

Article VIII.—REVIEW OF THE SOUTH AMERICAN SCIURIDÆ.

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PLATES I-XIV, AND 25 TEXT-FIGURES.

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INTRODUCTION.

The present 'Review' is an attempt to summarize and correlate our present knowledge of the Tree Squirrels of South America. The material on which it is based, while far exceeding in amount that available to any previous investigator of the subject, is painfully insufficient for a satisfactory revision of the group, but the author hopes that the results here brought together will be an aid to future workers in this field.

The basis for this undertaking is primarily the large collection of South American squirrels in the American Museum of Natural History, the greater part of which has been obtained during the last four years by expeditions sent out by the Museum to northern South America, under the direction, and largely through the efforts, of Dr. Frank M. Chapman, Curator of Birds in the American Museum. The purpose of these expeditions, thus far carried on mainly and extensively in Colombia, Venezuela, and Ecuador, has been the accumulation of material for a detailed study of the bird and mammal faunas of South America, with reference not only to the determination of the forms occurring there, but as well to their genetic and geographic relationships. The present is the third contribution of a somewhat monographic character based on the mammals, the first being my revision of the murid genus *Melanomys*, published in 1913,¹ and the second my review of the genus *Microsciurus*,² published in 1914. It was my intention at first to follow the *Microsciurus* paper with similar reviews of other groups of the South American Sciuridæ, but as the work progressed it was found preferable to combine the results in a single paper, and to delay publication in order to utilize the collections in prospect from expeditions still in the field. In the meantime it seemed best to publish in advance the descriptions of new forms³ discovered in the material at hand. In order to make the present paper a complete summary of the subject, the genus *Microsciurus* is here included, but the paper on this genus is given only in outline and brought down to date, the detailed descriptions and nomenclatural and other comment being omitted; and the same is true of the paper in which the various new forms were described.

¹ Revision of the *Melanomys* Group of American Muridæ. Bull. Amer. Mus. Nat. Hist., Vol. XXXII, pp. 533-555, pl. lxxviii, November 17, 1913.

² Review of the Genus *Microsciurus*. Bull. Amer. Mus. Nat. Hist., Vol. XXXIII, pp. 145-165, February 26, 1914.

³ Descriptions of New South American Squirrels. Bull. Amer. Mus. Nat. Hist., Vol. XXXIII, pp. 585-597, October 8, 1914. One genus and 14 species and subspecies here described as new.

A word respecting the origin of the present paper seems pertinent. Owing to the scarcity of authentically determined South American mammal material in American museums, including especially type material, I took with me early in 1913 some 600 specimens of small mammals recently received from our collectors in Colombia and Ecuador for direct comparison with the historic material in the British Museum. No monographic work was then contemplated, only the identification of my own material. Although my time was limited, I was able to devote about three weeks to the study of the South American Sciuridæ, which enabled me to become fairly familiar with the extensive British Museum series of these animals, as I listed nearly all the specimens, with their localities and other data, including collectors' measurements when present. I also studied carefully such types as had direct bearing upon my own material, and intended to take in hand all of the sciurid types from South America, although I had not then decided to take up the group comprehensively, but lack of time prevented, greatly to my subsequent regret, for on returning to the American Museum I soon decided to take up the squirrel group collectively, on the basis of my British Museum notes and the material in American museums. This plan has worked out quite satisfactorily except in the case of a few of Gray's types, which I had failed to examine. To remedy this omission, and to reinvestigate a few doubtful points, I had fully arranged for another visit to London when the breaking out of the present European war rendered this plan impracticable, greatly to my disappointment and embarrassment. The present paper is therefore presented with some misgivings, but I trust the labor expended upon it will not prove wholly futile.

It is needless to say that the material I have examined is wholly inadequate for anything like a final revision of the subject. It has been enough to show how great are the deficiencies, which only time and future field work can supply. Even the Guianas and southeastern Venezuela are among the regions poorly represented in the present material, while from the vast area of Brazil there is only enough to afford an outline of the sciurid fauna. And the same is nearly true of Peru and Bolivia.

The present paper includes South America and Panama as far north as the Canal Zone, the forms of *Microsciurus* which occur north of this boundary, and the *Sciurus hoffmanni* group as represented in Chiriqui and Costa Rica, these being South American types. The extralimital forms comprise the following species and subspecies: *Microsciurus alfari alfari* Allen, *Microsciurus alfari browni* Bangs, *Microsciurus boquetensis* Nelson, *Mesosciurus hoffmanni hoffmanni* (Peters), *Mesosciurus hoffmanni chiriquensis* Bangs.

Acknowledgments.

The material studied in the present connection numbers not far from 1020 specimens, of which about 610 are in the American Museum, about 150 in the British Museum, 112 in the United States National Museum (including the collections of the Biological Survey), 42 in the Field Museum of Natural History of Chicago, 53 in the Cambridge Museum of Comparative Zoölogy, 24 in the Carnegie Museum of Pittsburgh, and 17 in the museum of the Academy of Natural Sciences of Philadelphia. To the authorities of these several institutions I am indebted for prompt and most cordial responses to my requests for assistance, they having freely loaned types as well as other material. Especially and most emphatically am I indebted to Oldfield Thomas, of the British Museum, for not only free access to the material in his charge, but for information, given verbally and through correspondence; to Gerrit S. Miller, Jr., of the U. S. National Museum, E. W. Nelson and E. A. Goldman, of the Biological Survey, W. H. Osgood of the Field Museum, Mr. Samuel Henshaw and Dr. G. M. Allen of the Museum of Comparative Zoölogy, and Dr. Witmer Stone of the Philadelphia Academy of Natural Sciences.

Mention should also be here made of the field explorers who have made accessible for study the large amount of pertinent material in the American Museum. First among these is Leo E. Miller, who for the last four years has been continuously in the employ of the Museum as a field assistant in South America — in western Colombia, Venezuela, British Guiana, and in Brazil and Paraguay with the Roosevelt Expedition, who has collected more than half of the South American squirrels now in the American Museum. William B. Richardson, in Ecuador and extreme southwestern Colombia, and G. M. O'Connell in the Bogotá district, have also gathered a large amount of valuable material. In earlier days important collections were made for the Museum in Peru by H. H. Keays, in the Santa Marta district of Colombia by H. H. Smith, and in various parts of Venezuela by S. M. Klages and M. A. Carriker, Jr. Of borrowed material mention may be made of the important material collected by E. A. Goldman in Panama (Biological Survey collection), by W. H. Osgood in Venezuela and Peru (Field Museum), by J. Steinbach in Bolivia (Pittsburgh Museum), by H. H. Smith in Matto Grosso (Philadelphia Academy collection); P. O. Simons in Ecuador, Peru and Bolivia (British Museum), and by Fraser, Bridges, Garlepp, Stolzmann, Palmer, Pratt, Fleming, and others in western South America, and Alphonse Robert, McConnell, and others in Guiana and eastern Brazil (British Museum).

Finally I cannot close these acknowledgments without expressing my sincerest appreciation of the cordial and sympathetic assistance rendered me by H. E. Anthony, assistant in Mammalogy, in relieving me of much of the drudgery necessarily attending an investigation of this nature, and for many suggestions by which I have greatly profited. The photographs used in the present connection have been made by the American Museum photographer, Julius Kirschner, under Mr. Anthony's supervision.

Explanation of Measurements.

All measurements are in millimeters, unless otherwise stated.

All external measurements are the collector's measurements from the specimen before skinning, unless otherwise stated.

Hind foot: *c* affixed to measurement in the tables of measurements = cum unguis, or foot to end of claws; *s* affixed = sine unguis, or foot to base of claws. The length of the hind foot as given in the text includes the claws unless otherwise stated.

Skull, total length = occipitonasal length; zygomatic breadth = greatest breadth at zygomata; interorbital breadth = least breadth of frontals; breadth of braincase = at squamoso-parietal suture; length of nasals = greatest length in straight line; breadth of nasals = greatest breadth at anterior end; maxillary tooth-row = length at crown surface.

Measurements by different collectors cannot be taken as strictly comparable owing to the liability of difference in methods of measuring, except the total length, which should be in all cases comparable. When the collector gives only two measurements, as length of head and body and length of tail vertebræ, the total length here given is the sum of these two measurements; when the collector gives as measurements only total length and length of tail vertebræ, the head and body length is determined by subtracting the latter from the former. Obvious errors in collectors' measurements, due apparently to mistakes in recording them on labels, are sometimes corrected if the skins are well made and seem trustworthy for size and proportions; otherwise obviously erroneous measurements are wholly discarded. Only measurements of adult specimens, whether external or cranial, are utilized unless the fact of obvious immaturity is stated.

Measurements of specimens from different localities, when given collectively, are indicated as such in the accompanying text.

The measurements given in the general text are also separately tabulated for more convenient reference.

HISTORICAL OUTLINE.

Species and subspecies.

The first species of squirrel from South America to receive a systematic name was *Sciurus æstuans*, named, but only very briefly described, by Linné in 1766, from Surinam, and renamed in 1801 by Shaw *Myoxus guerlingus*. The second species to receive a systematic name was *Sciurus*

pusillus Desmarest, 1817, based on *Le petit Guerlinguet* of Buffon, from Cayenne. No other species was described till 1832, when Is. Geoffroy described and figured *Sciurus variabilis*, based on specimens supposed to have come from northern Colombia. The name has since been applied indiscriminately by authors to the large white-bellied red-backed squirrels of South America of which there are several species, some of which have no close interrelationship. As the description and figure are contradictory, and neither agrees well with any squirrel at present known, the name is here treated as unidentifiable.

In 1853 Brandt described *Sciurus langsdorffii*, from "Brasilia" — the first of various forms of the large bushy-tailed squirrels peculiar to the great Amazonian drainage basin to be made known, and the fourth recognizable species of South American squirrel described up to this date. In 1842 Wagner described *Sciurus igniventris* and *S. pyrrhonotus*, respectively from the Upper Rio Negro and the mouth of the Rio Madeira, both belonging to the *langsdorffii* group, which latter name (in 1850) he restricted to the form from Cuyubá, Matto Grosso. In 1843 he added *Sciurus gilvicularis*, from near the mouth of the Rio Madeira — a small species resembling *S. æstuans* in size and in coloration, to which it was generally erroneously referred for the next fifty years. Wagner's three species were all based on Natterer's collections.

In 1844 *Sciurus stramineus* was described and figured by Eydoux and Souleyet, a large squirrel from southwestern Ecuador. About the same time Poeppig (in Tschudi's 'Fauna Peruana') described *Sciurus tricolor*, the largest of all the South American squirrels. In 1845 Pucheran described two small squirrels from Santa Fé de Bogotá, Colombia, as, respectively, *Sciurus rufoniger* and *Sciurus chrysuros*, the relationships of which have only recently been determined, the names, when used, having been usually grossly misapplied. Only one other species was described for the next ten years, namely, *Sciurus nehouxi* I. Geoffroy, from northwestern Peru, a form closely related to *S. stramineus*, to which it is now referred as a subspecies.

This brings the number of species of South American squirrels described prior to 1856 to 13, representing 11 valid forms, one being unidentifiable and another a synonym. No more were added till 1867, when J. E. Gray published his 'Synopsis of American Squirrels' (Ann. and Mag. Nat. Hist. (3), XX, pp. 415-434, Dec. 1867). In this paper he described 18 species as new, of which 9 were from South America and 9 from Mexico and Central America. Of those described from north of the Isthmus of Panama only 3 are now regarded as valid forms, the others being synonymized with previously described species. Of the 9 South American species 4 are given recognition as species or subspecies in the present paper, 4 are assigned to

synonymy and 1 is considered indeterminable. Gray's 'Synopsis' made endless trouble for his successors, the descriptions being in most cases inadequate for the satisfactory identification of the species, and often the localities given are too indefinite for the requirements of modern zoölogy. The types of the new forms are fortunately still in the British Museum, and through these his species have been for the most part satisfactorily allocated.

Doubtless Gray's bad work helped to bring about the radical reaction on the species question, which reached its climax about ten or twelve years later, when, in 1877, the present writer published a revision of the American Sciuridæ in Coues and Allen's 'Monographs of North American Rodentia,'¹ in which all then known American Sciuridæ were included. Only 5 species were given positively as South American and one other (*Sciurus nebouri* Eyd. & Sol.) provisionally. The number of South American specimens available for study numbered only 35, of which 15 were skins and 20 in alcohol. All of this material is again before me. The 20 alcoholic specimens and 7 of the skins were referred to *Sciurus æstuans*, but none of them is referable to *æstuans* as now restricted. Three other skins were referred to the Mexican *S. hypopyrrhus* Wagner, but they really represent *S. stramineus*, and one other skin referred to *S. variabilis* is referable to *S. igniventris*. The four skins referred to *S. gerrardi* represent *S. gerrardi choco* Goldman of the present review.

From the above statement it is evident that this 1877 revision of the South American Sciuridæ was based almost wholly on the literature of the subject, which was very fully cited, and discussed with considerable confidence, on the basis of what seemed to be the conditions of variation in Central American and North American species, which for that early period were fairly well represented in the material available.

The following year appeared Edward R. Alston's paper 'On the Squirrels of the Neotropical Region' (Proc. Zool. Soc. London, June, 1898, pp. 656-670, pl. lxi), based on the collections in the museums of London, Paris, and Berlin. He says: "Within the last year I have been able to examine in the British Museum and the Museums of Berlin and Paris, the types of no less than *forty-one* nominal species of Neotropical *Sciuri*. In these collections I have been able to compare much more extensive series of specimens than even Mr. Allen had access to; and, through his kindness, I have examined typical examples of the species recognized by him. This study has led me to accept many of Mr. Allen's identifications (some of which were sufficiently

¹ Monographs of North American Rodentia. Memoirs U. S. Geological and Geographical Survey of the Territories (Hayden), Vol. IV, August, 1877. Sciuridæ, pp. 631-949. Species inhabiting Mexico, Central and South America, pp. 738-779.

startling at first sight), and in some instances to carry the reduction of species still further; but it has also enabled me to correct a few errors in his synonymy, and to point out a few apparently valid species with which he was not acquainted.

"Particularly rich in this group are the Paris and British Museums; and the study of their long suites of specimens leads one irresistibly to conclusions which must appear strange to those who only know the extreme links of the chain. Among other things they have convinced me that Mr. Allen has laid too much stress on the comparative size of the ears, and length and bushiness of the tail, as distinctive characters. In both these points, as well as in the quality of the pelage, every intermediate stage is often to be found; and I have therefore been obliged to unite Mr. Allen's *S. aureogaster* and *S. leucops*, his *S. boothiæ* and *S. hypopyrrhus*, and his *S. gerrardi* and *S. variabilis*. On the other hand, I have felt obliged to recognize, at least provisionally, the specific rank of *S. stramineus*, *S. griseogenys*, *S. rufo-niger*, and *S. pusillus* and more doubtfully that of *S. griseoflavus*,— thus raising the number of species from ten to twelve" (l. c., pp. 657, 658).

The seven species recognized by Alston as occurring in South America are *Sciurus stramineus*, *S. variabilis*, *S. griseogenys*, *S. æstuans*, *S. deppei*, *S. rufo-niger*, and *S. pusillus*, the first and the last being additional to those recognized by me the previous year.

A few months later I published my 'Synonymatic List of the American Sciuri, or Arboreal Squirrels' (Bull. U. S. Geogr. and Geol. Survey Terr. [Hayden], IV, pp. 877-887, and p. 905, footnote), in which I accepted the two species added by Alston, who in the meantime had kindly sent me specimens of *S. pusillus* for examination. In this list all the forms recognized by Alston are accepted, but the names adopted by him for two species are shown to be untenable.

This was for a long time the 'last word' on neotropical squirrels. Jentink, five years later, in his 'List of the Specimens of Squirrels in the Leiden Museum',¹ adopted the conclusions above outlined, except that he evidently did not know of my 'Synoptic List,' and in several instances reverted to the nomenclature of my 'Monograph' instead of accepting Alston's revision of it. He also thought Alston had admitted too many species and erroneously reduced three of them to synonyms, recognizing only 5 neotropical species in the collection of the Leyden Museum, represented apparently by 98 mounted skins and 20 skulls.

It was nearly twenty years before any naturalist again described a new species of squirrel from South America, the tendency being for a time to

¹ Notes from the Leyden Museum, V, 1883, pp. 91-144; American Squirrels, pp. 91-115.

reduce even the number admitted by Alston and Allen in 1878! The first to be added was *Microsciurus peruanus* Allen in 1897, followed in 1898 by *M. mimulus* Thomas, *Sciurus pyrrhinus* Thomas, and *Sciurus saltuensis* Bangs. In the following years new species and subspecies were frequently added, chiefly by Thomas and the present writer.

The total number of specific and subspecific names based on South American species of squirrels prior to the close of the year 1914 is 88, of which only one was published prior to the year 1800, and 12 prior to 1850; 15 appeared between 1850 and the end of the year 1898, of which 11 (10 of them by Gray) date from 1867. Only one new species was described between 1872 and 1896, but 4 were added in 1897 and 1898. In 1899 were added 8, and in 1899 to 1914 (both inclusive) 55, of which 20 were described in the single year 1914.

Of the total number of 88 names given to South American squirrels prior to 1915, 18 prove to be synonyms or indeterminable, while 3 were given to replace preoccupied names.

Comparison of the resources and viewpoints of 1878 and 1898.

Prior to about 1865 mammals of any species were usually represented in museums by only a few specimens, and never by large series from a single locality. The range of seasonal, geographical, and individual variation was hence necessarily little known. Soon after this date material began to accumulate rapidly in this country, so that it became possible to study successfully each of these questions. It was found that the range of individual variation in the commoner species, which could easily be collected in large series, was far greater than was commonly recognized; that season and locality had a great influence upon the character of the pelage; and that different geographical areas usually presented certain distinctive features of variation, notably in size and coloration, in correlation with the extent and character of divergent conditions of environment; and that the transition between local or geographic forms was as gradual and as complete as the correlated transition in physical conditions. All this was real progress in knowledge. It was found in some instances that the alleged characters of forms currently recognized as species were less divergent than the extremes in a large series of individuals of the same species from a single locality; and that in many other instances supposed species from somewhat distant localities completely intergraded in the intervening areas, and that it was more logical to treat such forms as 'varieties' than as full 'species.' This view soon met with wide acceptance in America and proved to be the stepping-stone to the present system of trinomial designations for intergrading

forms. This change of view at first made headway slowly abroad, but in the course of a few decades came to be almost universally accepted, finally taking form as a principle of nomenclature in all modern zoölogical codes.

But these discoveries were, for a time, not unmixed with evil in their results, especially with respect to mammals, where so many points have to be considered, and where in general, until near the close of the nineteenth century, the amount of material from outside of the temperate portions of North America was very small and very defective in quality. In the case of the smaller, and especially the exotic, species, as late as 1877, the skulls were often left in the skins, there were rarely any trustworthy measurements, dates of collecting were often omitted, and the localities given were usually more or less indefinite. Mexico, Central America, New Granada, Brazil, South America, written on the label, gave no very definite clew to the actual locality and environment of the specimen. Such was the state of affairs when, at the height of the lumping craze in 1877, I ventured to publish my 'Monograph of the American Sciuridæ.' A system that worked well where material was fairly adequate proved, as already shown, woefully inadequate when applied to little known faunal areas, like the American tropics.

The viewpoint of 1878 is well indicated in the following extracts from the introduction to Mr. Alston's paper 'On the Squirrels of the Neotropical Region.' He says: "No better example of a polymorphic genus can be found than the almost cosmopolitan *Sciurus*. Even our common European Squirrel assumes such phases of coloration in the north, in the east, and among the Alps that the extremes would undoubtedly be considered perfectly distinct species if the intermediate links were not known¹

"In facing the intricate and often baffling problem of distinguishing between 'species' and 'varieties' in such a protean group, I have endeavored to act in harmony with Mr. Darwin's directions: 'When a naturalist can unite by means of intermediate links any two forms, he treats the one as a variety of the other.' It must be remembered that many of these 'varieties' apparently breed true and prevail in certain parts of the range; but all that are here brought together are united by such intergradations that a sufficient series at once convinces one of their identity. It is evident, however, that still more complete material will be required before every point can be regarded as definitely settled."—Proc. Zool. Soc. London, 1878, pp. 656, 658.

The viewpoint of twenty years later (1898) may be illustrated by Mr. E. W. Nelson's 'Revision of the Squirrels of Mexico and Central America,'

¹ In 1912 Mr. Gerrit S. Miller, Jr., in his 'Mammals of Western Europe' (pp. 898-923) found it desirable to recognize 12 subspecies of the European Squirrel from western and central Europe.

published in May, 1899 (Proc. Washington Acad. Sci., I, pp. 15-110, pll. i and ii), based on 795 specimens.¹

From a study of this material Mr. Nelson recognized 41 forms (excluding 3 from north of Mexico),— 28 species and 13 subspecies, of which 6 were described as new, in contrast with my 9 in 1877, and Alston's 7 in 1898. According to Mr. Nelson's synonymies, my 9 Mexican forms included 13 of his, 28² of his 41 forms being based on new material not available in 1877.

