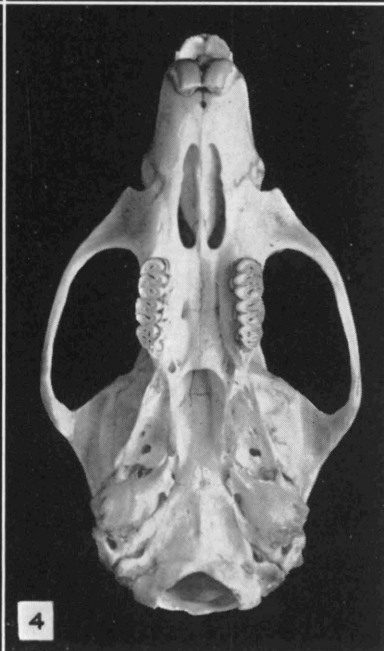
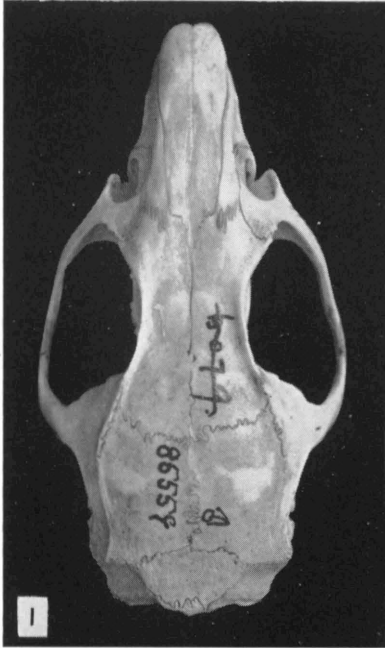
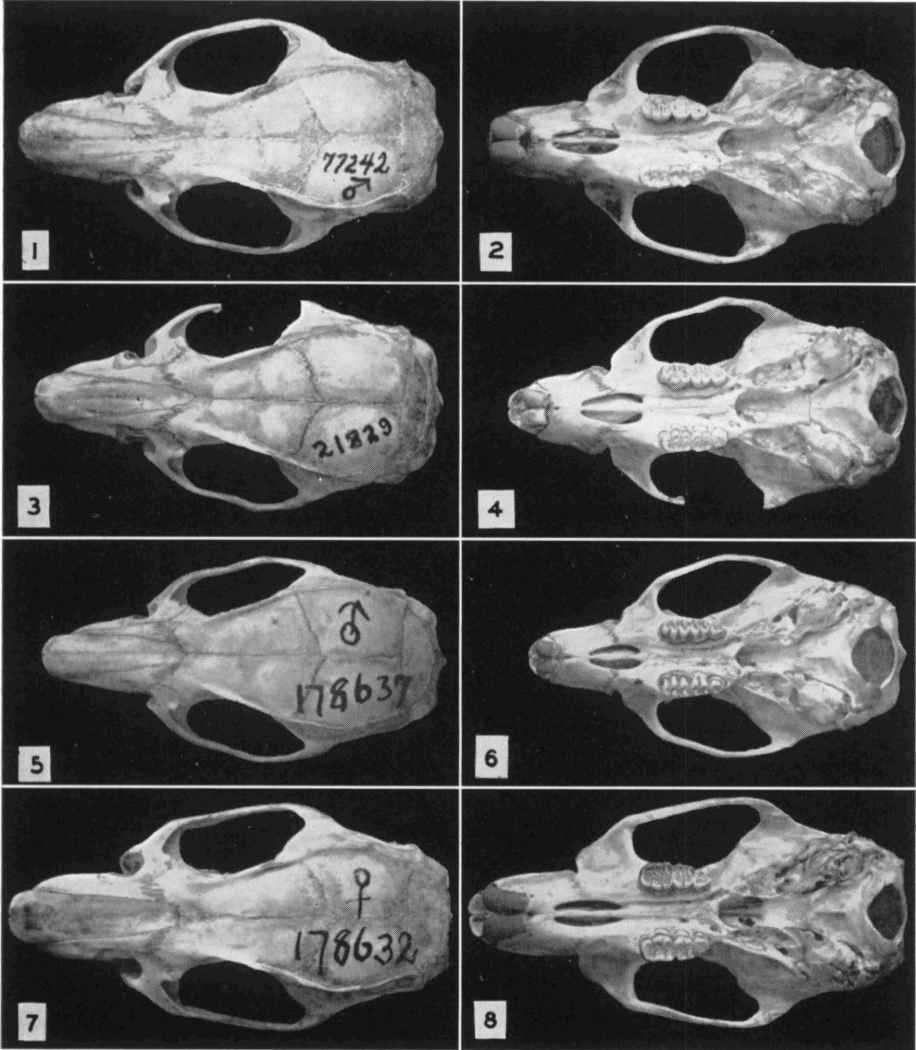