But the quality of the material at these two periods was as different as was the amount. In contrast with the roughly prepared and frequently distorted, half-filled skins, giving little clue to the size, proportions, or external appearance of the animal, and without measurements taken from the specimen while in the flesh, or definite data as to sex, locality, and date of capture, and the skulls often unavailable for examination, of the earlier period, the bulk of the new material consisted of smoothly-made skins, giving the correct proportions of the animal, each with its well prepared skull, accompanied by labels giving the fullest field data, and the external measurements made before skinning. In Mr. Nelson's case he had the further immense advantage of an intimate personal knowledge of the geographic conditions of the greater part of the area to which his revision of the squirrels related.

The excessive 'lumping' of the earlier period, in respect to mammals, was due in large part to the limited amount and the poor quality of the material available for study, and in part to the mistaken assumption that it was adequate for permanent revisionary work; also to the belief, of at least some of the prominent investigators of that day, that the mammal fauna of North America, and of some other parts of the world, was already pretty well known. Indeed, the announcement of the discovery of new forms, in certain groups at least, was looked upon with suspicion. Yet the prosecution of extensive field work under new methods of collecting and of preparation disclosed new genera as well as new species in supposedly previously well-worked fields.³ With this increase of material and the improvement in its quality has come the possibility, as well as the inclination, to recognize finer distinctions than formerly, so that many forms given nomenclatural status at present would not have been thus honored had these

¹ This may be contrasted with my total of 79 specimens for the same region, which included three of *Sciurus arizonensis* (the only ones then known), referred to *S. colliæi* of Mexico. Alston must have had access to much more extensive material, as well as to the types of most of the previously described species.

² Of these 4 were described by me between 1889 and 1895 — *S. nayaritensis* (1889), *cervicalis* (1890), *apache* (1893), *alfari* (1895).

³ Miller in 1912, in his 'List of North American Land Mammals' (Bull. 79, U. S. Nat. Mus.), listed 2138 forms (species and subspecies), as against 363 given by True in 1885, and 1405 given by Miller and Rehn in 1900.

fine differences been recognized, as indeed many of them were, and ignored. The 'splitting' craze of to-day may not be so harmful to scientific progress as was the 'lumping' craze of thirty years ago, but it is certainly burdening nomenclature to an embarrassing and unprofitable degree. As the field of discovery in the matter of noteworthy new forms is becoming exhausted, as in North America, intergrades between already recognized slightly differentiated forms are given names and appear in faunal lists, to the confusion of even the expert unless he be provided with plenty of topotype material. While faunistic studies cannot be made too intensive, minor local differentiations do not require pigeon-holing by means of nomenclature; they can be otherwise recorded as interesting facts in environmental differentiation.

GENERAL CONSIDERATIONS.

Before taking up the subject of genera and subgenera in relation to the American forms of tree squirrels heretofore usually referred to the genus *Sciurus*, it seems desirable to present certain general facts that have a bearing on genetic relationships, and also to discuss some other generalities that may be better considered here than elsewhere.

Premolar formula.

In the *Sciurinae* the presence or absence of p^3 is usually looked upon as of small taxonomic importance, since in some groups it is absent or reduced almost to disappearance, although in other groups it not only reaches the crown level of the molars but is sometimes an obviously functional tooth. Formerly it was sometimes looked upon as a feature of the milk dentition, which might or might not reappear in the permanent dentition, and therefore in some cases was evanescent. On the contrary, as stated by Nelson in 1899 (*l. c.*, p. 49): "It is not present with the milk premolar in immature skulls, but appears coincidently with the permanent premolar and is equally persistent." Geographically considered, it is absent in all species of South American squirrels except the peculiar and highly specialized genus *Microsciurus* of the Andean highlands of western South America, which occurs also as an intrusive genus in Central America as far north as central Costa Rica, and in the still more specialized genus *Sciurillus* of the Guianas. It is present in all species of North American squirrels except in *Parasciurus* (*Parasciurus* + *Aræosciurus*) of eastern United States and the Mexican tableland, and the intrusive *Mesosciurus* (= *Guerlinguetus*, part, auct.), of

South America, which ranges north in Central America as far as northern Nicaragua. These facts seem to imply genetic significance in the presence or absence of p^3 .

The degree of development of p^3 varies in different super-specific groups. In *Tamiasciurus* it is reduced to a minimum and is often absent. In this group it is truly vestigial, being always very small, barely or not always piercing the gum, and nearly hidden beneath the crown of p^4 . Yet its geographic constancy is noteworthy, it being present in about equal development in all three species of the group, and in all of their numerous subspecies, which collectively occupy all the wooded portions of North America from northern Georgia and the mountains of northern Lower California north to the limit of trees. In *Neosciurus* and *Echinosciurus* it is generally small and slender, but usually reaches the crown level of p^4 . In *Hesperosciurus*, *Otosciurus*, and in the tropical *Microsciurus* and *Syntheosciurus*, it is a conspicuous and functional tooth, frequently with a bicuspid crown. Its presence and degree of development, or absence, usually accompany marked specialization in other features.

Mammæ.

Text Figures 13-16, p. 165.

All American tree squirrels have either 6 or 8 (either 3 or 4 pairs) of mammæ, those with 6 having one of the abdominal pairs absent. All North American species have 8 mammæ, except *Baiosciurus* of eastern and southern Mexico, Guatemala and Nicaragua, and the intrusive South American *Mesosciurus*. All the squirrels of the northern border of northern South America (north of the llanos of Venezuela) and of the Andean region south to Peru and Bolivia, have only 6 mammæ, while all other South American squirrels have 8 mammæ, including not only the giant squirrels of the Amazonian drainage but also the little guerlinguets of the Guianas and eastern Brazil. Furthermore, the South American species with 8 mammæ are widely separated geographically from the North American species with 8 mammæ. The species with 6 mammæ include also species of large size as well as the smallest American forms. Thus the number of mammæ is not fortuitous but a factor of great constancy, as it is also one of high physiological significance. It doubtless has considerable taxonomic value, since supernumerary mammæ are about as rare as supernumerary teeth.

Size as a group character.

Text Figures 1-12, pp. 162-164.

South American squirrels present quite a range of difference in size, but the members of a closely related group of species agree so nearly in both size and proportions that often neither can be relied upon as diagnostic features, the range of individual variation in a dozen specimens of the same species, or subspecies, as the case may be, exceeding the average difference between allied forms. *Mesosciurus*¹ contains two subgenera, each of which comprises 12 forms. The two groups are not closely allied, either in size or coloration. The difference in average total length in the 12 forms of the first group is less than 20 mm., while the range in individual variation in total length ranges from 30 to 50 mm., or more, in each form. In the same group the average total length of the skull ranges from 54.5 to 57 mm. (a range of only 2.5 mm.), while the range of individual variation in each form runs from 3 to 4 mm. Taking the skull, which is the more trustworthy basis, and excluding three subspecies that are decidedly above the average, the average total length varies in the remaining 10 forms from 49 to 52 mm., a range of 3 mm., while the individual range in each form runs from 2 to 4 mm. The same comparison could be carried through other groups with similar results. The point is, first, that closely related forms present a small average range of variation in size, *inter se*, and a very wide range of individual variation; second, that measurements, external or cranial, have little diagnostic value.

The American squirrels fall into a number of superspecific groups in which difference in the size of the animal is a marked feature. The smallest are the pygmy squirrels (*Sciurillus* and *Microsciurus*) of the Guianas and Andean regions respectively, with a total length of about 225 to 260 mm., and the size increases by steps or stages to the giant squirrels of the Amazonas with an average length of about 575 mm., with individuals exceeding 600 mm. The size of the skull varies, *pari passu*, from less than 30 to more than 60 mm., the giant squirrels being cubically about eight times larger than the pygmy squirrels. The feature of size is always correlated with other differences, and should seemingly carry weight as a diagnostic character. It is presented graphically in accompanying illustrations.

¹ For diagnosis see *postea*, p. 182.

Explanation of Text Figures 1-12.

All figures one fourth nat. size.

Figures 1-12 are to show relative size, and the relative length of the tail to the total length. Figures 13-16 are to show the number and position of the mammae.

Fig. 1. *Microsciurus similis similis* (Nelson). No. 32497, Am. Mus., ♂ ad., Gallera, Western Andes, Colombia.

Fig. 2. *Leptosciurus pucheranii pucheranii* (Fitzinger). No. 34621, Am. Mus., ♂ ad., Fusugasugá, Eastern Andes, Colombia.

Fig. 3. *Leptosciurus ignitus ignitus* (Gray). No. 16560, Am. Mus., ♀ ad., Inca Mines, Peru.

Fig. 4. *Notosciurus rhoadsi* Allen. *Type*. No. 12725, Mus. Acad. Nat. Sci. Philadelphia. ♂ juv., Paguma Forest, Chunchi, Ecuador. (See also Fig. 17.)

Fig. 5. *Mesosciurus hoffmanni hoffmanni* (Peters). No. 18089, Am. Mus., ♂ ad., Mount Irazú, Costa Rica.

Fig. 6. *Mesosciurus gerrardi versicolor* (Thomas). No. 34166, Am. Mus., ♂ ad., Barbacoas, Colombia.

Fig. 7. *Guerlinguetus æstuans æstuans* (Linné). No. 36492, Am. Mus., ♂ ad., Bonasica, Essequibo River, British Guiana.

Fig. 8. *Guerlinguetus ingrami* (Thomas). No. 36487, Am. Mus., ♂ ad., Alambary, São Paulo, Brazil.

Fig. 9. *Hadrosociurus flammifer* (Thomas). No. 16946, Am. Mus., ♂ ad., Suapure, Venezuela.

Fig. 10. *Urosociurus tricolor* (Pæppig). No. 19762, Field Museum, ♂ ad., Yurimaguas, Peru.

Fig. 11. *Urosociurus duida* (Allen). *Type*. No. 36153, Am. Mus., ♀ ad., Rio Cunucunumá, base of Mt. Duida, Venezuela.

Fig. 12. *Simosciurus stramineus stramineus* (Eydoux and Souleyet). No. 9014, U. S. Nat. Mus., ♂ ad., Guayaquil, Ecuador.

Fig. 13. *Leptosciurus ignitus irroratus* (Gray). Same specimen as Fig. 3.

Fig. 14. *Mesosociurus gerrardi morulus* (Bangs). No. 170991, U. S. Nat. Mus., ♀ ad., Rio Indio, Canal Zone, Panama.

Fig. 15. *Guerlinguetus æstuans quelchii* (Thomas). No. 20036, Field Museum, ♀ ad., Serra da Lua (near Boa Vista), Brazil.

Fig. 16. *Urosociurus tricolor* (Pæppig). Same specimen as figure 10.

Ratio of tail length to the total length.

Text Figures 1-12, pp. 162-164.

The length of the tail vertebræ, relative to the total length of the animal, varies greatly in different groups of tree squirrels, probably in relation to their habits, being developed in proportion to their exclusiveness as tree dwellers. The North American chickarees (*Tamiasciurus*) and the Andean pygmy squirrels have the shortest tails of all the American species. Little

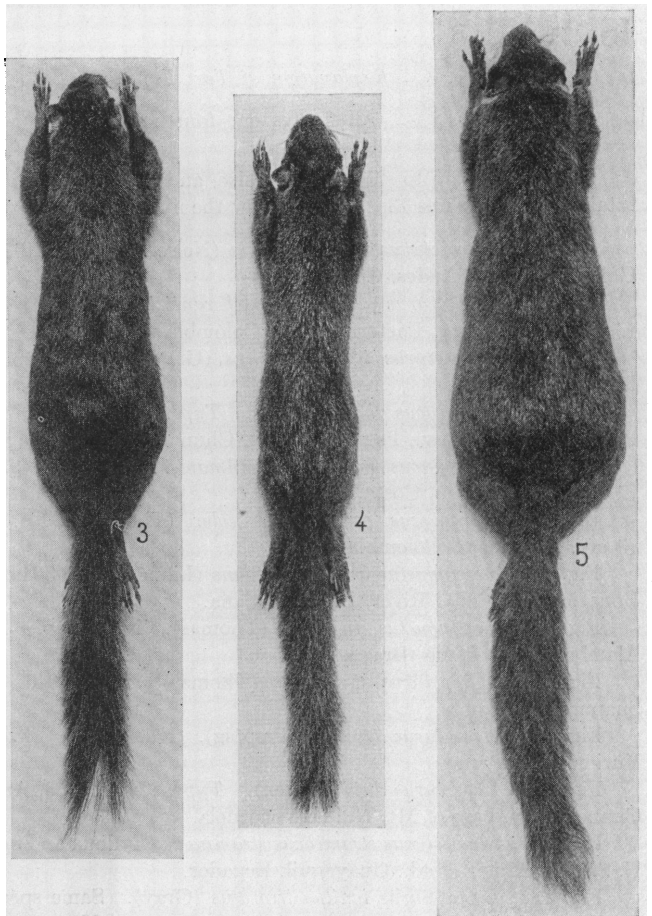


Fig. 1. *Microsciurus similis similis*.
 " 2. *Leptosciurus pucheranii pucheranii*.
 " 3. *Leptosciurus ignitus ignitus*.
 " 4. *Notosciurus rhoadsi*.
 " 5. *Mesosciurus hoffmanni hoffmanni*.
 One-fourth nat. size. See p. 161 for description.

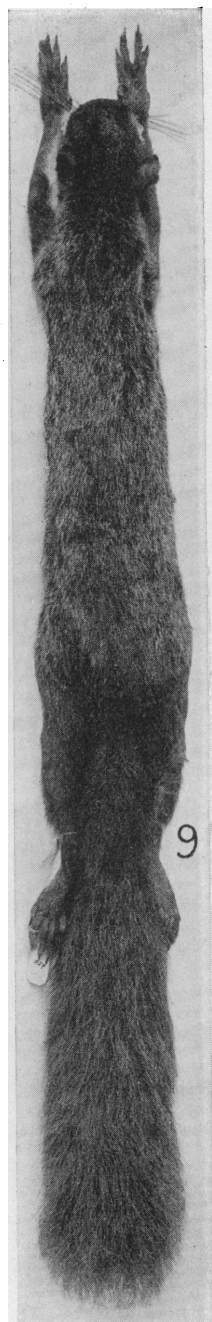
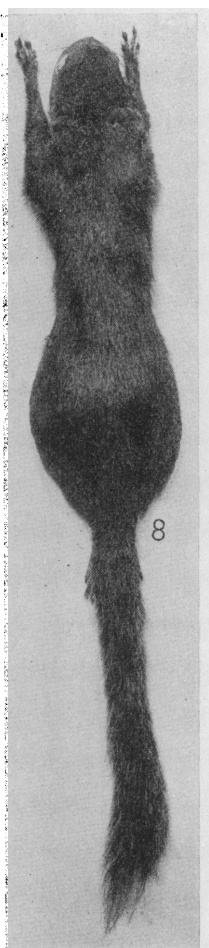
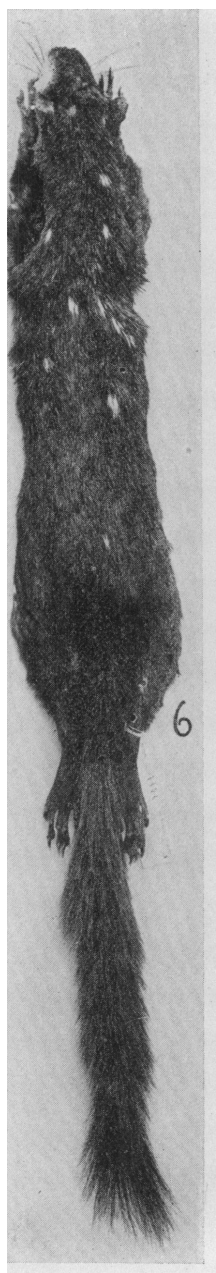


Fig. 6. *Mesosociurus gerrardi versicolor*.

" 7. *Guerlinguetus æstuans æstuans*.

" 8. *Guerlinguetus ingrami*.

" 9. *Hadrosociurus flammifer*.

One fourth nat. size. See p. 161 for description.

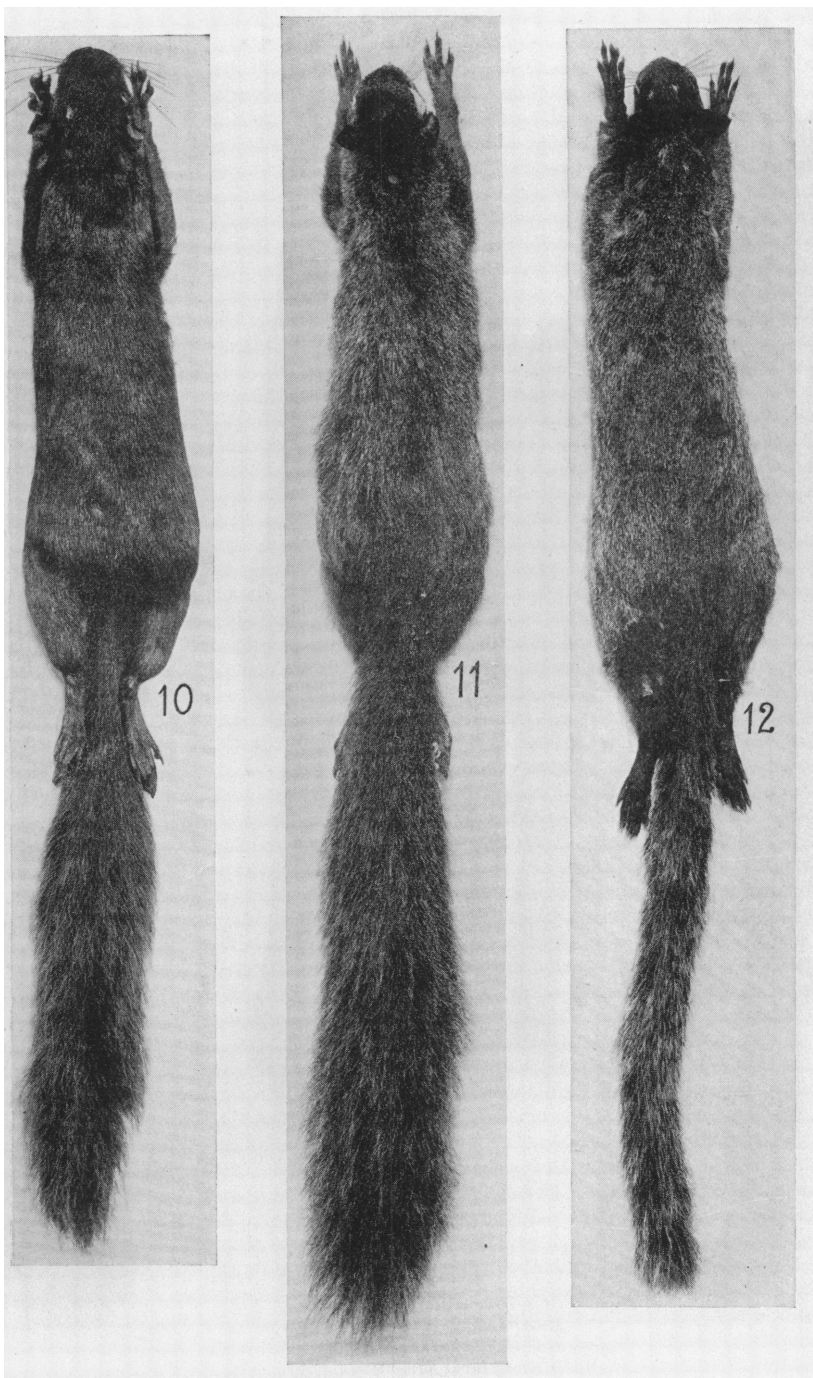


Fig. 10. *Urosciurus tricolor*.

" 11. *Urosciurus diuda*.

" 12. *Simosciurus stramineus stramineus*.

One fourth nat. size. See p. 161 for description.

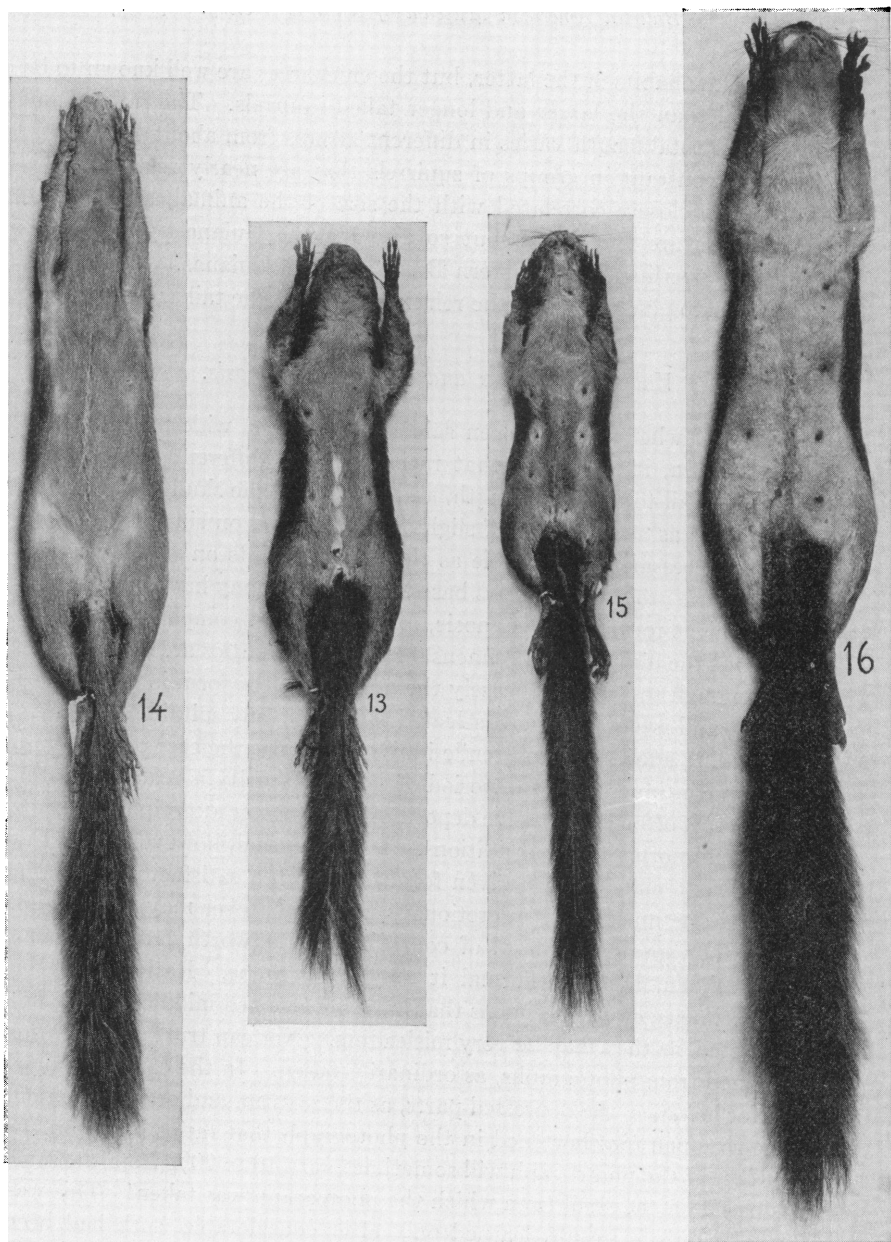


Fig. 13. *Leptosciurus ignitus ignitus*.
 " 14. *Mesosciurus gerrardi morulus*.
 " 15. *Guerlinguetus astuans quelchii*.
 " 16. *Urosciurus tricolor*.
 One fourth nat. size. See p. 162 for description.

is known of the habits of the latter, but the chickarees are well known to be less arboreal than the larger and longer tailed squirrels. The ratio of tail length to the total length varies in different groups from about 40 to 52%, and is very constant in groups of squirrels that are nearly related. It is not, however, closely correlated with the size of the animal, although all large squirrels are long-tailed, but so also are the Guiana pygmy squirrels and the guerlinguets of eastern Brazil and the Guianas. It therefore seems proper to give weight to the relative length of the tail as a taxonomic character.

Value of averages and ratios in diagnosis.

In view of what has just been said respecting the wide range of individual variation, it is evident that ratios between different parts, as the length of the tail to the total length, and of parts of the skull to each other or to the skull as a whole, are of slight value if based on single specimens, they being necessarily as variable as the measurements on which they are based. On the other hand, ratios based on averages may have a high value as a convenient formula in diagnosis, and as bases of comparison of allied forms. But the number of specimens on which such ratios are based should be large enough to approach closely the normal for the form in question — at least 10, and preferably more, selected to include only suitable specimens, *i. e.*, excluding adolescent and senile individuals. In the case of the skull, ossification continues after the period of sexual maturity is reached, and in old age there is often an excessive deposit of bony matter at peripheral points much beyond normal adult conditions. It is not usual, however, to find at hand sufficient material of a given form to furnish a satisfactory basis for ratios, and one must make discretionary use of whatever may be at hand. Three or four specimens afford of course more trustworthy results than a single specimen, however normal it may seem to be. Ratios based on single specimens, or on specimens that have not reached middle-life, are not to be trusted, as they may be very misleading. Nor can trustworthy ratios be obtained from photographs, as ordinarily taken. In the case of squirrel skulls, for instance, the depressed parts, as the rostrum and occipital region, become so much foreshortened in the photograph that ratios based on the flat surface of the photograph will sometimes vary 10 to 20% from the same ratios based on the skull from which the photograph was taken! This was to me a surprising result, learned only after considerable work had been expended in computing ratios from the flat surface of photographs.

Another point to be mentioned in connection with averages and ratios, brought out strongly in computing skull ratios, is the difficulty of taking correct measurements of convex surfaces, or where the boundaries of parts

are not sharply defined, as with the posterior border of the nasals in mammals. In the work here presented all measurements were taken with dividers in a straight line between the most extreme points of the parts measured. In the case of the nasal bones in squirrels, it is difficult to measure the same specimen twice alike; and the difference of half a millimeter in the length of the nasals will very essentially affect the result in computing, *e. g.*, the ratio of the length of the nasals to the interorbital breadth. In such cases there is, further, the element of the personal equation whenever the work of two or more investigators is subjected to comparison. In the case of averages, such slight aberrations are likely to offset each other, and hence the only trustworthy ratios are those based on a normal determined from averages.

Pelage and coloration.

Squirrels which live in temperate and boreal zones have always soft, thick fur, with abundant underfur, the thickness of the coat being correlated with climatic conditions; the coat is hence longer and thicker in winter than in summer. A similar correlation would be expected in squirrels inhabiting tropical and subtropical zones. It not only prevails similarly under tropical conditions, but here environment over-rides genetic relationship. In tropical lowlands the pelage is shorter and thinner, usually without underfur, and often more or less coarse and hispid, in contrast with that of species of the same genus, or even with that of subspecies of the same species, living at altitudes of 6000 to 12,000 feet in nearby mountain ranges. This is true not only of the pygmy squirrels of the genus *Microsciurus*, but of various members of *Echinosciurus* (as mentioned repeatedly by Nelson (*l. c.*, p. 21 and *passim*) of Mexico and Central America, and in *Microsciurus*, *Mesosciurus*, and *Guerlinguetus* in South America. The character of the pelage has therefore little taxonomic significance except among conspecific subspecies.

The case is quite different in the matter of coloration, which, as has often been observed, is frequently a trustworthy index of genetic relationship. The *Tamiasciurus* group of North America has a distinctive style common to the group as a whole, but it is not so strongly marked as in the ground squirrels of the genera *Tamias* and *Eutamias*. What would be called a distinct 'pattern' of coloration is absent in most tree squirrels, where, in some groups, individual variation in color runs riot, as is exceptionally exemplified in the *Echinosciurus* group of Mexico and Central America. On the other hand, certain groups, as *Microsciurus*, *Guerlinguetus*, *Urosciurus*, and a numerous group of species and subspecies in *Meso-*

sciurus, have each a fairly constant or uniform style of coloration, while in another group of the last-named genus it varies not only with each subspecies, but in some of the subspecies the range of individual variation is so excessive that it is difficult to find two specimens from the same locality that are wholly alike, with extremes that are exceedingly diverse. Variability in coloration is as much a feature of this group as constancy to a single type of coloration is a feature of certain other groups. In general, South American squirrels, large or small, have red bellies, or underparts that are washed or suffused with buff, ochraceous, or deep ferruginous; a few only have pure white bellies. There is a tendency to a black dorsal area in many species of the Andean region — restricted and not strongly developed in some of the forms of *Leptosciurus* and *Microsciurus*, but strongly developed in some of the subspecies of the *hoffmanni* group, and in all of the subspecies of the *Mesosciurus gerardi* group, in some of which the median half or more of the dorsal area is deep black, with the limbs and flanks red. In most of the smaller species of South America the upperparts are gray, suffused more or less strongly with fulvous or rufous; in the larger species, brown strongly washed or suffused with ferruginous.

Melanism, in the usual sense, is rare in South American squirrels, the only known instance being *Sciurus flammifer* Thomas of the Orinoco Valley, in which about half of the known specimens are strongly melanistic. A few melanistic specimens of other species have been recorded, being noteworthy on account of the rarity of such occurrences in South America. On the other hand, melanism is a widespread local condition among the gray and fox squirrels of eastern United States, and a common condition on a large scale in some of the squirrels of southern Mexico and Central America.¹

In a general way peculiarities of coloration among South American squirrels may be considered as indicative of group affinities.

Skull and teeth.

In attempting to discover tangible differences in the form of the skull and in the character of the teeth in American squirrels, with a view to their use as the basis of generic or subgeneric divisions, some surprises have been met with in respect to the variability of such features in specimens of the same

¹ In the humid tropical lowlands of western Colombia, western Ecuador and adjoining portions of Peru, irregular small white spots, consisting of tufts of elongated white hairs, are of more or less frequent occurrence in all the squirrels inhabiting this region, including species of *Microsciurus*, *Mesosciurus*, and *Simosciurus*. They occur most frequently on the limbs and dorsal surface, but appear also on the ventral surface. Their contrast in color with the surrounding pelage renders them conspicuous marks, but they are obviously pathological, caused probably by bites of insects, and have no taxonomic significance.

species from the same locality. The dorsal contour of the skull varies with the age of the individual, and also in those of the same age, as does the relative development of the rostrum, the form of the nasals, and the relative interorbital breadth. These, however, are less disturbing than the variability in the form and in the details of the crown pattern of p^4 and m^3 , and to a less extent in m^1 and m^2 . Single skulls of various species were taken at random for photographing and for detailed study. In several instances what were thought to be important characters were discovered, and later when, to make sure of their diagnostic value, they were checked up by comparison with a series, it was found that their importance vanished, as the differences proved to be not constant.

GENERA AND SUBGENERA OF AMERICAN TREE SQUIRRELS.

The American tree squirrels are separable into a number of fairly well circumscribed, and therefore natural, groups, not all, of course, of the same degree of differentiation. None are strictly congeneric with *Sciurus*, *sens. stric.*, typified by *Sciurus vulgaris* Linné of Europe and Northern Asia. In 1880 Trouessart, in his revision of the genus *Sciurus*,¹ divided the American species into five subgenera, as follows: (1) *Neosciurus*, (2) *Parasciurus*, (3) *Macroxus* (= *Guerlinguetus* Gray, 1821), (4) *Echinosciurus*, (5) *Tamiasciurus*. Another, *Microsciurus* Allen, was added in 1895. In 1899 all of them were accepted by Nelson (Proc. Washington Acad. Nat. Sci., I, pp. 15-106), who proposed four more, namely: (1) *Hesperosciurus*, (2) *Otosciurus*, (3) *Aræosciurus*, (4) *Baiosciurus*. Another, *Syntheosciurus*, was added as a full genus by Bangs in 1902, making eleven generic and subgeneric groups for the American tree squirrels found north of Panama. In June, 1914, Thomas added *Sciurillus*, as a full genus, for the pygmy squirrels of Guiana, which he referred to the subfamily Nannosciurinae, previously known only from West Africa and the Malay Archipelago. In the present paper seven additional subdivisions are recognized for groups occurring only in South America, namely, *Notosciurus*, *Leptosciurus*, *Mesosciurus*, *Histriosciurus* (as a subgenus of *Mesosciurus*), *Hadrosociurus*, *Urosociurus*, and *Simosciurus*.

In 1912, G. S. Miller, Jr., in his 'List of North American Land Mammals' (Bulletin 79, U. S. Nat. Mus.), recognized 38 species and 58 additional subspecies (96 forms) of tree squirrels as occurring north of Panama, referred by him to three genera and three additional subgenera, four of the ten sub-

¹ Revision du genre *Écureuil* (*Sciurus*), *La Naturaliste*, No. 37, pp. 290-293, Oct. 1, 1880.

genera recognized by Nelson in 1899 being suppressed, and *Sciurus* retained in a generic sense for all the species except those referred to *Microsciurus* and *Syntheosciurus*, which were accepted as full genera.¹

As noted by Nelson, the subgenera recognized by him in 1899 "occupy clearly defined geographic areas and, without exception, the ranges of the most closely related groups are separated by a distinct gap" (*l. c.*, p. 24). *Tamiasciurus* is the most northern group, occupying the wooded temperate and cold temperate parts of North America, no member of the group occurring south of the 34th degree of latitude except in the higher mountain ranges. *Neosciurus* is restricted to the eastern half of the United States, nowhere reaching the Mexican border. *Hesperosciurus* is its representative on the west coast, where it occurs, chiefly in the mountain ranges, from western Washington to northern Lower California, its range slightly overlapping that of *Tamiasciurus*, with which it has no near genetic relationship. *Otosciurus* is restricted to the southern Rocky Mountains and the northern Sierra Madre of northern Mexico. *Parasciurus* is limited to the eastern United States, ranging (formerly) from central New York to Texas and the immediately adjoining portions of northeastern Mexico. *Aræosciurus* inhabits the mountains bordering the tableland of Mexico from about 6000 to 12,000 feet, and extends north into southwestern New Mexico and southern Arizona, and south to Pueblo and western Vera Cruz. The ranges of *Parasciurus* and *Aræosciurus* nearly meet in northeastern Mexico; while some of the forms differ slightly in cranial characters, *Aræosciurus* may well be united with *Parasciurus*.

The preceding six groups are warm temperate to boreal in their geographical ranges, while the following four are tropical. *Echinosciurus* ranges from southern Mexico south to Costa Rica and Panama, but does not extend into South America. It comprises all the large squirrels (some 50 species and subspecies) of this extensive and greatly diversified area. *Baiosciurus* is also tropical, ranging from central Tamaulipas through eastern Mexico to Nicaragua. *Guerlinguetus* (as recognized by Nelson, not *Guerlinguetus* Miller) is chiefly South American in its range, but extends north to northeastern Nicaragua. *Microsciurus* ranges from central Costa Rica south in the Andean region to Peru. *Syntheosciurus* is known only from the mountains of Chiriqui.

¹ These 96 forms (38 species and 58 additional subspecies) were distributed as follows:
Subgenus *Tamiasciurus*, 21 forms, referred to 3 species.

Subgenus *Baiosciurus*, 4 forms, referred to 2 species.

Genus *Sciurus* (= *Echinosciurus*, *Neosciurus*, *Hesperosciurus*, *Otosciurus*), 50 forms, referred to 20 species.

Subgenus *Guerlinguetus*, 16 forms, referred to 9 species.

Genus *Microsciurus*, 4 forms, referred to 2 species.

Genus *Syntheosciurus*, 1 form.

In considering the genera and subgenera of South American squirrels it seems desirable to take into account also those of North America. The number of forms (species and subspecies) of American tree squirrels now known is about 175, a number likely to be considerably increased when those of South America become as well known as those of North America. Nearly as many more occurring in the Eastern Hemisphere are still more or less currently included in the genus *Sciurus*, but many referred a generation ago to *Sciurus* have since been segregated into a number of groups characterized originally as subgenera. Some of these divisions have come into use as full genera, but all of the American species are still commonly referred to *Sciurus*. *Sciurus* as generally accepted, is thus an unwieldy assemblage of several hundred species and subspecies, the considerable structural diversity and the relationships of which are concealed under a single generic name, although the mass includes many well circumscribed natural groups of admittedly superspecific value. The tendency is, on the part of recent specialists, to admit more and more of these groups to generic rank, in order to express more clearly the interrelationships and the diversities of their constituent elements. In line with this trend the present seems a favorable opportunity to call attention to the desirability of eliminating the genus *Sciurus* from the American biota and employing in its place such generic divisions as seem properly to express the diversity of the sciurid types of North and South America.

The tree squirrels collectively, morphologically, and in habits, are a singularly uniform group, due obviously to their strict adaptation to arboreal life. In *Sciuropterus* and *Pteromys*, the so-called flying squirrels, this adaptation is modified for pseudo flight, and they are not sciurid in a strict sense. The ground squirrels, beginning with *Tamias* and *Eutamias*, and including the spermophiles, prairie dogs and marmots, are adapted not only to terrestrial life, but have developed burrowing habits, with correlated modifications of structure.

The skull conforms closely throughout the group to a single type, of which the European tree squirrel (*Sciurus vulgaris* Linné) may be regarded as representative. In outline, as seen from above or below, the form varies from a broad to a long narrow oval outline; as seen in profile the dorsal outline varies from slightly convex or nearly straight to highly arched; the orbital fossa varies from subcircular to elongate, the greatest breadth of the fossa being usually at or slightly posterior to the postorbital processes; the interparietal is widely variable in both size and shape, but is generally similar in closely related forms; the maxillary teeth are either 4 or 5 on each side, and when p^3 is present it is greatly reduced in size; the cusps on the outer border of the molars, in unworn teeth, vary in prominence in different

species, and may become greatly reduced in size or even obsolete. In respect to external features, the mammæ number either 6 or 8; the tail varies in length in accordance with the habits of the species. Taking the total length from the tip of the nose to the end of the tail vertebræ (not to the end of the hairs) as 100, the ratio of the length of the caudal vertebræ to the total length is found to vary only from about 40 to 52; in other words, from considerably less to slightly more than the head and body length. The limbs and feet, under the control of scansorial adaptation, are short and strong, with the hind limbs never lengthened. The rostrum and incisors are modeled for strength and efficiency in extracting the nutrient kernels from nuts and husks. Consequently although tree squirrels constitute a numerous group their arboreal adaptation restricts the range of their structural modifications to narrow limits. It is hence apparently desirable to emphasize such features of differentiation as may be available in order to indicate the genetic interrelationships of the considerable number of super-specific natural groups so long hidden under the old Linnæan name *Sciurus*.

North American genera.

My present views on the classification of North American tree squirrels are here presented, with diagnoses of the generic and subgeneric groups, and illustrations of cranial characters and dentition.

Genus **Tamiasciurus**.

Plate I¹, Figs. 10-12; Plate VI, Figs. 2, 3.

Tamiasciurus Trouessart, 1880 (subgenus of *Sciurus*). Type, by original designation, *Sciurus hudsonicus* Erxleben.

Size small (smallest of North American arboreal squirrels); tail short and narrow, about 40% of total length; coloration distinctive; a conspicuous black lateral line in summer pelage. Mammæ, 8.

Premolars, $\frac{2}{1}$, p^3 vestigial; dentition otherwise similar to that of restricted *Sciurus*. Skull rather narrow for the length, moderately convex, the highest point at the fronto-parietal suture; nasals short, narrow, posterior border obtusely V-shaped; length of nasals to total length, about 28% (35% in *S. vulgaris*); interorbital breadth to total length, 30% (37% in *S. vulgaris*); zygomatic breadth to total length, 56% (68% in *S. vulgaris*).

Species: *Tamiasciurus hudsonicus*, *T. douglasii*, *T. fremonti*, each with numerous subspecies.

¹ For explanation of Plates I-VI, see pp. 179, 180.

Tamiasciurus, as the name implies, is on the border line between the terrestrial and arboreal types, and differs morphologically more from the other North American arboreal squirrels than any other sciurid group except *Microsciurus*. Figures of the skull and maxillary teeth are given in comparison with similar figures of *Sciurus vulgaris*.

Range.—The forested parts of the northern half of the North American continent.

Genus *Neosciurus*.

Plate III, Figs. 1-3; Plate VI, Figs. 12, 13.

Neosciurus Trouessart, 1880 (subgenus of *Sciurus*). Type, by original designation and monotypy, *Sciurus carolinensis* Gmelin.

Size medium; tail of medium length (about 46% of total length), broad and full; coloration not distinctive, gray above, white below. Mammæ, 8.

Premolars, $\frac{2}{1}$; p^3 small, not reaching the crown level of p^4 ; dentition not distinctive. Skull long and narrow, dorsal outline only slightly convex anterior to fronto-parietal suture; rostrum long and narrow, nasals narrow, moderately V-shaped on posterior border, about 33% of length of skull, 93% of interorbital breadth; zygomatic breadth 55% of total length.

Species: *Neosciurus carolinensis*, with numerous subspecies.

Range, eastern half of United States.

In cranial characters *Neosciurus* is similar to *Otosciurus* but it differs from it in external characters.

Genus *Otosciurus*.

Plate IV, Figs. 1-3; Plate VI, Fig. 16.

Otosciurus Nelson, 1899 (subgenus of *Sciurus*). Type, by original designation, *Sciurus aberti* Woodhouse.

Size large, tail long and full (about 48% of total length). Ears large, heavily tufted in winter; upperparts gray with a reddish dorsal area; underparts white; an indistinct black lateral line. Mammæ, 8.

Premolars, $\frac{2}{1}$, p^3 strongly developed; dentition otherwise, and also cranial characters, nearly as in *Neosciurus*.

Range, southern Rocky Mountain region, from northern Colorado to Chihuahua and Durango, west to Arizona.

Species: *Otosciurus aberti* (with numerous subspecies), *O. durangi*, and *O. kaibabensis*.

Genus **Hesperosciurus**.

Plate III, Figs. 4-6; Plate VI, Figs. 14, 15.

Hesperosciurus Nelson, 1899 (subgenus of *Sciurus*). Type, by original designation and monotypy, *Sciurus griseus* Ord.