PLATE IV

- FIGS. 1 and 2. Dorsal and ventral aspects of cranium of *Nectomys alfari esmeraldarum* (U.M.M.Z. 77242 ♂, adult, × 2, Carolina, Ecuador).
- FIGS. 3 and 4. Dorsal and ventral aspects of cranium of *Nectomys alfari* near *russulus* (F.M. 21829 ♂, young adult, × 2, La Azulita, Venezuela).
- FIGS. 5 and 6. Dorsal and ventral aspects of cranium of *Nectomys alfari efficax* (U.S.B. 178637 ♂, juvenile, topotype, × 2, Cana, Panama).
- FIGS. 7 and 8. Dorsal and ventral aspects of cranium of *Nectomys alfari efficax* (U.S.B. 178632 ♀, old adult, topotype, × 2, Cana, Panama).

PLATE IV



MAP 1

MAP 1. Collecting stations of *Nectomys squamipes* arranged according to subspecies (A-P, I, II).

All number one (1) localities are type localities; locality numbers with the symbol X are literature references; two or more localities within a short distance of each other are indicated by the same number; names of collectors are in parentheses. Altitudes of many of the localities (according to the collector) are given in the lists of specimens examined.

A. *Nectomys squamipes squamipes*

1. São Sebastião, São Paulo, Brazil (Hempel; Rosenberg; Tanlo).
- 2X. Ilha de São Sebastião, São Paulo, Brazil (Garbe).
3. Rio das Pedras, São Paulo, Brazil (Zech).
4. Ipanema, São Paulo, Brazil (Robert).
5. Itararé, São Paulo, Brazil (Garbe).
- 6X. Roça Nova, Paraná, Brazil (Robert).
- 7X. Taquara do Mundo Novo, Rio Grande do Sul, Brazil (von Ihring).
- 8X. Porto Alegre, Rio Grande do Sul, Brazil (Hensel).
- 9X. Rio Jordão, tributary of Rio Paranahyba, Minas Geraes (Robert).

B. *Nectomys squamipes aquaticus*

1. Rio das Velhas, near Lagôa Santa, Minas Geraes, Brazil (Becker).
- 2X. Bahia (São Salvador), Bahia, Brazil.

C. *Nectomys squamipes olivaceus*

1. Therezopolis, five miles north, Rio de Janeiro, Brazil (Sanborn).
2. Fazenda Cardoso, Serra Caparaó, Minas Geraes, Brazil (Holt).

D. *Nectomys squamipes pollens*

1. Sapucay, Paraguay (Foster).
2. Río Yuqueri, Paraguay (Wees).
A small tributary of the Iguazú, south of Yhú; the Iguazú joins the Acarahy to flow into the Paraná.
3. Caraguatay, Misiones, Argentina (Sanborn).
A small port fronting the Paraná, about 20 kilometers south of Piray.
4. Maracajú, Mato Grosso, Brazil (Gilmore).
A ranch east of the Serra of the same name; situated on a tributary of the Rio Brillhante, on the Campo Grande-Ponte Porán road.
5. Annápolis, Goyaz, Brazil (Gilmore).