Size very large, tail very long and full (about 50% of total length); coloration gray above, white below, without special markings. Mammæ, 8.

Premolars, $\frac{2}{1}$, p^3 heavily developed; m^3 with a single strongly developed conical cusp, with the accessory cusplets nearly suppressed; dentition otherwise as in *Neosciurus* and *Otosciurus*. Skull massive, heavily built, but contour and proportions nearly as in *Neosciurus* and *Otosciurus*; malar heavier, process of superior border better developed.

Range, Pacific coast of the United States, from southwestern Washington to northern border of Lower California.

Species: *Hesperosciurus griseus*, with several subspecies.

The practically monotypic genera *Neosciurus*, *Otosciurus*, and *Hesperosciurus* are closely related genetically but widely separated geographically; they have become strongly differentiated in external features, much less so in cranial characters and in dentition. *Otosciurus* and *Hesperosciurus* could very well stand as subgenera of *Neosciurus*.

Genus **Echinosciurus**.

Plate II, Figs. 1-8; Plate VI, Figs. 8-11.

Echinosciurus Trouessart, 1880 (subgenus of *Sciurus*). Type, by original designation, *Sciurus hypopyrrhus* Wagler (= *Sciurus aureogaster hypopyrrhus* Nelson).

Size large; tail long, about 50% of the total length (49 to 51 in different species); coloration variable; texture of pelage soft or hispid, according to the environment. Mammæ, 8.

Premolars, $\frac{2}{1}$, p^3 usually small, slender; molar dentition not distinctive. Skull broad, dorsal outline flattened or slightly swollen at frontal region; rostrum short, length of nasals about 95% of interorbital breadth (in the type species reaching 100% in some specimens).

Range, southern Mexico, south to northern Panama.

Species numerous (about 16, some of them with numerous subspecies), variable in cranial details.

The type species is a middle form in respect to the shape of the skull. The *E. poliopus*, *E. socialis* and *E. sinaloensis* groups have a longer ros-

trum and longer and posteriorly much narrower nasals; the *E. boothiæ*, *melania*, *thomasi*, *goldmani*, *variegatoides*, and *adolphi* groups a shorter and broader rostrum, wider and shorter nasals, and a broader skull than the *hypopyrrhus* (= *aureogaster*) group. The latter are tropical and southern, the former subtropical and northern, but they all blend so thoroughly that it seems impracticable to attempt to separate *Echinosciurus* into minor divisions. At the south *Echinosciurus* is sharply separated from all of the South American squirrels; at the north it is separated by a wide interval, geographically and in cranial characters, from either *Hesperosciurus* or *Neosciurus*, and in structural characters from *Otosciurus*, which ranges south into the mountains of northern Mexico.

Genus **Baiosciurus**.

Plate I, Figs. 7-9; Plate VI, Figs. 6, 7.

Baiosciurus Nelson, 1899 (subgenus of *Sciurus*). Type, by original designation, *Sciurus deppei* Peters.

Size medium; tail of medium length (about 47% of total length); coloration uniform grizzled dark rusty or yellowish brown above, grayish white with a buffy wash below; tail black fringed with white. Mammæ, 6.

Premolars, $\frac{2}{2}$, p^3 well-developed; p^4 small, crown nearly square; cusps on outer border of molars well-developed, the cusplets weakly developed. Skull broad, dorsal outline low; rostrum short, nasals about 27% of total skull length, 86% of interorbital breadth; zygomatic breadth about 58% of skull length.

Range, eastern Mexico, from central Tamaulipas to Chiapas, Guatemala, Honduras, and northern Nicaragua.

Species: 2, with several subspecies.

Baiosciurus is about twice the size of *Tamiasciurus*, and about half the size of *Mesosciurus hoffmanni*, taking the skull as a basis of comparison. It has 6 mammæ, as in *Mesosciurus* instead of 8 as in *Echinosciurus* and *Tamiasciurus*. It is too different from either of these genera in cranial characters to require detailed comparison. The quadrate instead of triangular form of p^4 in *Baiosciurus* is a distinguishing feature.

Genus **Syntheosciurus**.

Text Figs. 17-19; Plate VI, Fig. 1.

Syntheosciurus Bangs, 1902. Type, *Syntheosciurus brochus* Bangs, by designation and by monotypy.

Size small (about as in *Tamiasciurus*); tail of medium development,

about 46% of total length. Pelage thick and soft; coloration about as in the *hoffmanni* group of *Mesosciurus*. Mammæ, 6:

Skull narrow, rostrum very long and narrow; nasals 103% of interorbital

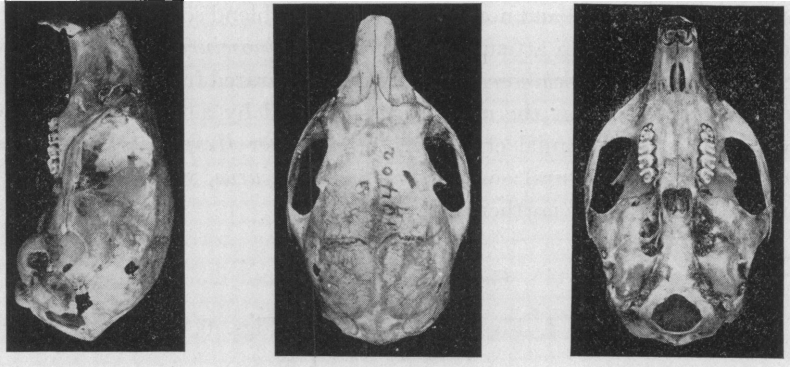


Fig. 17.

Fig. 18.

Fig. 19.

Figs. 17-19. *Syntheosciurus brochus* Bangs. Type skull, nat. size.

breadth, 29% of total length of skull, their posterior border deeply emarginate; zygomatic breadth about 48% of skull length.

Premolars, $\frac{2}{1}$; incisors grooved in front; p^3 well developed; molariform dentition not specialized.

Known only from a single species, from Chiriqui, Panama, where it lives at an altitude of 7000 feet.

Syntheosciurus is surprisingly unlike any other known squirrel, having no very close relationship with its near neighbors, *Microsciurus* and *Mesosciurus*, which occur in the same region, and of course is very different from the large *Echinosciuri* of the same general area.

Genus *Parasciurus*.

Plate IV, Figs. 4-6; Plate V, Figs. 1-9; Plate VI, Figs. 17-24.

Parasciurus Trouessart, 1880 (subgenus of *Sciurus*). Type, *Sciurus niger* Linné, by monotypy.

Aræosciurus Nelson, 1889. Type, *Sciurus oculatus* Peters, by original designation.

Size large, among the largest of American tree squirrels; tail long and broad, about 50% of the total length. Pelage thick and soft; color of upperparts gray (generally dark gray with fulvous suffusion), underparts white or buffy, sometimes ferruginous. Mammæ, 8.

Skull broad and heavy, dorsal outline flattened over the frontal region,

and occipital region relatively slightly depressed; rostrum and nasals broad, the latter well produced posteriorly, forming about 33% of the total length of the skull, their length about equal to the interorbital breadth (varying from 90 to 110% in specimens of the same species!); zygomatic breadth about 58% of length of skull.

Premolars, $\frac{1}{2}$; p^4 with (usually) a strong cusp on fronto-lateral border of crown; molars not distinctive.

Range, eastern United States, south in the mountains of the Mexican tableland to Pueblo and southern Jalisco, west to western Arizona, Sonora, and Sinaloa.

Species: 6, several with subspecies.

There seems to be no good reason for regarding *Aræosciurus* as separable from *Parasciurus*. The *P. niger* group is closely related to *P. apache* and *P. oculatus* (the latter the type of *Aræosciurus*) and the other species do not differ essentially from *niger*.

The skull of *Parasciurus* is similar in proportions to the skull in *Neosciurus*, *Otosciurus*, and *Hesperosciurus*, but the rostrum is broader and the occipital region is much less depressed; the premolar formula is $\frac{1}{2}$ instead of $\frac{2}{1}$, and p^4 is heavier and has the anterior cusp much more strongly developed, there being four well developed cusps on the outer border instead of only three, as in the genera having two premolars.

The two remaining genera of North American tree squirrels, *Mesosciurus* (*Guerlinguetus* auct., part) and *Microsciurus*, are intrusive from South America, where they have their principal distribution. The first, *Mesosciurus*, extends across the northern border of South America and throughout the Andean regions in the west to southern Ecuador. Its range in Central America is discontinuous with its South American range; it is known north of the Isthmus from Chiriqui to central Costa Rica, with an outlying member (*Mesosciurus richmondi*) in northeastern Nicaragua. The northernmost locality known for *Microsciurus* is central Costa Rica, whence it appears to extend continuously southward in the Western and Central Andes to southern Peru and neighboring parts of Bolivia.

South American genera.

The South American genera of tree squirrels are in general better circumscribed and more easily characterized than those of North America. They may be simply enumerated here, for comparison with the North American list, they being described in detail in the following pages.

Microsciurus Allen, 1895 (subgenus of *Sciurus*). Type, by original designation and monotypy, *Sciurus* (*Microsciurus*) *alfari* Allen.

Premolars, $\frac{2}{1}$; mammæ, 6. (For description see p. 188.)

Range, western Andean region, south to Peru and Bolivia, north to central Costa Rica. About 20 species and subspecies.

Sciurillus Thomas, 1914 (genus, referred to *Nannosciurinae*). Type, by original designation, *Sciurus pusillus* Desmarest. (For description see p. 196.)

Premolars, $\frac{2}{1}$; mammæ, 6 (?).

Range, the Guianas. One species, with subspecies.

Leptosciurus gen. nov. (for description see p. 199). Type, *Sciurus rufoniger* Pucheran, not of Gray = *Funambulus pucheranii* Fitzinger.

Range, Andean Region of Colombia, and portions of Peru and Bolivia. Three species, several subspecies.

Notosciurus Allen, 1914. Type, by original designation and monotypy, *Notosciurus rhoadsi* Allen. (For description see p. 209.)

Range, Ecuador. Known only from the type specimen.

Mesosciurus gen. nov. (for description see p. 212). Type, *Sciurus æstuans* var. *hoffmanni* Peters.

Premolars, $\frac{1}{1}$; mammæ, 6.

Range, northeastern Nicaragua, northern border of South America, and the Andean region south to Ecuador. Numerous species and subspecies.

Histrosciurus (subgen. nov. of *Mesosciurus* (see pp. 213, 236)). Type, *Sciurus gerrardi* Gray.

Range, western and northern coast regions of Colombia.

Guerlinguetus Gray (subgenus of *Sciurus*). Type by tautonymy, *Sciurus guerlinguetus* Gray = *Sciurus æstuans* Linné. (For description see p. 254.)

Premolars, $\frac{1}{1}$; mammæ, 8.

Range, the Guianas, west to the Orinoco, the lower Amazon, and eastern Brazil. About 5 species and subspecies.

Hadrosociurus gen. nov. (for description see p. 265). Type, *Sciurus flammifer* Thomas.

Premolars, $\frac{1}{1}$; mammæ, 8.

Range, Caura district, Rio Orinoco. Known only from the type species.

Urosociurus gen. nov. (for description see p. 267). Type, *Sciurus tricolor* Poeppig.

Premolars, $\frac{1}{1}$; mammæ, 8.

Range, basin of the Amazon. About 5 species, with numerous subspecies.

Simosciurus gen. nov. (for description see p. 280). Type, *Sciurus stramineus* Eydoux and Souleyet.

Premolars, $\frac{1}{1}$; mammæ, 8.

Range, southwestern Ecuador and northwestern Peru. One species, with several subspecies.

EXPLANATION OF PLATES I-VI.

PLATE I.

All figures nat. size.

Figs. 1-3. *Sciurus vulgaris leucourus* Kerr. No. 36596, Am. Mus., ♂ ad., Burnham Beeches, England. For comparison with American types.

Figs. 7-9. *Baiosciurus deppei vivax* Nelson. No. 107928, U. S. Nat. Mus., ♂ ad., Apazote, Campeche, Mexico.

Figs. 10-12. *Tamiasciurus hudsonicus gymnicus* (Bangs). No. 8205, Am. Mus., ♂ ad., Forks of Tobique River, New Brunswick.

PLATE II.

All figures nat. size.

Figs. 1-3. *Echinosciurus aureogaster hypopyrrhus* (Wagler). No. 17196, Am. Mus., ♂ ad., Pasa Nueva, Vera Cruz, Mexico.

Figs. 4, 5. *Echinosciurus poliopus cervicalis* (Allen). No. 26050, Am. Mus., ♂ ad., Volcan de Fuego, Jalisco, Mexico.

Figs. 6, 7. *Echinosciurus variegatoides variegatoides* (Ogilby). No. 30753, Am. Mus., ♂ ad., Matagalpa, Nicaragua.

Fig. 8. *Echinosciurus melania* (Gray). No. 18867, Am. Mus., ♂ ad., Boqueron, Chiriqui.

PLATE III.

All figures nat. size.

Figs. 1-3. *Neosciurus carolinensis carolinensis* (Gmelin). No. 2486, Am. Mus., ♀ ad., Hastings, Westchester Co., New York.

Figs. 4-6. *Hesperosciurus griseus griseus* (Ord). No. 11863, Am. Mus., ♀ ad., Colusa Co., California.

PLATE IV.

All figures nat. size.

Figs. 1-3. *Otosciurus aberti aberti* (Woodhouse). No. 1686, Am. Mus., ♀ ad., Mogollon Mts., Arizona.

Figs. 4-6. *Parasciurus arizonensis arizonensis* (Coues). No. 1706, Am. Mus., ♀ ad., Fossil Creek, Arizona.

PLATE V.

All figures nat. size.

Figs. 1, 2. *Parasciurus niger rufwenter* (Geoffroy). No. 2508, Am. Mus., ♂ ad., Tangipahoe Parish, Louisiana.

Figs. 5, 6. *Parasciurus oculatus oculatus* (Peters). No. 10886, Am. Mus., ♂ ad., Las Vigas, Vera Cruz, Mexico.

Figs. 8, 9. *Parasciurus apache* (Allen). No. 21353, ♀ ad., Arroyo de Bucy, Durango, Mexico.

PLATE VI.

All figures $\frac{3}{4}$.

Fig. 1. *Syntheosciurus brochus* Bangs. Type. No. 10402, Bangs Coll., Mus. Comp. Zool., ♂ ad. Left maxillary tooththrow, direct crown view.

Fig. 2. *Tamiasciurus hudsonicus gymnicus* (Bangs). No. 8205, Am. Mus., ♂ ad., Tobique River, New Brunswick. Maxillary tooththrows, direct crown view.

Fig. 3. Same specimen as Fig. 2. Oblique view of left maxillary tooththrow, to show crenulation of outer border.

Fig. 4. *Sciurus vulgaris leucourus* Kerr. No. 36596, Am. Mus., ♀ ad., Slough, England. Left maxillary tooththrow, direct crown view. For comparison with American types.

Fig. 5. Same specimen as Fig. 4. Oblique view of left maxillary tooththrow.

Fig. 6. *Baioosciurus deppei matagalpæ* Allen. No. 29812, Am. Mus., ♂ ad., Pena Blanca, Nicaragua. Maxillary tooththrows, direct crown view.

Fig. 7. Same specimen as Fig. 6. Oblique view of left maxillary tooththrow.

Fig. 8. *Echinosciurus aureogaster hypopyrrhus* (Wagner). No. 17196. Am. Mus., ♀ ad., Pasa Nueva, Vera Cruz, Mexico. Direct crown view of left maxillary tooththrow.

Fig. 9. Same specimen as Fig. 8. Oblique view of left maxillary tooththrow.

Fig. 10. *Echinosciurus polioopus cervicalis* (Allen). No. 26050, Am. Mus., ♂ ad., Volcan de Fuego, Jalisco, Mexico. Direct crown view of left maxillary tooththrow.

Fig. 11. Same specimen as Fig. 10. Oblique view of left maxillary tooththrow.

Fig. 12. *Neosciurus carolinensis carolinensis* (Gmelin). No. 2486, Am. Mus., ♀ ad., Hastings, Westchester Co., New York. Direct crown view of left maxillary tooththrow.

Fig. 13. Same specimen as Fig. 12. Oblique view of left maxillary tooththrow.

Fig. 14. *Hesperosciurus griseus griseus* (Ord). No. 11863, Am. Mus., ♂ ad., Colusa Co., California.

Fig. 15. Same specimen as Fig. 12. Oblique view of left maxillary tooththrow.

Fig. 16. *Otosciurus aberti aberti* (Woodhouse). No. 1686, Am. Mus., ♀ ad., Mogollon Mts., Arizona. Direct crown view of left maxillary tooththrow.

Fig. 17. *Parasciurus niger rufiventer* (Geoffroy). No. 2508, Am. Mus., ♂, Tangipaho Parish, Louisiana. Direct crown view of left maxillary tooththrow.

Fig. 18. Same specimen as Fig. 17. Oblique view of left maxillary tooththrow.

Fig. 19. *Parasciurus arizonensis arizonensis* (Coues). No. 1706, Am. Mus., ♀ ad., Fossil Creek, Arizona. Crown view of left maxillary tooththrow.

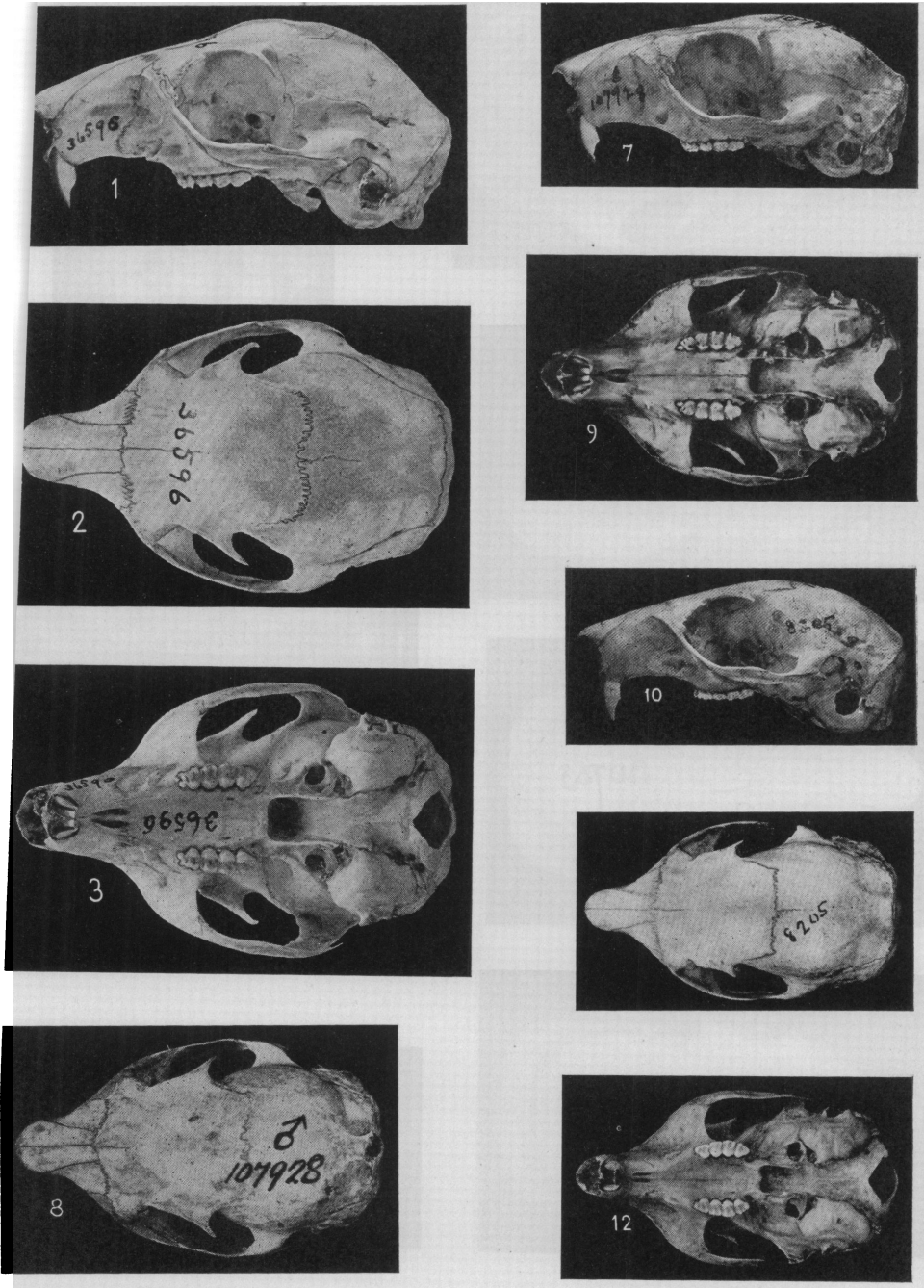
Fig. 20. Same specimen as Fig. 19. Oblique view of left maxillary tooththrow.

Fig. 21. *Parasciurus apache* (Allen). No. 21353. Am. Mus., ♀ ad., Arroyo de Bucy, Durango, Mexico. Crown view of left-maxillary tooththrow.

Fig. 22. Same specimen as Fig. 21. Oblique view of left maxillary tooththrow.

Fig. 23. *Parasciurus oculus oculus* (Peters). No. 10886, Am. Mus., ♂ ad., Las Vigas, Vera Cruz, Mexico. Left maxillary tooththrow, direct crown view.

Fig. 24. Same specimen as Fig. 23. Oblique view of left maxillary tooththrow.

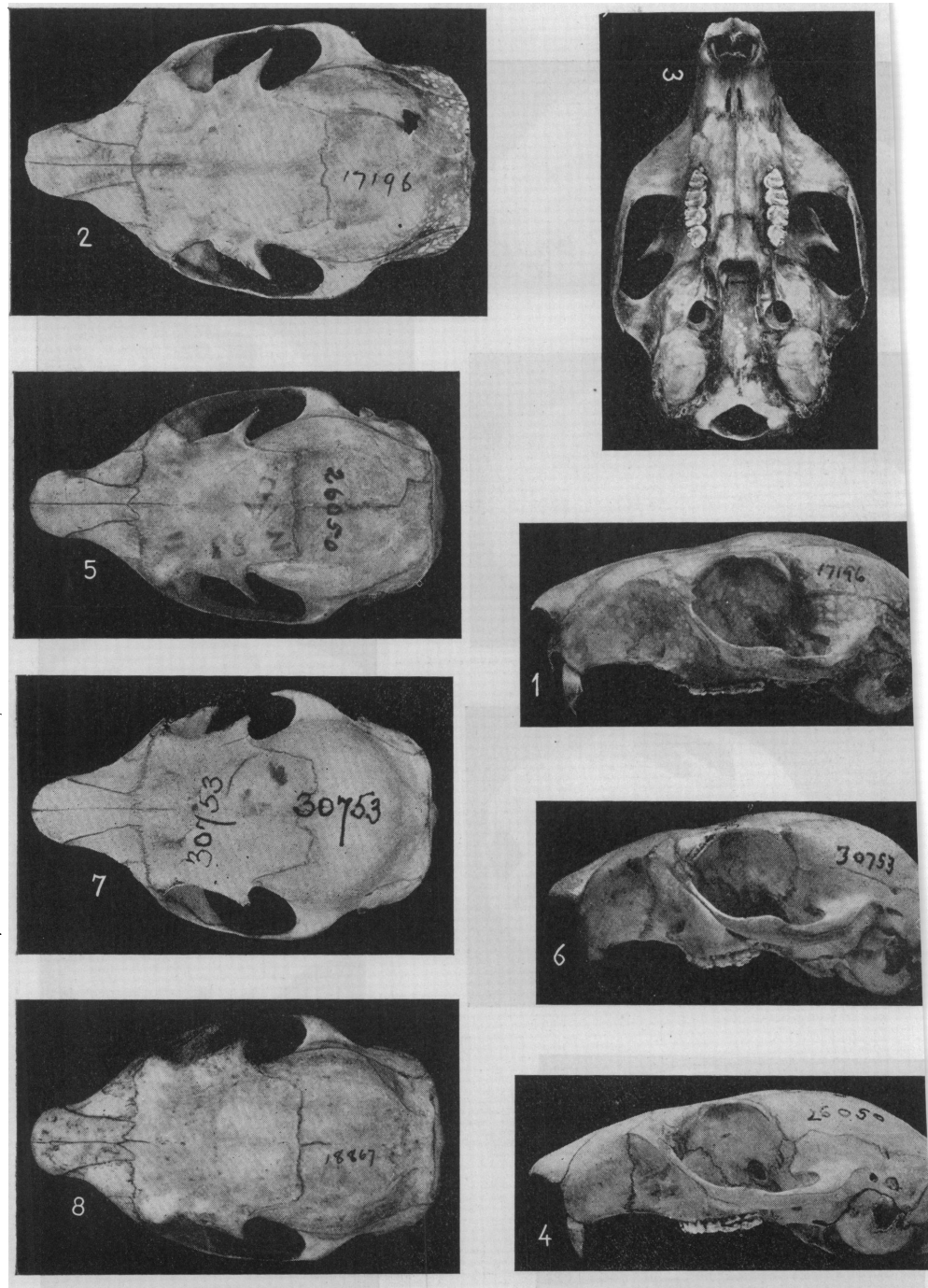


All figures nat. size.

Figs. 1-3. *Sciurus vulgaris leucourus*.

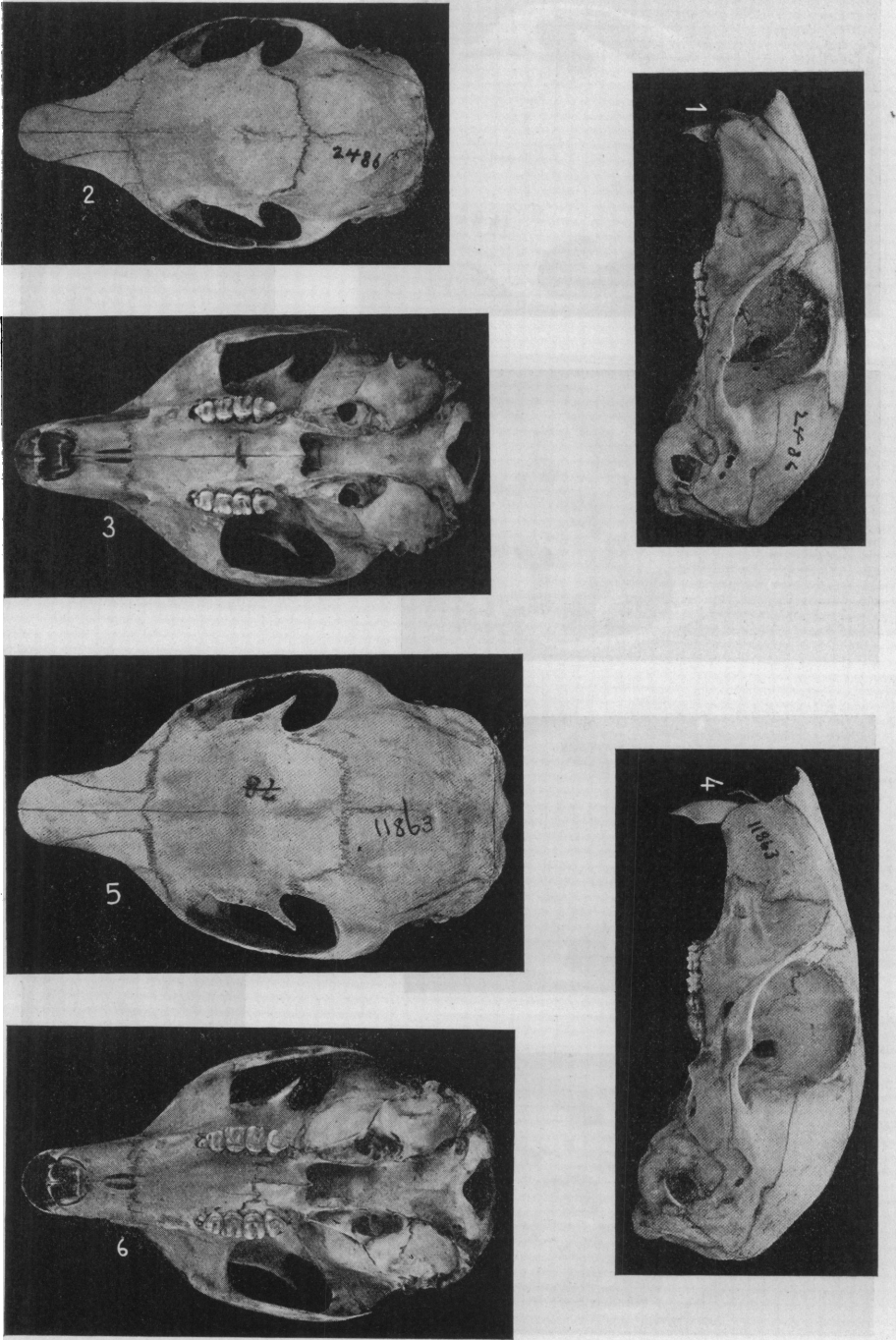
Figs. 7-9. *Baiosciurus deppei vivax*.

Figs. 10-12. *Tamiasciurus hudsonicus gymnicus*.



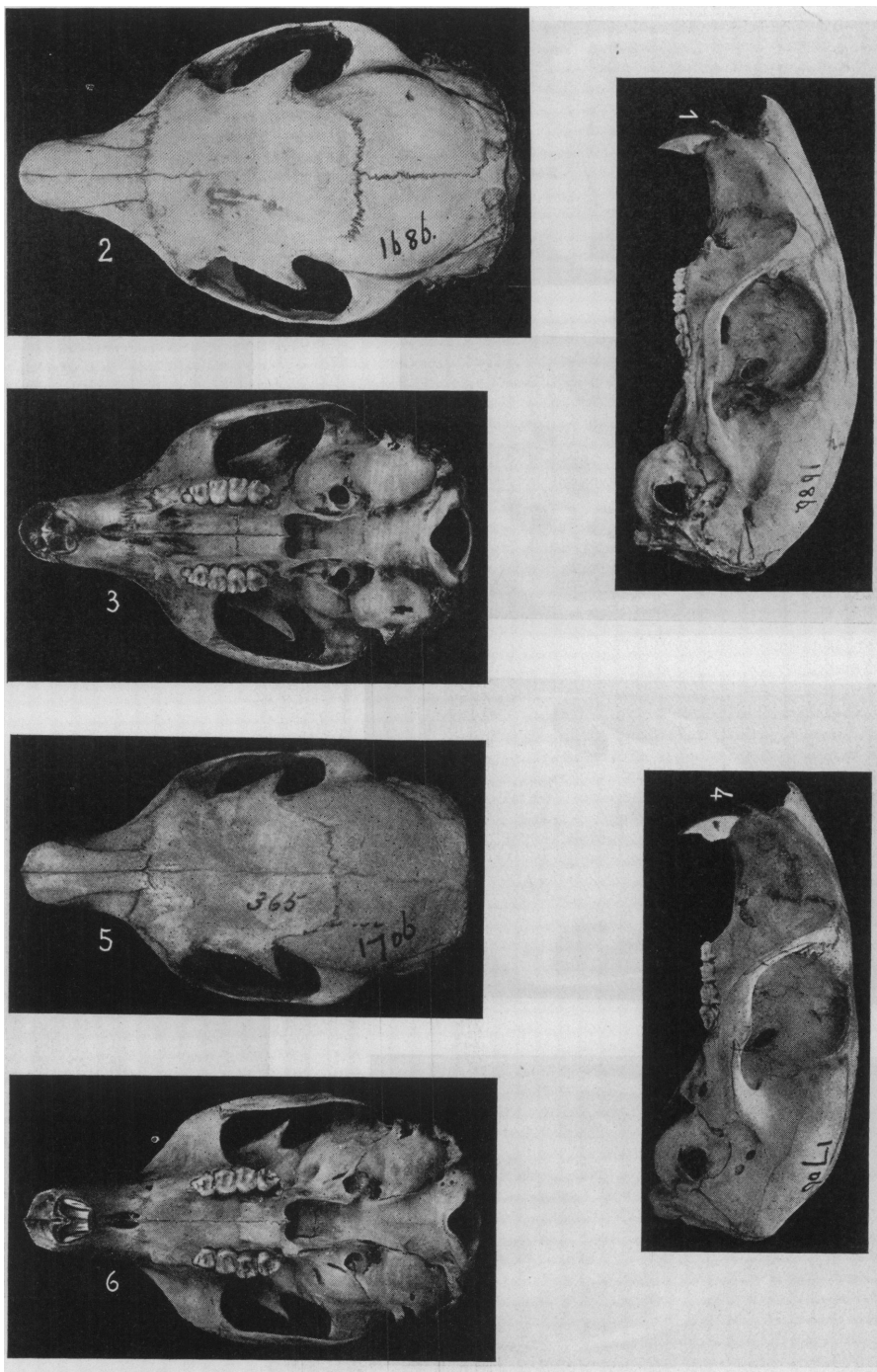
All figures nat. size.

Figs. 1-3. *Echinosciurus aureogaster hypopyrrhus*.
" 4, 5. " *poliopus cervicalis*.
" 6, 7. " *variegatoides variegatoides*.
" 8. " *melania*.



All figures nat. size.

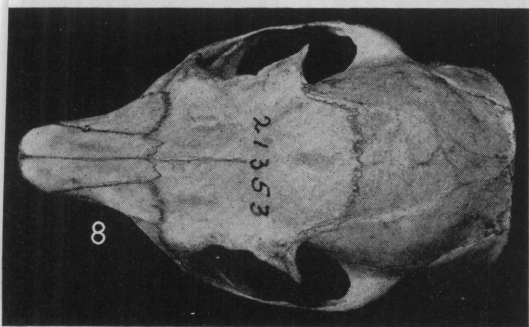
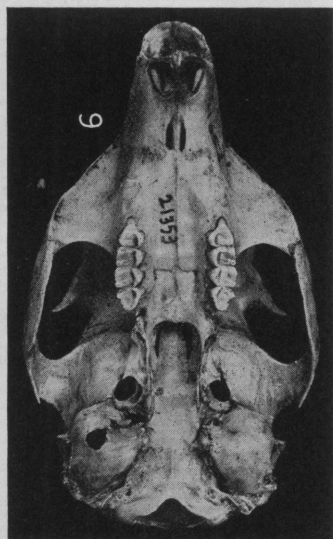
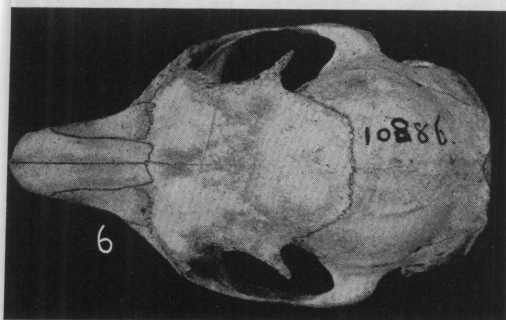
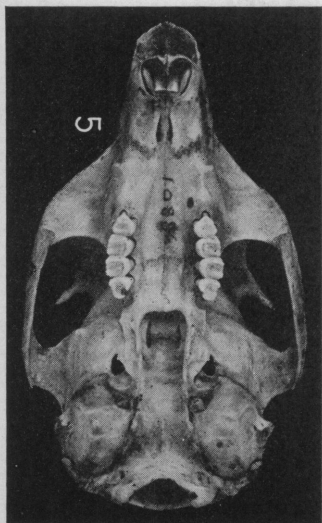
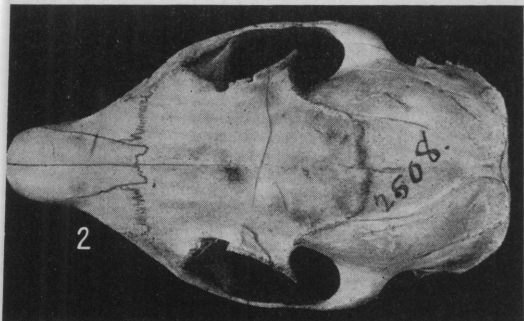
- Figs. 1-3. *Neosciurus carolinensis carolinensis*.
" 4-6. *Hesperosciurus griseus griseus*.



All figures nat. size.

Figs. 1-3. *Otosciurus aberti aberti*.

" 4-6. *Parasciurus arizonensis arizonensis*.

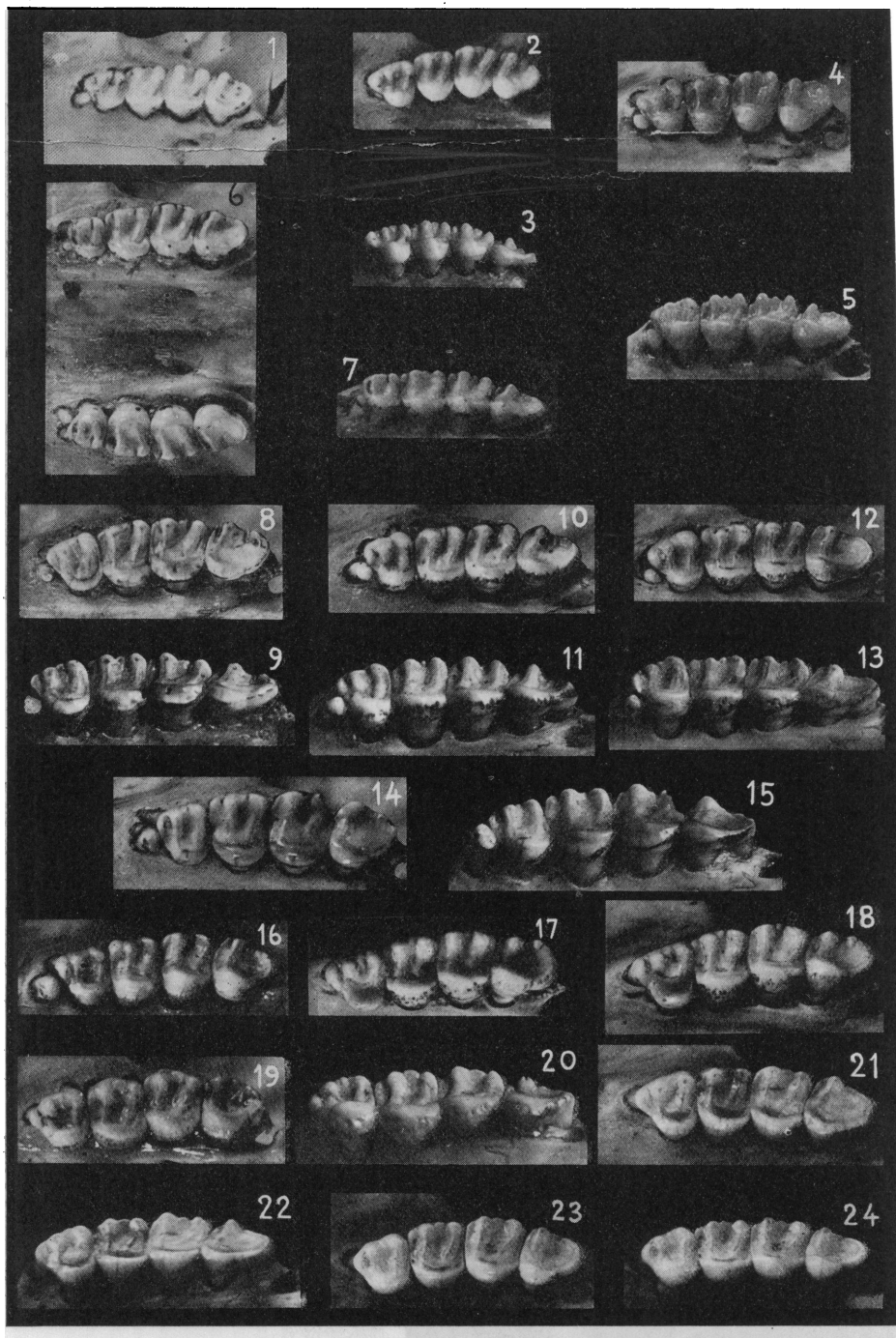


All figures nat. size.

Figs. 1, 2. *Parasciurus niger rufiventer*.

Figs. 5, 6. *Parasciurus oculatus oculatus*.

Figs. 8, 9. *Parasciurus apache*.

All figures $\frac{3}{1}$.Fig. 1. *Syntheosciurus brochus*." 2, 3. *Tamasciurus hud. gymniscus*." 4, 5. *Sciurus vulgaris leucourus*." 6, 7. *Balosciurus deppel-matagalpæ*." 8, 9. *Echinosciurus aureo. hypopyrrhus*." 10, 11. " *pollopus cervicalis*.Figs. 12, 13. *Neosciurus car. carolinensis*." 14, 15. *Hesperosciurus gr. griseus*." 16. *Otosciurus aberti aberti*." 17, 18. *Parasciurus niger rufiventer*." 19, 20. " *ariz. arizonensis*." 21, 22. " *apache*.Figs. 23, 24. *Parasciurus oculatus oculatus*.

SOUTH AMERICAN SCIURIDÆ.

In the following pages the tree squirrels of South America are divided into nine natural and, for the most part, geographically and morphologically well-circumscribed groups. They are here treated, partly for nomenclatural convenience, as full genera. Their ultimate valuation will naturally vary with the viewpoint of the taxonomer. The reasons for this proposed subdivision have already been stated (pp. 169–172). Illustrations of the cranial characters are given of the leading types in Plates VII–XIV.¹

The forms here recognized (including 5 from Central America) number 76, of which 38 are given the status of species, with 38 additional subspecies. The ‘giant’ squirrels of the Amazonian region are unfortunately poorly represented in the material available for study, and the recognition accorded to several of the forms of this group is merely provisional.

Five genera (*Leptosciurus*, *Mesosciurus*, *Hadrosciurus*, *Urosciurus*, *Simosciurus*), one subgenus (*Histrosciurus*), and two subspecies (*Guerlinguetus æstuanus venustus*, *Mesosciurus gerrardi baudensis* and *M. g. valdiviæ*) are here characterized as new. [For the last two see Addenda, p. 308.]

*Key to the Genera.*²

Mammæ, 6.