E. *Nectomys squamipes mattensis*

- 1X. Chapada, Mato Grosso, Brazil (Robert).
- 2X. Tapirapoan, Mato Grosso, Brazil.
Near the head of the Paraguay, on a "riacho" of the Rio Sepotuba.

F. *Nectomys squamipes amazonicus*

1. Tauary, Rio Tapajóz, Pará, Brazil (Olalla).
2. Piquiatuba (Olalla).
3. Aramanahy (Olalla).
4. Limõatuba (Olalla).
5. Igarapé Amarim (Olalla).

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6. Cameté, Rio Tocantins, Pará, Brazil (Olalla).
6. Ilha do Taiuna (Olalla).
A large island in the Tocantins directly opposite Cameté.
7. Benevides, Pará, Brazil.
8. Tranqueira, Maranhão, Brazil (H. Sneathlage).
Near the Rio Medonho, a small tributary of the Parnahyba.
9. Canna Brava, Nova Roma, Goyaz, Brazil (Blaser).
A small site in the vicinity of Nova Roma, Rio Paranan, upper Tocantins.
10. Urupá, Rio Gy-Paraná, tributary of Rio Madeira, Amazonas, Brazil (Miller).

G. *Nectomys squamipes melanius*

- 1X. Lower Essequibo, twelve miles above mouth, British Guiana (Warren).
Position arbitrarily indicated on right bank of river.
2. Georgetown, mouth of Demerara River, British Guiana (Rodway).
- (2X). Pen Hope (Selater).
On coast twenty miles east of Georgetown.
3. Hyde Park, Demerara River (Warren).
3. Hyama Creek.
About five miles south of Hyde Park; flows into the Demerara.
4. Rockstone, Essequibo River (Miller).
- 5X. Supinaam River.
Tributary of Essequibo, entering near its mouth.
6. Kartabo (Beebe).
At the point between junction of the Cuyuni and Mazaruni rivers.
6. Kyk-over-al (Beebe).
An island below Kartabo point.
6. Saimiri Island (Beebe).
Mazaruni River, near Kartabo.
- (6X). Kalacoon (Beebe).
About one and one-half miles below Kartabo.
7. Oko Mountains (Blake).
8. Holmia (De Freitas).
In Potaro Highlands at junction of Chenapowa and Potaro rivers.
9. Oronoque Base Camp (Blake).
Right bank Oronoque River where it joins the New River, a tributary of the Courantyne.
10. Mount Roraima, Bolívar, Venezuela (Tate and Carter).
11. Mount Auyan-tepui, Bolívar, Venezuela (Phelps Expedition).
12. Mount Duida, Bolívar, Venezuela (Olalla; Tate).
13. Esmeralda, Río Orinoco (Olalla; Tate).
14. Buenavista, Río Casiquiare, Venezuela (Olalla).
15. Yavanari, Rio Negro, Amazonas, Brazil (Olalla).
- 16X. Rio Juruá, Amazonas, Brazil (Garbe).
Position of collecting station indicated.
17. Puerto Indiana, Loreto, Peru (Olalla).
On Marañon, above mouth of Río Napo.
18. Sarayacu, Río Ucayali, Loreto, Peru (Olalla).
19. Lagunas, Río Huallaga, Loreto, Peru (Osgood and Anderson).
Marañon.
20. Puerto Arturo, Río Huallaga (Osgood and Anderson).
About 10 kilometers below Yurimaguas.

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21X. Yurac Yacu, San Martín, Peru (Hendee).

At junction of Río Yurac Yacu with the Mayo, a tributary of the Huallaga.