Premolars, $\frac{2}{1}$.

Size small, total length about 240–260 mm., hind foot 35–40; tail much shorter than head and body.....*Microsciurus* (p. 188)

Size very small, total length about 220 mm., hind foot about 28; tail as long as or longer than the body.....*Sciurillus* (p. 196)

Premolars, $\frac{1}{1}$.

Size small, total length about 320–380, hind foot 40–45; tail shorter than head and body.

Soles naked, plantar pads normal.....*Leptosciurus* (p. 199)

Soles heavily furred nearly the whole length, plantar pads all near base of toes.....*Notosciurus* (p. 209)

Size medium, total length about 375–450 mm., hind foot 50 to 55; tail about equal to or shorter than head and body....*Mesosciurus* (p. 212)

Mammæ, 8; premolars, $\frac{1}{1}$; tail as long as or longer than head and body.

Size small, tail narrow.....*Guerlinguetus* (p. 254)

Size large, total length 490–580, tail broad and bushy.

Skull broad and heavy, rostrum short.....*Hadrosciurus* (p. 265)

Skull long and narrow, rostrum slender.....*Urosciurus* (p. 267)

Size large, tail very long and narrow, skull short, rostrum very short and broad.....*Simosciurus* (p. 280)

¹ For explanation of the Plates (Pl. VII–XIV) see pp. 286–288.

² For maps showing the distribution of the genera see pp. 298–301. For a sketch-map showing localities in southwestern Colombia from which squirrels have been examined in the preparation of this review, see this Bulletin, Vol. XXXIII, 1914, pl. xiii.

Genus **Microsciurus** Allen.

Plate VII, Figs. 4-6; Plate XIII, Figs. 3, 4; Text Fig. 1 (p. 162).

Microsciurus ALLEN, Bull. Amer. Mus. Nat. Hist., VII, p. 332, Nov. 8, 1895 (subgenus of *Sciurus*).—NELSON, Proc. Washington Acad. Sci., I, p. 32, pl. i, fig. 6, pl. ii, fig. 2, May, 1899 (subgenus of *Sciurus*).—GOLDMAN, Smithson. Misc. Coll., LVI, No. 36, p. 4, Feb. 12, 1912 (genus).—MILLER, Bull. 79, U. S. Nat. Mus., p. 338, 1912 (genus).—ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, pp. 145-165 (genus; monographic review).

Type, *Sciurus* (*Microsciurus*) *alfari* Allen.

Smallest of the American tree squirrels, except *Sciurillus*. Total length about 240 to 260 mm.; tail short and narrow, tail vertebræ about 40% of the total length (*i. e.*, tip of nose to end of tail vertebræ). Mammæ, 6.

Premolars, $\frac{2}{1}$. Skull short, broad, and deep; greatest width near the front border of the zygomatic fossæ (at m^1), equal to about 60% of total length of skull; dorsal outline highly arched, the highest point at the post-orbital processes; nasals short and broad, their length about 28% of the total length of the skull, and about 76% of the interorbital breadth; breadth of braincase 50% of total skull length. Orbital fossa circular, when seen from above nearly closed posteriorly, the open space behind the postorbital process very small instead of forming one third or more of the whole space, as in other tree squirrels; zygomata converging posteriorly instead of anteriorly; malar broad, with a deep depression in the superior border just behind the middle, as in *Nannosciurus*. Upper molars nearly normal in form and position, parastyle, mesostyle, and metastyle strongly and about equally developed in p^4 , m^1 and m^2 , without the intermediate cusplets usually present; transverse ridges on crown strongly developed, but directed obliquely internoposteriorly instead of transversely or anteriorly; p^4 is nearly as large as m^3 and similar to it in outline; p^3 is a well developed column reaching the level of the other teeth, with often a bicuspid functional crown.

Geographic distribution.—The western Andean region of Colombia, south to the southern border of Peru, north to central Costa Rica. Represented by 17 described species and subspecies. (See Map, p. 298.)

Remarks.—The distinctive external features of the genus are small size, a short narrow tail, and usually prominent postauricular patches of long soft whitish or buffy hair. The shape of the skull is widely different from that of ordinary sciurids, the dorsal outline being much more convex, the braincase greatly expanded and deep, the greatest expansion of the zygomatic arches near the front border instead of at the middle or posterior to the middle. The well developed and functional p^3 is rarely absent.

In a few characters *Microsciurus* resembles *Nannosciurus*, but in other features the two genera are widely unlike, whatever may be the case with *Sciurillus*. The skull of the latter I have been unable to examine. (For comparative figures of the skulls and teeth of *Nannosciurus* and *Microsciurus*, see Plates VII and XIII.)

The known distribution of the genus *Microsciurus* is the Andean region of South America, excluding the Bogotá district, from the southern border of Peru northward to Panama, and thence through Panama to central Costa Rica, from sea-level to about 8000 feet. Little is yet known of the limits of distribution of the species and subspecies, a number of which are at present known only from their type localities.

Heretofore almost nothing has been recorded of the habits of these squirrels. The following notes by Mr. Leo E. Miller, who has collected a considerable number of these animals in western Colombia for the American Museum of Natural History, are therefore most welcome. He says:

"I have always found the *Microsciuri* much rarer than other squirrels, and usually in pairs. They seem to prefer the palm forests that are so abundant on the hillsides, where they feed on the various kinds of palm fruits and nuts. They invariably evince considerable curiosity, and can be approached to within a short distance before taking fright and hiding in the palm leaves. They move rapidly and gracefully, making long, daring leaps. In running over the leaves or branches they follow the lateral stems, and on reaching the end, leap to another and repeat the same performance; other squirrels frequently ascend through the tree top or thick foliage by leaping crosswise from twig to twig, as if leaping from one ladder rung to another. But my experience with them is not extensive enough to enable me to say that this is always the case."

Following is a revised list of the species and subspecies, as now recognized, with their type localities, and a statement of the number of specimens of each examined in the preparation of the present review.

Microsciurus alfari Allen. Volcano Turrialba, near Jiménez, Costa Rica. Specimens examined, 6, including the type.

Microsciurus alfari venustus Goldman. Gatun, Canal Zone, Panama. Specimens examined, 4, including the type and a topotype.

Microsciurus alfari browni Bangs. Bogaba, Chiriqui, Panama; altitude 600 feet. Specimens examined, 3 topotypes.

Microsciurus boquetensis Nelson. Boquete, Chiriqui, Panama; altitude 6000 feet. Specimens examined, 2, type and topotype.

Microsciurus similis similis Nelson. Cali, Western Andes, Colombia; altitude 6000 feet. Specimens examined, 12, including the type.

Microsciurus similis fuscus Thomas. Juntas, Rio San Juan, Chocó

district, Colombia; altitude 400 feet. Specimens examined, 5, including the type and two topotypes.

Microsciurus otinus Thomas. Medellin, Colombia. Specimens examined, 3, including the type and a topotype. [See Addenda, p. 307.]

Microsciurus isthmius isthmius Nelson. Rio Truandó, Isthmus of Darien, Colombia. Specimens examined, 10, including the type and a topotype.

Microsciurus isthmius vivatus Goldman. Near Cana, eastern Panama; altitude 3500 feet. Specimens examined, 3, the type and 2 topotypes.

Microsciurus mimulus Thomas. Cachavi, Esmeraldas, Ecuador; altitude 560 feet. Specimens examined, 14, including the type and 2 topotypes.

Microsciurus palmeri Thomas. Sipi, Chocó district, Colombia; altitude 150 feet. Specimens examined, 12, including the type and 7 paratypes (one of them a topotype).

Microsciurus simonsi Thomas. Porvenir, Bolivar Province, Ecuador; altitude 5000 feet. Specimens examined, 1, the type.

Microsciurus peruanus Allen. Guayabamba, Peru; altitude 4000 feet. Specimens examined, 1, the type.

Microsciurus napi Thomas. Mouth of Rio Coco, upper Rio Napo, Ecuador. Specimens examined, 1, the type.

Microsciurus brevirostris Allen. Chanchamayo, central Peru; altitude 5000–5300 feet. Specimens examined, 5, including the type.

Microsciurus florenciæ Allen. Florencia, Caquetá district, Colombia; altitude 1000 feet. Specimens examined, 4, including the type.

Microsciurus arunculus Thomas. Gualaquiza, Ecuador; altitude 2500 feet; specimens examined, none.

This list differs from the one given in my paper on *Microsciurus* published in February, 1914 (this Bulletin, XXXIII, pp. 145–165), through the omission of three species and the addition of one, the latter described since its publication. Of the three omitted one, *chrysuros*, is now referred to *Leptosciurus* (see below, p. 200), and two, *pusillus* and *kuhlîi*, to *Sciurillus*, since established by Thomas, who refers *kuhlîi* to *pusillus* as a synonym. These three forms were unrepresented in the material available to me for examination. The number of forms now recognized is 17, of which 13 are given the rank of species, with 4 additional subspecies.

The bibliographical references, the type localities, and the geographic ranges of the above forms here follow; but the descriptions (given in the former paper) are omitted.

Microsciurus alfari alfari Allen.

Sciurus (Microsciurus) alfari ALLEN, Bull. Amer. Mus. Nat. Hist., VII, p. 333, Nov. 8, 1895.

Sciurus alfari NELSON, Proc. Washington Acad. Sci., I, p. 105, pl. i, fig. 6, pl. ii, fig. 2, May 9, 1899. Type skull figured.

Microsciurus alfari MILLER, Bull. 79, U. S. Nat. Mus., p. 338, 1912.

Microsciurus alfari alfari ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 149, Feb. 26, 1914.

Type locality.— Volcan de Turrialba, near Jiménez, Costa Rica.

Geographic distribution.— Known only from central Costa Rica.

Microsciurus alfari venustulus Goldman.

Microsciurus alfari venustulus GOLDMAN, Smithson. Misc. Coll., LVI, No. 36, p. 4, Feb. 19, 1912.— MILLER, Bull. 79, U. S. Nat. Mus., p. 338, 1912.— ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 150, Feb. 26, 1914.

Type locality.— Gatun, Canal Zone, Panama.

Geographic distribution.— Known only from the Canal Zone, Panama.

Microsciurus alfari browni Bangs.

Sciurus (Microsciurus) browni BANGS, Bull. Mus. Comp. Zool., XXXIX, p. 24, April, 1902.

Microsciurus browni MILLER, Bull. 79, U. S. Nat. Mus., p. 338, 1912.

Microsciurus alfari browni ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 151, Feb. 26, 1914.

Type locality.— Bogabo, Chiriqui, Panama; altitude 600 feet.

Geographic distribution.— Known only from the type locality.

Microsciurus boquetensis Nelson.

Sciurus (Microsciurus) boquetensis NELSON, Proc. Biol. Soc. Washington, XVI, p. 121, Sept. 30, 1903.

Microsciurus boquetensis MILLER, Bull. 79, U. S. Nat. Mus., p. 338, 1912.— ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 151, Feb. 26, 1914.

? *Sciurus rufoniger* ALSTON, Proc. Zool. Soc. London, 1878, p. 669. Veragua, Panama. Not *S. rufoniger* Gray, 1842, nor of Allen, 1877.

Type locality.— Boquete, Chiriqui, Panama; altitude 6000 feet.

Geographic distribution.— Known only from the type locality.

Microsciurus similis similis Nelson.

Sciurus (Microsciurus) similis NELSON, Bull. Amer. Mus. Nat. Hist., XII, p. 78, April 14, 1899.—ALLEN, *ibid.*, XXXI, p. 92, April 19, 1912.

Microsciurus similis similis ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 153, Feb. 26, 1914.

Type locality.—Near Cali, Western Andes, Colombia; altitude 6000 feet.

Geographic distribution.—Colombia; Western and Central Andes at altitudes of 4000 to 7200 feet.

Microsciurus similis fuscus Thomas.

Sciurus (Microsciurus) similis fuscus THOMAS, Ann. and Mag. Nat. Hist. (8), VI, p. 503, Nov. 1910.

? *Microsciurus similis fuscus* LÖNNBERG, Arkiv. för. Zool., VIII, No. 16, p. 26, July 12, 1913. Near Guala, Ecuador.

Microsciurus similis fuscus ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 154, Feb. 26, 1914.

Type locality.—Juntas, Rio San Juan, Chocó district, Colombia; altitude 400 feet.

Geographic distribution.—Known only from the Chocó district, Colombia.

Microsciurus otinus Thomas.

Sciurus (Microsciurus) otinus THOMAS, Ann. and Mag. Nat. Hist. (7), VII, p. 193, Feb., 1901.

Microsciurus otinus ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 156, Feb. 26, 1914.

Type locality.—Medellin, Colombia.

Geographic distribution.—Recorded only from Medellin and Valdivia, at altitudes of about 3000 to 4000 feet.

Microsciurus isthmus isthmus Nelson.

Sciurus (Microsciurus) isthmus NELSON, Bull. Amer. Mus. Nat. Hist., XII, p. 77, April 14, 1899.

Microsciurus isthmus isthmus ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 157, Feb. 26, 1914.

Type locality.—Truandó River, Isthmus of Darien, Colombia.

Geographic distribution.—Coast region of Colombia from the Truandó River south to the Rio San Juan, Chocó district.

***Microsciurus isthmius vivatus* Goldman.**

Microsciurus isthmius vivatus GOLDMAN, *Smithson. Misc. Coll.*, LX, No. 2, p. 4, Sept. 20, 1912.—ALLEN, *Bull. Amer. Mus. Nat. Hist.*, XXXIII, p. 158, Feb. 26, 1914.

Type locality.—Near Cana, Pirri range, eastern Panama; altitude 3500 feet.

Geographic distribution.—Known only from the type locality.

***Microsciurus mimulus* Thomas.**

Sciurus (Microsciurus) mimulus THOMAS, *Ann. and Mag. Nat. Hist.* (7), II, p. 266, Sept. 1898.

Microsciurus mimulus ALLEN, *Bull. Amer. Mus. Nat. Hist.*, XXXIII, p. 158, Feb. 26, 1914.

Type locality.—Cachavi, Esmeraldas, Ecuador; altitude about 665 feet.

Geographic distribution.—Coast region of northwestern Ecuador and southwestern Colombia.

***Microsciurus palmeri* Thomas.**

Sciurus (Microsciurus) palmeri THOMAS, *Ann. and Mag. Nat. Hist.* (8), IV, p. 234, Sept. 1909.

Microsciurus palmeri ALLEN, *Bull. Amer. Mus. Nat. Hist.*, XXXIII, p. 160, Feb. 26, 1914.

Type locality.—Sipi, Rio Sipi, tributary of Rio San Juan, Chocó district, Colombia; altitude 150 feet.

Geographic distribution.—Coast region (Chocó district) of western Colombia.

***Microsciurus simonsi* Thomas.**

Sciurus (Microsciurus) simonsi THOMAS, *Ann. and Mag. Nat. Hist.* (7), VI, p. 294, Sept. 1900.

Microsciurus simonsi ALLEN, *Bull. Amer. Mus. Nat. Hist.*, XXXIII, p. 161, Feb. 26, 1914.

Type locality.—Porvenir, near Zaparal, Bolivar province, Ecuador; altitude, 1500 m. (5000 feet).

Geographic distribution.—Known only from the type locality.

Microsciurus peruanus Allen.

Sciurus (Microsciurus) peruanus ALLEN, Bull. Amer. Mus. Nat. Hist., IX, p. 115, April 26, 1897.

Microsciurus peruanus ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 161, Feb. 26, 1914.

Type locality.—Guayabamba, northwestern Peru; altitude 4000 feet.

Geographic distribution.—Known only from the type locality.

Microsciurus napi Thomas.

Sciurus (Microsciurus) napi THOMAS, Ann. and Mag. Nat. Hist. (7), VI, p. 295, Sept. 1900.

Microsciurus napi ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 163, Feb. 26, 1914.

Type locality.—Mouth of Rio Coco, upper Rio Napo, on the Ecuador-Colombia boundary.

Geographic distribution.—Known only from the type locality.

Microsciurus rubrirostris Allen.

Sciurus chrysurus THOMAS (not of Pucheran), Proc. Zool. Soc. London, 1893, p. 333, La Gloria, Chanchamayo, Peru.

Microsciurus rubrirostris ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 163, Feb. 26, 1914.

Type locality.—Chanchamayo, central Peru; altitude 2000 m. (about 6700 feet).

Geographic distribution.—Known only from the type locality.

Microsciurus florenciæ Allen.

Microsciurus florenciæ ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 164, Feb. 26, 1914.

Type locality.—Florencia, Caquetá district, southwestern Colombia; altitude about 1000 feet.

Geographic distribution.—Known only from the vicinity of the type locality.

***Microsciurus avunculus* Thomas.**

Microsciurus avunculus THOMAS, Ann. and Mag. Nat. Hist. (8), XIII, p. 574, June, 1914.

Type locality.—Gualaquiza, eastern Ecuador; altitude 2500 feet.

Geographic distribution.—Known only from the type locality.

Description.—"Closely similar to *M. napi*, but markedly larger throughout.

"Size a little larger than in any described species. General colour above finely grizzled olive-brown, the fore back slightly greyer, the hind back warmer. Chest greyish 'cinnamon-buff,' not such a bright ochraceous as in *M. rubrirostris*; belly and inner sides of hind limbs dull tawny, toned down by the slaty bases of the hairs. Crown finely ticked with ochraceous, a little warmer than nape, more like back, not so ochraceous as in *rubrirostris*. Ears with their inner surface grizzled ochraceous; outer surface grey anteriorly, with a large whitish patch posteriorly, the upper part of this patch buffy. Hands and feet grizzled ochraceous. Edges of tail pale buffy.

"Skull conspicuously larger than that of *napi*, about as in *M. rubrirostris*.

"Dimensions of the type:—Hind foot, s. u. 39, c. u. 42 mm.; ear 15.

"Skull: tip of nasals to front of interparietal 35.5; condylo-incisive length 34; zygomatic breadth 23.3; nasals 11×4.8 ; interorbital breadth 14.2; breadth of brain-case 19; palatal length 16; tooth-row (exclusive of p^3) 6.2.

"*Hab.* Oriente of Ecuador. Type from Gualaquiza; alt. 2500'.

"*Type*. Young adult male. B. M. No. 14.4.25.53. Original number 312. Collected 31st November, 1913, by Gilbert Hammond. Presented by Oldfield Thomas.

"This species is in colour quite like *M. napi*, which occurs in the same region, but is so much larger, as evidenced by its skull- and tooth-measurements, that it is clearly different. It is probably most nearly related to *M. rubricollis*, the species I have always regarded as *M. peruanus* Allen, but is distinguished from both by its much duller and less contrasted under surface"—Thomas, *l. c.*

Specimens examined, 0.

Remarks.—Not seen; description and comment from Thomas, given above in full.

Table I.—Measurements of Species and Subspecies of *Microsciurus*.

	External Measurements					Cranial Measurements					
	Numb. of specimens	Total length	Head and body	Tail	Hind foot	Numb. of specimens	Greatest length	Zygom. breadth	Interorb. breadth	Breadth of braincase	Length of nasals
<i>M. alfari alfari</i>	Type	250	145	105	36.5	Type	36	22	13	19	10
<i>M. alfari venustus</i>	"	250	148	102	40	"	37	23.2	14	17.6	10.5
<i>M. alfari browni</i>	"	260	140	120	38	"	36	21.2	12.4	—	11
<i>M. boquetensis</i>	"	257	141	116	37	"	—	—	14	—	—
<i>M. similis similis</i>	5	250	127	121	33	4	35.4	20.5	13.4	17.7	10
<i>M. similis fuscus</i>	Type	234	126	108	35	None	—	—	—	—	—
<i>M. simonsi</i>	"	250	138	112	38	Type	38.8	23.5	—	—	—
<i>M. otinus</i>	"	242	130	112	36	"	—	22.7	13.3	—	10
<i>M. isthmus isthmus</i>	"	—	150	—	37	"	—	22	14.3	18	10
" " "	3	243	137	110	36	4	35.3	21.9	13.3	17.8	10.2
<i>M. isthmus vivatus</i>	Type	260	147	113	38	Type	38.2	22.5	13.4	18	10.7
" " "	2 top.	239	129	110	36	—	—	—	—	—	—
<i>M. mimulus</i>	Type	239	130	109	36	Type	38	23	13.5	—	10.6
" "	7	246	136	109	36	4	39.5	22.7	14	18.9	10.9
<i>M. palmeri</i>	8	270	149	120	40	4	37.8	21.7	13.4	18.1	10.7
<i>M. peruanus</i>	Type	240	130	110	38	Type	35	21.3	13	18	9
<i>M. napi</i>	"	—	157	—	37	"	—	21	13	—	9
<i>M. rubrirostris</i>	"	278	145	133	38	"	37	22	13.3	18.5	10
" " "	1	310	160	150	40	1 top.	37	23	13.4	19	10
<i>M. florenciæ</i>	Type	270	150	120	40	Type	40	23.7	14	19	10
" "	3	273	143	130	40	3	38	22.8	13.8	18.8	10

Genus *Sciurillus* Thomas.