H. *Nectomys squamipes apicalis*

1. Tena, Napo-Pastaza, Ecuador (Herskovitz).

2. Río Hollín (Jondache), (Clark-MacIntyre).

Enters the Misahuallí, a tributary of the Napo.

3. Canelos, Río Bobonaza (Clark-MacIntyre).

4. Sarayacu, Río Bobonaza (Tate).

5. Montalvo, Río Bobonaza (Olalla).

6. Pindo Yacu, tributary of upper Río Tigre (Olalla).

7. Río Curaray, at junction with the Napo (Olalla).

8. Río Oyacaachi, tributary of the Quixos (Olalla).

Collecting site below Chaco, i.e., on the Quixos proper, a tributary of the Río Coca which enters the Napo.

9. Río Suno, tributary of upper Napo.

9. San José abajo ("below San José"), left bank Río Suno (Olalla).

10X. Gualaquiza (Fraser).

On Río Gualaquiza, a tributary of the Zamora.

11. Zamora, Río Zamora (Cherrie).

The Zamora joins with the Paute to form the Santiago which enters the Marañon.

12. San Ignacio, Río Chinchipe, Cajamarca, Peru (Watkins).

The Chinchipe is a tributary of the Marañon. On some maps it appears in Loja Province, Ecuador.

13X. Tambillo, Cajamarca, Peru (Stolzmann).

Formerly an hacienda on left bank of the Marañon near Cujillo, between the embouchures of the Ríos Chamay and Yaucan (Llaucan).

14X. Yambra, Amazonas, Peru (Hendee).

No doubt identical with Yambrasbamba, on the river of the same name which continues below as the Río Imaza, a tributary of the Marañon.

15X. Molinopamba, Amazonas, Peru (Hendee).

East of Chachapoyas, on a small tributary of the Utcubamba.

J. *Nectomys squamipes napensis*

1. San Francisco, Río Napo, Ecuador (Herskovitz).

2. Intillama, Río Napo (Herskovitz).

3. Llunchi, Río Napo (Herskovitz).

An island about 18 kilometers below mouth of Río Coca.

K. *Nectomys squamipes montanus*

1. Hacienda Exito, Río Cayumbá, tributary of the Huallaga, Huanuco, Peru (Heller).

2. Hacienda Buenavista, Río Chinchao, Huanuco (Heller).

The Chinchao is a tributary of the Huallaga next above the Cayumbá.

2. Hacienda San Antonio, Río Chinchao (Heller).

3. Vista Alegre, Río Chinchao (Zimmer).

On south bank near junction with the Huallaga.

3. Chinchavita, Río Huallaga, Huanuco (Heller).

At mouth of Río Chinchao.

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4. Pozuzo, Huanuco (Heller).
5. Tingo María, Río Huallaga, Huanuco (Hendee).
6. San Jerónimo, Río Ucayali, Loreto, Peru (Hendee).
- 7X. San Nicolás, Río Huambo, Amazonas, Peru (Hendee).
About 50 kilometers east of Chachapoyas near the head of the Río Huambo.
The Huambo continues below as the Huayabamba (Guallabamba), a tributary of the Huallaga.
- 7X. Huambo, Río Huambo, Amazonas (Stolzmann).
Formerly an hacienda near San Nicolás.
- 7X. Chirimoto, Río Totorá (Milpuc), Amazonas (Stolzmann).
An abandoned site southwest of San Nicolás; the Río Totorá enters the Huambo about 15 kilometers below San Nicolás.

L. *Nectomys squamipes garleppi*

1. Río Occobamba Valley, Cuzco, Peru (Garlepp).
The Río Occobamba flows into the Yanatili which enters the Urubamba a short distance above Rosalina.
- 2X. Chicosa, Río Ucayali, Loreto (Hendee).
A small settlement below the junction of the Urubamba and Tambo Rivers.
3. Río Perené, Junín (Watkins).
Known as the Río Chanchamayo above its junction with the Tulumayo.
4. Chanchamayo, Junín (Schunke).
At point of junction of the Ríos Vitoc (Aynamayo) and Tulumayo; the latter stream enters the Perené.
- 4(X). Amable María, Junín (Jelski).
Formerly a farm between the Ríos Chanchamayo and Vitoc, a short distance above the Tulumayo.
- 4(X). Maraynioc, Junín (Jelski).
Farm near the source of the Aynamayo (upper Río Vitoc), between 11,000 and 12,000 feet altitude. Specimens taken by Jelski at much lower altitudes, in the Montaña or Valle de Vitoc, were also labeled "Maraynioc."
5. Río Comerciato, Cuzco (Heller).
A small tributary of the Urubamba.
6. Yuvini, Río Cosireni, Cuzco (Heller).
The Cosireni is a tributary of the Urubamba next above the Comerciato.
7. San Fernando, Río San Miguel, Cuzco (Heller).
The San Miguel enters the Cosireni from the east.
8. Inca Mines, Río Inambari, Puno (Keays).
Actual collecting site may have been on either the right or left bank of the Inambari, a tributary of the Río Madre de Dios.
9. Río Huacamayo, Puno, Peru.
Source in Cordillera de Carabaya, flows into the Tambopata which, in turn, enters the Río Madre de Dios at Puerto Maldonado.
10. Santo Domingo, Puno (Keays; Ockenden).
Upper Inambari Valley, in Cordillera de Carabaya.
11. Mapiri, La Paz, Bolivia (Tate).
On Río Camata, tributary of Río Beni.
12. Charuplaya, Cochabamba, Bolivia (Simons).
Said to be at 16° south latitude, on the Río Securé, a tributary of the Mamoré.

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M. *Nectomys squamipes vallensis*

1. Santa Ana, Río Urubamba, Cuzco, Peru (Erdis).

N. *Nectomys squamipes grandis*

- 1X. Concordia, Antioquia, Colombia (Salmon).

O. *Nectomys squamipes magdalenae*

1. Magdalena Valley, west Cundinamarca.
Position on map arbitrarily placed between Fusugasugá and Girardot.
2. Río Chili, upper Río Cucuana, a tributary of the Río Soldaña which flows into the Magdalena from the west, Tolima (Brother Nicéforo María).
3. San Agustín, Huila (Miller).
At headwaters of the Río Magdalena.
4. Andalucía, Huila (Miller).
Summit of trail across Eastern Andes from the Magdalena Valley to the Caquetá region. Collections were made on western slope of the range.
5. Florencia, Río Orteguzaza, Caquetá (Miller).
The Orteguzaza is a tributary of the upper Río Caquetá.

P. *Nectomys squamipes palmipes*

1. Princetown, Victoria, Trinidad (Chapman).
(1X). Savana Grande, Victoria (Rendall).
2. Caparo, Caroni (Chapman).
3. Caroni Marshes, Caroni.
4. Caura, St. George (Chapman).
5. Heights of Orepouche, St. Andrew.