Sciurillus THOMAS, Abstr. Proc. Zool. Soc. London, No. 133, p. 36, May 12, 1914; Proc. Zool. Soc. London, 1914, p. 416, June, 1914. Cf. also THOMAS, Ann. and Mag. Nat. Hist. (8), XIII, p. 575, June, 1914 (incidental reference).

Type, *Sciurus pusillus* Desmarest; or, "should any doubt be thrown on the determination of *Sciurus pusillus*, the genus should be considered as founded on the species represented by the type of *S. kuhlii*" (Thomas, *l. c.*).

"Postorbital processes over posterior root of zygoma. Interorbital space as broad as the braincase. Zygomata very broad and strong. Anteorbital foramen small, far in front of the teeth, as in *Nannosciurus*, its opening continued upwards as a peculiar curved groove along the front edge of the anteorbital fossa.

"Cheek-teeth $\frac{5}{2}$, as in *Nannosciurus*. Molars low, as in other *Nannosciurinae*, their set normal, as in *Nannosciurus*, the last molar not facing outwards as in *Myosciurus*. Their upstanding cusps, both above and below,

very little developed. Their surface more smoothly basin-shaped, with less evident transverse ridges."

"As a genus, *Sciurillus* is very closely related to *Nannosciurus*, the reduction in the prominent transverse ridges of its molars, the peculiar structure of its anteorbital foramina, and its high but abruptly truncated ectopterygoids being its chief distinguishing characters. From *Myosciurus*, though both are undoubtedly of the same group, it is more widely separated" (Thomas, *l. c.*).

Sciurus pusillus, the Guiana pigmy squirrel, although well described and figured by Buffon in 1798, and first technically named from Buffon's specimen by Desmarest in 1817, has always been poorly represented in collections, and consequently very imperfectly known. Thomas first described its cranial characters in June, 1914, from the study of "a practically perfect skull," then recently received at the British Museum. "An examination of this skull," he says, "shows that instead of being in any way related to *Microsciurus* [to which genus it has of late years been referred] or other forms of American Sciurinae, the Guianan Squirrel is a member of the *Nannosciurinae*, in which it forms a special genus closely related to *Nannosciurus*." As the *Nannosciurinae* have heretofore been supposed to be "rigidly restricted to a small part of West Africa and to the Malay Archipelago," he adds: "The addition of Guiana to the known distribution of the group is therefore of extraordinary interest."

***Sciurillus pusillus pusillus* (Desmarest).**

Le petit guerlinguet BUFFON, Hist. nat., Suppl., VII, 1789, p. 263, pl. lxvi (Cayenne).

Sciurus *pusillus* DESMAREST (ex Geoffroy MS.), Nouv. Dict. d'Hist. nat. (nouv. éd.), X, 1817, p. 109 (based on Buffon, as above).

Macroxus pusillus GRAY, Ann. and Mag. Nat. Hist. (3), XX, p. 433, Dec. 1867 (Guiana).

Sciurus pusillus ALSTON, Proc. Zool. Soc. London, 1878, p. 670, pl. xli, part.—ALLEN, Bull. U. S. Geol. Survey (Hayden), IV, No. 4, pp. 887, 905, Dec. 11, 1878, part.

Microsciurus pusillus ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 154, Feb. 26, 1914 (general account).

Macroxus kuhlii GRAY, Ann. and Mag. Nat. Hist. (3), XX, p. 443, Dec. 1867, "Brazil" (= probably Guiana).

Sciurus *kuhlii* (Gray) NELSON, Proc. Washington Acad. Sci., I, p. 32, May 9, 1899 (in text). Referred to *Microsciurus*.

Microsciurus kuhlii ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 162, Feb. 26, 1914 (description from Gray, and comment).

Type locality.—Cayenne.

Geographic distribution.—Cayenne (Buffon); Guiana (Gray).

In my paper on *Microsciurus* (l. c.), *Macroxus kuhlii* Gray was given provisionally as a species of *Microsciurus*, on the assumption that the type of *kuhlii* was obtained by Castelnau, as stated by Gray, and that it hence was probably collected on the Ucayali River during his journey across Peru. It was further suggested that such being the case the name *kuhlii* might have to replace my name *peruanus* for a species of *Microsciurus* from near the supposed type locality of *kuhlii*. Since this paper was published Thomas has stated that the type of *kuhlii* "is beyond question the '*Sciurus pusillus*' of Guiana, whence the type must have come — probably accidentally mixed with Castelnau material by the dealer (Parzudaki) from whom it was bought. The fact that the hind foot of the type of *kuhlii* is only 26 mm. in length would alone distinguish it from any of the Andean *Microsciuri*." It is to be hoped that this decision by Thomas will give the troublesome name "*Macroxus kuhlii* Gray" a final resting place as a synonym of *Sciurillus pusillus*.

***Sciurillus pusillus glaucinus* Thomas.**

Sciurillus pusillus glaucinus THOMAS, Ann. and Mag. Nat. Hist. (8), XIII, p. 575, June, 1914.

Type locality.— Great Falls of Demerara River, British Guiana.

Geographic distribution.— Known only from the type locality.

Description.—"Like *S. pusillus* [*pusillus*], but much paler throughout.

"General colour above 'neutral grey' instead of greyish hair-brown. Under surface pale grey washed with light buffy, instead of dark grey washed with fulvous. Crown, muzzle, and inner side of ears pale grizzled buffy, many shades lighter than the almost ferruginous colour of *pusillus*. Back of ears and patches behind them prominently snowy white. Feet grizzled buffy. Tail-hairs tipped with whitish, a number of hairs in the terminal pencil black, a line along the centre below also black.

"Skull apparently rather smaller than in *pusillus*, but the type is not as old as the available examples of that animal.

"Dimensions of the type (measured on the skin): Head and body 104 mm.; tail, 113; hind foot, 27.7.

"Skull: Greatest length 27.5; condylo-incisive length 25; zygomatic breadth 20; nasals (on outer edge) 7×4.7 ; interorbital breadth 12.5; breadth of brain-case 15; palatilar length 10; upper tooth-series (exclusive of p^3) 3.8."— Thomas, l. c.

Specimens examined, 0.

Remarks.— Known to me only from Thomas's description, quoted above in full.

Genus **Leptosciurus** gen. nov.

Plate VII, Figs. 7-14; Plate XIII, Figs. 5-10; Text Figs. 2, 3 (p. 162).

Type, *Sciurus rufoniger* Pucheran = *Macroxus pucheranii* Fitzinger (to replace *rufoniger*, preoccupied).

Similar (in the typical phase) in external appearance to *Microsciurus*, but size larger and tail relatively longer and fuller (about 46% of total length instead of 40%). Mammæ, 6.

Premolars, $\frac{1}{1}$. Skull similar in general form and proportions to that of *Guerlinguetus æstuans*. Differs from *Guerlinguetus* in the structure of the upper molars, the outer border of the crowns having only two prominent cusps instead of three, and the intervening cusplets, usually prominent in *Guerlinguetus* and in most other American tree squirrels, are practically obsolete or entirely absent. The mammæ are also 6 instead of 8, and the tail is relatively shorter (about 46% of the total length instead of 50%).

Geographic distribution.—The Colombian Andes and parts of Peru and Bolivia. (See Map, p. 301.)

Remarks.—*Leptosciurus* is primarily based on the *Sciurus pucheranii* group, which in size, coloration, and texture of pelage greatly resembles the larger forms of *Microsciurus*. With it, on the basis of the tooth structure, number of mammæ, and relative length of the tail must be associated the *Sciurus ignitus* (= "*cuscinus*") group and Gray's *Macroxus leucogaster*, which latter differs from all the others in slightly larger size, different coloration, and coarser pelage.

List of Species and Subspecies, with their type localities, and statement of number of specimens examined.

Leptosciurus pucheranii pucheranii (Fitzinger). Bogotá, Colombia. Specimens examined, 8.

Leptosciurus pucheranii medellinensis (Gray). Medellín, Antioquia, Colombia. Specimens examined, 3.

Leptosciurus pucheranii caucensis (Nelson). Rio Lima, near San Antonio, Western Andes, Colombia. Specimens examined, 8.

Leptosciurus pucheranii salentensis (Allen). Salento, Central Andes, Colombia. Specimens examined, 14.

Leptosciurus ignius ignittus (Gray). Astillero, Bolivia. Specimens examined, 13.

Leptosciurus ignitus irroratus (Gray). Ocabamba, Peru. Specimens examined, 13.

Leptosciurus leucogaster Gray. Santa Cruz de la Sierra, Bolivia. Specimens examined, 7.

Key to the Species and Subspecies of Leptosciurus.

Smaller, average total length 300–350 mm.

Tail fringed with white.

Blackish dorsal line usually obsolete.

Underparts brownish gray, the pectoral region faintly washed with buff.

pucheranii (p. 200)

Underparts brownish, strongly washed with ochraceous buff.

caucensis (p. 203)

Blackish dorsal line usually prominent.

Underparts strongly washed with maize yellow. . . *salentensis* (p. 203)

Underparts washed with white. *medellinensis* (p. 201)

Tail fringed with yellow.

Underparts ochraceous buff. *ignitus* (p. 204)

Underparts antimony yellow. *irroratus* (p. 206)

Larger, average total length about 385 mm., underparts white. . *leucogaster* (p. 207)

***Leptosciurus pucheranii pucheranii* (Fitzinger).**

Text Fig. 2 (p. 162); Plate VII, Figs. 7, 8; Plate XIII, Figs. 5, 6.

Sciurus rufoniger PUCHERAN, Rev. zool., VIII, p. 336, Sept. 1845. Not *Sciurus rufoniger* of Gray 1842, nor of Allen 1877, nor of Alston 1878 (cf. this Bulletin, XXXIII, 1914, pp. 152, 153).

? *Sciurus chrysuros* PUCHERAN, Rev. zool., VIII, p. 337, Sept. 1845, "Santa-Fe de Bogata."

Funambulus pucheranii FITZINGER, Sitzb. d. math.-naturw. Cl., LV, Abth. 1, p. 487, 1867.

Macroxus tephrogaster GRAY, Ann. and Mag. Nat. Hist. (3), XX, p. 431, Dec. 1867, part (the Bogotá reference only).

Type locality.—Vicinity of Bogotá, Colombia.

Geographic distribution.—The Eastern Andes of Colombia, at altitudes of 6200 to 9000 feet.

Description.—Upperparts reddish brown, the hairs dusky at base tipped with ochraceous rufous; a blackish median band, varying from deep black to dusky, often nearly obsolete; nose and cheeks dull yellowish gray; underparts brownish gray faintly washed with pale yellow, brightest on the breast and paler on chin, throat, and abdomen; tail long and narrow, grizzled rufous and black, the hairs basally alternately ringed narrowly with rufous and black, with a broader subterminal bar of black and conspicuous white tips, forming a white edging; ears small but rather long and pointed, well haired, dark brown with a reddish tinge; upper surface of the feet nearly like the flanks.

Total length (5 specimens, collector's measurements), 312 (300–328) mm.; head and body, 165 (150–184); tail vertebrae, 145 (135–158); hind

foot (with claws), 43 (41–45). Skull (2 adult topotypes), total length, 41, 42; zygomatic breadth, 24, 25; interorbital breadth, 13.8 (each); breadth of braincase, 20 (each); length of nasals, 11 (each); diastema, 9, 10; maxillary toothrow, 6.6, 7. (See also Table II, p. 208.)

Specimens examined, 13.—**Colombia**: Vicinity of Bogotá, 8 (Br. Mus., 6; Am. Mus. 2); Fusugasugá, 3; La Candela and Andalucia, each 1 (Am. Mus.).

Remarks.—*L. pucheranii pucheranii* was described by Pucheran in 1842, under the preoccupied name *Sciurus rufoniger*, and renamed *pucheranii* by Fitzinger in 1867. Its relationships have since been misinterpreted by various authors, owing to the defective original description, which made no reference to the dentition and gave no measurements, and to the absence of specimens from Bogotá for a long period that agreed with it. The validity of the species seems to have been recognized some years since by Thomas, as specimens received at the British Museum from the Bogotá district in 1899 are labelled *S. pucheranii*.

The specimens from Fusugasugá (6000 to 8000 ft.), a short distance southwest of Bogotá, agree very closely in size and coloration with those from Bogotá, and differ mainly from those of the Salento region in the paler coloration of the ventral surface. One specimen each from La Candela and Andalucia, near the southern end of the Eastern Andes, seem also to belong here.

In my recent paper on *Microsciurus* (*l. c.*, pp. 153, 158) I referred *Sciurus rufoniger* Pucheran to *Microsciurus*, and suggested its possible reference to *M. mimulus* Thomas, mainly on the basis of Alston's apparent representation that it had two upper premolars.¹ I have since been informed by Mr. Thomas (*in litt.*, Feb. 9, 1914) that all the squirrels from Bogotá that have been referred to *Microsciurus* are really members of the *pucheranii* group. As soon as I took up the *pucheranii* group for critical study I recognized that two specimens recently received at the American Museum from Bogotá, and others from nearby localities in the Eastern Andes, conformed perfectly with Pucheran's description of his *Sciurus rufoniger*.

Sciurus chrysuros Pucheran is not at present satisfactorily identifiable. It was described at the same time as *S. rufoniger*, it following that species on the same page, and as coming from the same locality,—“Habite la Colombie (Santa-Fe de Bogota).” It is described as being intermediate between “le Guerlinguet et l'Ecurcuil nain” (*Sciurus æstuans* and *S. pusillus* auct.), without the median dark band on the back of his *S. rufoniger*, and the tail “roux doré” instead of fringed with white. If the tips of the

¹ In 1878 Alston sent me one of the types of his (not Pucheran's) *Sciurus rufoniger*, on the label of which was written, “Compared with Pucheran's type in Paris Museum. E. R. A. April, 1878.” (*Cf.* Allen, *Bull. U. S. Geolog. Survey*, IV, No. 4, p. 905, Dec. 11, 1878.)

hairs of the tail were worn, the tail of *rufoniger* would present this appearance. Alston appears to have compared the type of *chrysuros* with the type of *rufoniger* (both then in the Paris Museum) and says of them (Proc. Zool. Soc. London, 1878, p. 669): "The type of *S. rufoniger* has the middle of the back nearly black; while that of *M.* [= *S.*] *chrysurus* appears to be a variety, merely differing in the tail being more rufous." My present material supports Alston's opinion.

***Leptosciurus pucheranii medellinensis* (Gray).**

Macroxus medellinensis GRAY, Ann. and Mag. Nat. Hist. (4), X, p. 408, Nov. 1872.

Geographic distribution.—Known only from the vicinity of the type locality.

Description.—Similar above to *L. p. pucheranii*; ventral surface clear white superficially, the basal plumbeous portion of the pelage along the sides of the abdomen showing through. A Valdivia specimen has the ventral surface heavily washed with buff.

Total length (2 specimens, Valdivia, collector's measurements), 310, 310 mm.; head and body, 160, 170; tail vertebræ, 150, 140; hind foot (without claws), 39, 40; ear, 19, 18. No skull available at this writing.

Specimens examined, 3.—**Colombia**: Medellín, 1, topotype; Valdivia (near Medellín), 2 (all Br. Mus.). [See Addenda, p. 307.]

Remarks.—*L. pucheranii medellinensis* was originally described from 5 specimens from Medellín, two of which became the property of the British Museum, to which specimens from Valdivia have been since added. These I saw in April, 1913, but at this writing have only my notes to rely upon. Gray in describing the species compared it with his *Macroxus tephrogaster* (= *Sciurus deppei* Peters¹), from Guatemala and Mexico, stating that it was "not above half the size of the more southern [northern] specimens," and that he was inclined to regard them "as a variety or species, under the name of *Macroxus medellinensis*." He comments on the variability of the black dorsal band, which in one of the two specimens used in his description extended from the base of the neck to the tail, while the other had a very indistinct dorsal streak, with a squarish black spot on the middle of the back; in the former the white on the ventral surface was confined to "the middle of the throat, chest, and belly, the sides being grayish," while in the other the ventral surface was much whiter. A Valdivia specimen has the belly deep buff, showing that the usual wide range of individual variation in the color of the underparts obtains in this as in the other forms of the *pucheranii* group.

¹ Cf. Nelson, Proc. Washington Acad. Sci., I, p. 103, May 9, 1899.

Leptosciurus pucheranii caucensis (Nelson).

Sciurus (*Guerlinguetus*) *caucensis* NELSON, Bull. Amer. Mus. Nat. Hist., XII, p. 79, April 14, 1899.

Sciurus medellinensis THOMAS, Ann. and Mag. Nat. Hist. (7), VI, p. 366 (in text), Oct. 1900.

Type locality.—Rio Lima, near San Antonio, Western Andes, Colombia; altitude 6000 feet.

Geographic distribution.—Known only from the vicinity of the type locality.

Description.—Upperparts dark reddish brown, brightest on the outside of the shoulders and fore limbs, with an indistinct darkening along the middle of the back, quite different from the well-defined black median stripe of the northern forms, particularly *salentensis* and *pucheranii*; sides of the nose distinctly reddish instead of gray as in the other forms; underparts heavily washed with reddish buff, deepening on the breast to yellowish rufous; tail dark chestnut red grizzled with black and edged with white.

Total length (3 specimens, type and 2 topotypes, collector's measurements), 300 (288–313) mm.; head and body, 155 (140–160); tail vertebrae, 147 (144–148); hind foot (with claws), 43 (42–44). Skull (type and topotype), total length, 40.8 (40.6, 41); zygomatic breadth, 23.8 (23.5, 24); interorbital breadth, 13.9 (13.8, 14); breadth of braincase, 19.9 (19.8, 20); length of nasals, 11 (11, 11); diastema, 9.5 (9, 10); maxillary toothrow, 6.8 (6.8, 6.8).

Specimens examined, 8.—**Colombia**: Rio Lima, 4, type and topotype (Am. Mus.) and 2 topotypes (Br. Mus.); Parvas, Western Andes, 4 (Br. Mus.).

Remarks.—In *L. pucheranii caucensis* the upperparts are more strongly suffused with red than in any of the other forms of the group, especially the fore limbs and the sides of the nose, while the underparts are much deeper yellow, approaching orange yellow on the breast.

In 1900 this subspecies was referred by Thomas (*l. c.*) to Gray's *medellinensis*, but these two forms prove to represent the two most diverse phases of the group, especially in respect to the coloration of the ventral surface.

Leptosciurus pucheranii salentensis (Allen).

Guerlinguetus pucheranii salentensis ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 587, Sept. 8, 1914.

Type locality.—Near Salento, Central Andes, Colombia; altitude 9000 feet.

Geographic Distribution.—Central Andes, from the Salento district (near Quindio Pass), south to Miraflores, at altitudes of 6000 to 9000 feet.

Description.—Upperparts with a broad median dusky band, sparingly punctated with ochraceous, the rest of the upperparts with the hairs broadly tipped with bright ochraceous; underparts nearly uniform pale yellow; tail as usual in the group, blackish above washed with white, below grizzled ochraceous and black edged with white.

Total length (type, collector's measurements), 312 mm.; head and body, 163, tail vertebræ, 143; hind foot, 40. Six adult specimens, Salento and a little above Salento (7000–9000 feet): Total length, 300.5 (288–312); head and body, 158 (149–163); tail vertebræ, (135–150); hind foot, 41.7 (40–45).

Skull (type), total length, 42; zygomatic breadth, 24; postorbital breadth, 12.4; breadth of braincase, 20; length of nasals, 11; maxillary toothrow, 6.8.

Specimens examined, 14.—**Colombia**, western slope of Central Andes: Salento and vicinity, 7; El Roble, 2; Laguneta, 2; Miraflores, 2; Palmira, 1 (all Am. Mus.). [See Addenda, p. 307.]

Remarks.—In three specimens the dorsal band is black, broad, and sharply defined; in two it is obsolete; in all the others it is merely a darkening of the median line, the hairs being lightly tipped with ochraceous. The two specimens from Miraflores (alt. 6200 ft.) and the single specimen from Palmira very closely resemble those from La Guneta (alt. 10,300 ft.), El Roble, and part of the Salento specimens; one, however, from above Salento (alt. 9000 ft.) and one from Salento differ from the others in being nearly white below with only a faint yellowish wash.

***Leptosciurus ignitus ignitus* (Gray).**

Macrozus ignitus GRAY, Ann. and Mag. Nat. Hist. (3), XX, p. 429, Dec. 1867. "Bolivia (Brydges)."

Sciurus cuscinus THOMAS, Ann. and Mag. Nat. Hist. (7), IX, p. 129, Feb. 1902, part. (Charuplaya, Bolivia, alt. 1350 m.).

Sciurus cuscinus ochrescens THOMAS, Ann. and Mag. Nat. Hist. (8), XIII, p. 362, March, 1914 (Astillero, Bolivia, alt. 2700 mm.).

Type locality.—"Bolivia"—probably near Yungas, upper Rio Beni, which may be regarded as the type locality.

Geographic distribution.—Bolivian Andes, at altitudes of about 3500 to 9000 feet.