I. *Nectomys squamipes* subspecies I

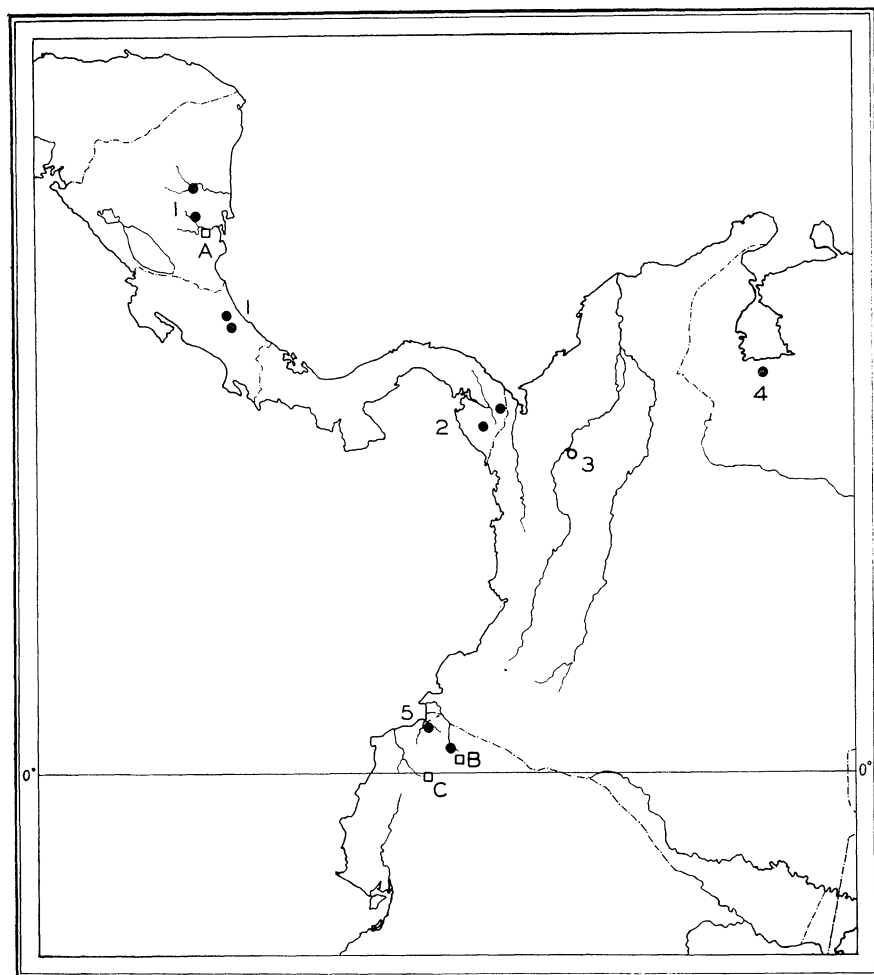
2. Guaicaramo, Río Upía, Meta, Colombia (Brother Nicéforo María).
3. Mambita, Cundinamarca (Brother Nicéforo María).
On Río Upía, tributary of the Meta.
4. Medina, Cundinamarca (Brother Nicéforo María).
On a tributary of the upper Río Meta.
5. Villavicencio, Río Guatiquia, Meta (Gilmore; Brother Nicéforo María).
- 5(X). Buenavista, west of Villavicencio.

II. *Nectomys squamipes* subspecies II

2. San Antonio, southeast of Mt. Turumiquire, Monagas, Venezuela (Tate and Clement).
3. Latal, Sucre, Venezuela (Tate and Clement).
Coffee plantation northwest of Mt. Turumiquire.



MAP 1. Collecting stations of *Nectomys squamipes* arranged according to subspecies (A-P, I, II).



MAP 2. Distribution of subspecies of *Nectomys alfarí* (circles, 1-5) and species of the *Incertae sedis* group (squares, A-C).

Symbols in outline are for literature references; names of localities for each form given, in order, from north to south.

1. *Nectomys alfarí alfarí*: Nicaragua (Río Grande and Río Tuma; Río Siquía), Costa Rica (Jiménez, type locality; El Sauce Peralta).
 2. *Nectomys alfarí efficax*: Panama (Tacareuna; Cana, type locality).
 3. *Nectomys alfarí russulus*: Colombia (Valdivia, type locality).
 4. *Nectomys alfarí* near *russulus*: Venezuela (La Azulita).
 5. *Nectomys alfarí esmeraldarum*: Ecuador (San Javier, type locality; Carolina).
- A. *Nectomys dimidiatus*: Nicaragua (Escondido River, seven miles below Rama, type locality).
- B. *Nectomys saturatus*: Ecuador (Ibarra, type locality).
- C. *Nectomys hammondi*: Ecuador (Mindo, type locality).

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