Description.—Pelage soft, of medium length and fulness. Mammæ 6. Upperparts olive, the hairs minutely tipped with yellow; underparts varying (in different specimens from the same locality) from light yellow to

deep yellow, a little lighter on throat and chin than on the belly; tail above, at the extreme base, like the back, rest of the upper surface blackish, the hairs with long reddish yellow tips often nearly concealing the darker basal portions; under surface of tail grizzled orange and black medially, with a broad subterminal band of black strongly edged outwardly with reddish yellow or orange; ears reddish yellow with bright orange postauricular patches; upper surface of feet finely grizzled orange and black, the toes in some specimens becoming clear orange yellow, in others not different from the proximal portion of the foot.

Ten adult specimens (7 females, 3 males), from Astillero, San Carlos, San Ernesto, Yungas, and Charumplaya, Bolivia (long. 65°–68°, lat. 15°–16°), collected and measured by P. O. Simons: Total length, 355 (342–370); head and body, 180 (160–198); tail vertebrae, 178 (160–180); hind foot (s. u.). 46.6 (45.48). (See also Table II, p. 208.)

Specimens examined, 13.—**Bolivia**: Astillero, 3 (type and 2 topotypes); Charumplaya, 2; San Carlos, 2; San Ernesto, 3; Yungas, 3 (all in Br. Mus., except 1 of the Yungas specimens, which is in Am. Mus.).

Remarks.—*Sciurus cuscinus ochrescens* has been described since my examination of the “*cuscinus*” material in the British Museum. At that time I was strongly impressed with the wide range of color variation shown in series of specimens from the same locality, and was rather surprised when I received the description of “*ochrescens*”, based on the Bolivian specimens. It being impracticable for me to reexamine the *cuscinus* group material, I provisionally accept *ochrescens* (= *ignitus*), moved partly to this decision by Thomas’s opinion and partly by the geographical probabilities of the case. The “*cuscinus*” group, as now known, occupies an oval area of considerable geographical extent in the Peru-Bolivia Andes, with its major axis running in a northwest-southeast direction, from west longitude 65° at the south to 72° at the north (approximately 500 miles), and between 12° and 16° south latitude (approximately 300 miles). The type localities of *cuscinus* and *ochrescens* are, respectively, as are those of *irroratus* and *ignitus*, at the extreme northwestern and extreme southeastern borders of this area, and therefore widely separated in a region of considerable physiographic diversity, yet the two forms are only slightly differentiated.

In this connection two questions of nomenclature require consideration. In 1867, Gray described two species that evidently belong to the “*cuscinus*” group, both from localities not definitely indicated, namely, *Macroxus irroratus*, from Peru, collected by E. Bartlett on the “Upper Ucayali”; and *Macroxus ignitus*, from “Bolivia (Brydges),” probably on the Upper Rio Beni. *M. ignitus* precedes by two pages the name *irroratus*, both names

having been published in the same paper, and the former will be first considered.

Some twenty years ago (hence before *cuscinus* was described), I identified a single specimen of squirrel from Yungas, Bolivia, as *ignitus* Gray, and a restudy of this specimen, in connection with considerable "*cuscinus*" material, leads me to believe that this determination was correct. The type locality of *ignitus* was within the present known range of *ochrescens*, and not the Sta. Cruz de la Sierra region, where the well-known collector Steinbach has found Gray's *Macroxus leucogaster* but no squirrels of the *cuscinus* group. This being the case, and there being nothing contra-indicative in the description, *Macroxus ignitus* is apparently the earliest name for any member of the *cuscinus* group.

Macroxus irroratus as clearly belongs also to the *cuscinus* group. This was recognized by Thomas when, in 1897, he described *cuscinus*, but owing to certain slight discrepancies between the description of *irroratus* and his type of *cuscinus*, he decided to hold the name *irroratus* in abeyance. In view of the now known wide range of individual variation in undoubted *cuscinus* specimens, the supposed importance of these discrepancies practically disappears.

Both *ignitus* and *irroratus* are very unlike any other squirrels, although both have been referred to "*æstuans*," as *æstuans* was formerly understood. They are nearest in size and tooth structure to Gray's *Macroxus leucogaster*, but the original descriptions forbid their reference to this species. No other small squirrel (except species of *Microsciurus*) is known to occur nearer than 500 miles of the range of the *ignitus-irroratus* ("*cuscinus*") group, namely the Ecuador forms of *hoffmanni* of the genus *Mesosciurus*. Its range is thus widely separated from that of any other with which it has any near alliance.

***Leptosciurus ignitus irroratus* (Gray).**

Text Fig. 3 (p. 162); Plate VII, Figs. 10-12; Plate XIII, Figs. 7, 8.

Sciurus æstuans TSCHUDI (not of Linné), Fauna Peruana, I, Therologie, 1844-46, p. 158, part.

Macroxus irroratus GRAY, Ann. and Mag. Nat. Hist. (3), XX, p. 431, Dec. 1867 (Upper Ucayali River, Peru).

Sciurus æstuans cuscinus THOMAS, Ann. and Mag. Nat. Hist. (7), III, p. 40, Jan. 1899 (Ocabamba, Peru); *ibid.*, VII, p. 187, Feb. 1901 (Rio Inambari).—ALLEN, Bull. Amer. Mus. Nat. Hist., XIII, p. 226, Nov. 16, 1900; *ibid.*, XIV, p. 46, Jan. 31, 1901 (Inca Mines, near Juliaca, Peru).

Type locality.—Upper Rio Ucayali, Peru.

Geographic distribution.—Andes of southeastern Peru.

Description.—Similar to *ignitus* in size and general coloration, but color of underparts rather paler.

Four adult specimens, all females, from Inca Mines (lat. 13° 30' S., long. 70°, alt. 6000 ft.) collected and measured by H. H. Keays: Total length 349.5 (343–356); head and body, 184 (178–197); tail vertebrae, 165 (159–178); hind foot (s. u.), 45.2 (44.5–47.6).

Four skulls from Inca Mines, Peru, occipito-nasal length, 45.5 (44.5–46); zygomatic breadth, 26.5 (26–27); interorbital breadth, 14.5 (13–15); breadth, of braincase, 20.9 (20.5–21); length of nasals, 12.6 (12–13.3); diastema, 11.2 (10.2–11.5); upper molar series, 6.9 (6.5–7).

Specimens examined, 13.—**Peru**: Ocabamba, 2, type and topotype of *cuscinus*; Rio Yimimpare, 2; Maracapata, 3; Pachita, 1; Inca Mines (Carabaya Range), 5 (all in Brit. Mus. except the Inca Mines specimens, which are in Am. Mus.).

Remarks.—As already noted, the type locality of *irroratus* was the upper Rio Ucayali. Its range occupies, as stated by Thomas (for his "*cuscinus*"), the region drained by the upper Ucayali and Madre de Dios Rivers. *Sciurus cuscinus* was originally described from two specimens from Ocabamba, Province of Cuzco, Peru, collected by Otto Garlepp in 1897, and from whom were later received (in 1903) at the British Museum six other specimens from nearby localities. In 1900 five specimens were received at the American Museum from Inca Mines, Carabaya Range, Peru, collected by H. H. Keays. All are from the Andean region of southeastern Peru, at 6000 to 8000 feet altitude.

***Leptosciurus leucogaster* (Gray).**

Plate VII, Figs. 13, 14; Plate XIII, Figs. 9, 10.

Macroxus leucogaster GRAY, Ann. and Mag. Nat. Hist. (3), XX, p. 430, Dec. 1867. Not *Sciurus leucogaster* F. Cuvier, 1831 = *S. aureogaster* F. Cuvier, 1829.

Type locality.—Santa Cruz de la Sierra, Bolivia; coll. Bridges.

Geographic distribution.—Provinces of Santa Cruz de la Sierra and del Sara, eastern Bolivia, and westward into La Paz Province.

Description.—Pelage short and thin. Mammæ 6. Upperparts olive, minutely punctated with yellow; eyerings and sides of nose pale buff; underparts white nearly or quite to the base of the hairs, varying in different individuals; tail broad, above like the back, edged with pale yellow; under surface of tail grizzled black and pale buff medially, the hairs with a broad subterminal band of black and pale yellow tips; ears long, pointed, yellowish brown externally, rusty yellow internally, with a buffy yellow postauricular

Table II.—Measurement of Species and Subspecies of *Leptosciurus*.

	External Measurements					Cranial Measurements							
	Number of specimens	Total length	Head and body	Tail vertebrae	Hind foot	Number of specimens	Total length	Zygomatic breadth	Interorbital breadth	Breadth of braincase	Length of nasals	Diastruma	Maxillary toothrow
<i>pucheranii</i> Near Bogotá O'Connell and Gonzales	Aver. Min. Max.	312 300 328	165 150 184	145 135 158	43° 41 45	2	41.5 41 42	24.5 24 25	13.8 13.8 13.8	20 20 20	11 11 11	9.5 9 10	6.8 6.6 7
<i>salentensis</i> Salento, Col. L. E. Miller	Aver. Min. Max.	300 288 310	153 148 163	143 135 150	42° 40 45	4	41.4 41 42	23.9 23.7 24	13.7 12.5 14.6	19.7 19.4 20	11.7 11.3 12	— — —	6.7 6.5 7
<i>caucensis</i> Upper Rio Cauca, Col. J. H. Batty	Aver. Min. Max.	300 288 315	155 140 160	147 144 148	43° 42 44	3	40.8 40.6 41	23.8 23.5 24	13.9 13.8 14	19.9 19.8 20	11 11 11	9.5 9 10	6.8 6.8 6.8
<i>medellinensis</i> Medellin, Col. British Museum	Aver. Min. Max.	310 310 310	165 160 170	145 150 140	39°.5 39 40	0							
<i>irroratus</i> Inca Mines, Peru H. H. Keays	Aver. Min. Max.	349 343 356	184 178 197	165 159 178	45°.2 44.5 47.6	4	44.5 44.5 46	26.5 26 27	14.5 13 15	20.9 20.5 21	12.6 12 13.3	11.2 10.2 11.5	6.9 6.5 7
<i>ignitus</i> Bolivian Andes P. O. Simons	Aver. Min. Max.	355 342 370	180 160 198	178 160 180	46°.6 45 48	1	48	26.7	15.3	22	14	11.5	7
<i>leucogaster</i> Santa Cruz de la Sierra, Bolivia T. Steinbach	Aver. Min. Max.	385 380 390	200 200 200	185 180 190	48°.5 48 49	1	48	28	15.3	21	14	12	8

patch in winter pelage, obsolete or absent in summer pelage; upper surface of feet colored like rest of upperparts.

Total length (2 adult males, collector's measurements), 390, 380 mm.; head and body, 200, 200; tail vertebræ, 190, 180; hind foot (in dry skin, with claws), 49, 48; ear, 23, 23.

Skull, adult female (Prov. del Sara, Bolivia), occipito-nasal length, 48; zygomatic breadth, 28; interorbital breadth, 15.3; postorbital breadth, 17; breadth of braincase, 21; length of nasals, 14; diastema, 12; maxillary toothrow, 8.

Specimens examined, 7.—**Bolivia**: Santa Cruz de la Sierra, 2 "cotypes" (Br. Mus.); Chulumani, La Paz, 1 (Br. Mus.); Central Bolivia, 1 (Br. Mus.); Santa Cruz de la Sierra, 1, topotype (Pittsb. Mus.); Province del Sara, 1 (Pittsb. Mus.); Rio Mapaiso, Rio Grande, 1 (Pittsb. Mus.). Five of the specimens were collected by T. Steinbach, the two cotypes by Bridges. On Steinbach's label on the specimen from Rio Mapaiso is written: "The only specimen seen south of Santa Cruz."

Remarks.—*Leptosciurus leucogaster* is similar to *L. ignitus* but paler above throughout, with the belly white instead of deep yellow, and much larger in all external measurements. Gray's specific name *leucogaster* (*Macroxus leucogaster*) is available in the present connection, as the species is not a *Sciurus* in a strict sense, and the name therefore not preoccupied by the earlier *Sciurus leucogaster* of F. Cuvier.

Genus **Notosciurus** Allen.

Plate IX, Figs. 1-3; Text Figs. 4 (p. 162), 20, 21.

Notosciurus ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 585, Oct. 8, 1914.

Type, *Notosciurus rhoadsi* Allen.

Size small, tail of medium length, the tail vertebræ 46% of total length; naked part of plantar surface of hind feet restricted to distal half, the rest heavily furred; posterior pad large and nearly square, occupying the whole breadth of the sole, close to the toe pads; number of mammæ not known, but probably 6.

Premolars $\frac{1}{1}$ (?).¹ Skull in general form much like that of *Guerlinguetus astuans*, but the preorbital portion is relatively much shorter, and the breadth at the anterior end of the zygomata much less, the zygomatic arches

¹ The single known skull is young, still retaining the milk premolar (p⁴), so that it is impossible to say whether or not the permanent dentition might include p⁴.

being strongly instead of moderately convergent anteriorly; ratio of breadth of skull at m^1 49% of the total length instead of 57% as in *æstuans*, or 53% as in *hoffmanni*; malar of nearly even width, and nearly straight instead of having a well developed superior process and a marked depression behind it; molars and other cranial features nearly as in *æstuans*. (As the type skull is somewhat immature, allowance is made for slight change in form through growth.)

Geographic distribution.—Known only from the type locality of the single known species.

Remarks.—The distinctive feature of the present genus is the striking character of the plantar surface of the hind feet, which renders it at once distinguishable from all other genera. The very short rostrum, the narrowness of the skull at the front border of the orbits and the form of the malar bone serve to distinguish it also from *Leptosciurus*, *Guerlinguetus*, and *Mesosciurus*.

Notosciurus rhoadsi Allen.

Sciurus irroratus STONE, Proc. Acad. Nat. Sci. Philadelphia, 1914, p. 14 (not of Gray).

Notosciurus rhoadsi ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 585, Oct. 8, 1914.

Type locality.—Pagma Forest, Chunchi, Ecuador; altitude 6300 feet.

Geographic distribution.—Known only from the type locality.

Description.—"Character of the pelage and coloration nearly as in *Guerlinguetus hoffmanni*, but ears relatively long and narrow, and the proximal half of the soles of the hind feet heavily furred.

"Upperparts uniformly finely grizzled pale yellow and dusky, the hairs individually blackish basally and narrowly ringed near the tip with pale yellow and black, mixed sparingly with hairs wholly black, resulting in a pale yellowish brown general effect; underparts ochraceous orange, paler on the chin, throat and sides of nose; limbs externally like the upperparts, and internally like the belly, the feet grizzled with pale orange; ears rufous, well haired on both surfaces; tail grizzled on both surfaces like the back, the tips of the hairs pale orange, the hairs individually narrowly ringed alternately with yellowish buff and black, the undersurface of the tail with a submarginal, rather narrow band of black and long ochraceous tips.

"Total length (collector's measurements), 330 mm.; tail vertebræ, 152; hind foot, 50; ear, 20.

"Skull, total length 47; zygomatic breadth, 27; interorbital breadth, 15; postorbital breadth, 13; breadth of braincase, 22.5; nasals, 14×7 ; diastema, 11; maxillary toothrow, 8. The skull still retains the milk premolars,

and therefore the specimen is not fully adult, although it has the appearance of being adult in all other respects."—Allen, *l. c.*

Specimens examined, 1.—Known only from the type, in the Museum of the Philadelphia Academy of Natural Sciences.

Remarks.—The general appearance of *Notosciurus rhoadsi* is that of a

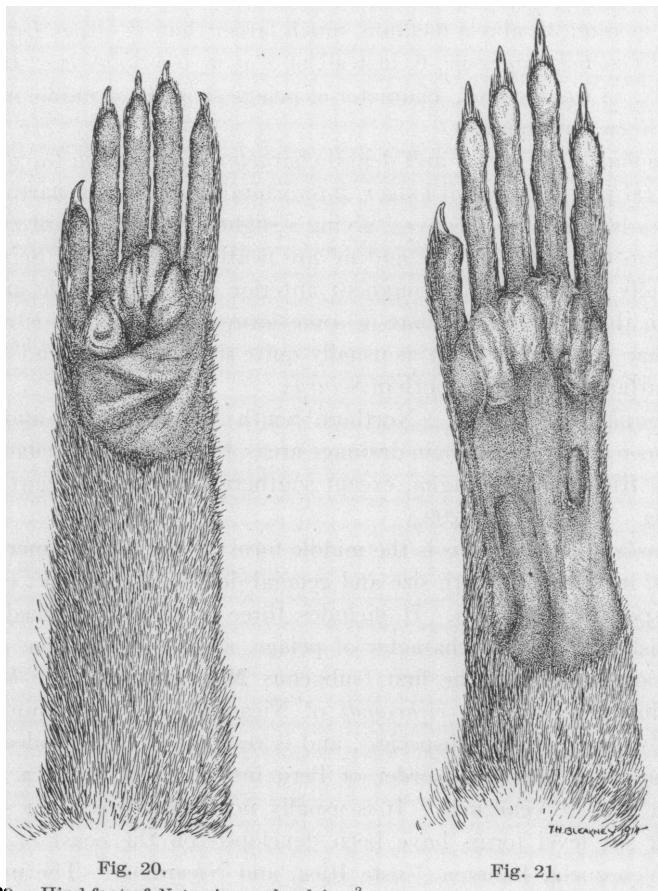


Fig. 20.

Fig. 21.

Fig. 20. Hind foot of *Notosciurus rhoadsi*. ♂.

Fig. 21. Hind foot of *Mesososciurus hoffmanni hoffmanni* (Peters), for comparison with Fig. 20. ♀.

pale *hoffmanni* in miniature, in bulk *N. rhoadsi* being less than half the size of *hoffmanni*. The generic characters render it distinguishable at sight, particularly the structure of the hind foot.

Genus **Mesosciurus** gen. nov.

Plate VIII, Figs. 1-10; Plate XIII, Figs. 11-18, Text Figs. 5, 6, 14
(pp. 162-165).

Type, *Sciurus æstuans* var. *hoffmanni* Peters.

Size medium to above medium, much larger than in either *Leptosciurus* or *Guerlinguetus*; mammæ, 6, instead of 8 as in *Guerlinguetus*; tail about 47 to 48% of total length; character of pelage strongly variable, in correlation with the environment.

Premolars, $\frac{1}{2}$. Cranial and dental characters nearly as in *Guerlinguetus*, but rostral portion of skull longer, interorbital area slightly narrower, and zygomata laterally more convex, giving a slightly higher ratio of zygomatic breadth to total length. M^1 and m^2 are nearly as in typical *Sciurus*; m^3 has usually two subequal prominent anterior cusps (parastyle and mesostyle) on the outer border, but in some forms the mesostyle is decidedly larger than the parastyle; p^4 is usually quite similar in form and details of crown surface to the same tooth in *Sciurus*.

Geographic distribution.—Northern South America, north and west of the Orinoco and Amazon main drainage areas, from southern Ecuador north to Costa Rica and Nicaragua, except southern Panama and northwestern Colombia. (See Map, p. 299.)

Remarks.—*Mesosciurus* is the middle form among South American tree squirrels, in respect to both size and general details of structure, especially with respect to dentition. It includes three quite well marked groups, distinguishable by size, character of pelage, style of coloration, and geographic distribution. The first (subgenus **Mesosciurus**), the *hoffmanni* group (including *Sciurus richmondi* of Nicaragua), is very numerous in forms (6 species and 6 subspecies), and is restricted to the Andean region from about the northern border of Peru into Central America, and the northern part of Venezuela. It is usually not represented near sea level, although sea level forms have been developed on the coast of Ecuador and in Venezuela, Panama, Costa Rica, and Nicaragua. The usual altitudinal range is the subtropical and temperate zones, where it reaches altitudes of 8,000 to 10,000 feet. In the Central and Eastern Andes typical *hoffmanni* develops various local forms, through which, to the eastward, it appears almost to intergrade with the *griseogena* group, from which *chapmani* of northeastern Venezuela and Trinidad is not strongly different, and from which the insular forms of the group have been differentiated. Typical *hoffmanni* presents a remarkable hiatus in distribution in northwestern Colombia and the southern part of Panama, where as yet no specimens have

been collected, although it seems impossible to separate subspecifically central Costa Rica specimens from those of the Western Andes in Colombia.

A second group (subgenus **Histriosciurus**¹) is the *gerrardi* group, consisting of a considerable number of exceedingly variable forms (1 species with 7 subspecies) the most diverse of which, in their extreme phases, are strikingly unlike in coloration, and vary *inter se* to some extent in size and cranial characters. In proportions of parts and in cranial characters they are quite similar to the *hoffmanni* section of the genus. The *gerrardi* forms are practically restricted to the tropical zone, and occupy the low lands of northern and western Colombia from the Venezuela boundary to the Canal Zone in Panama, and range thence southward along the coast of Colombia to northeastern Ecuador. So far as now known the ranges of the *gerrardi* and *hoffmanni* groups do not overlap.

The third group (subgenerically referable to *Histriosciurus*) consists of 2 species and 2 subspecies, the *saltuensis* group of the Santa Marta district of northeastern Colombia and *pyrrhinus* of Peru. The known forms of this group are similar in size to the forms of the *gerrardi* group, but do not closely resemble them in coloration, but in other respects are nearly related. The *saltuensis* group is white-bellied, while the *gerrardi* group is red-bellied. Although not formerly known to occur outside of the Santa Marta district, it has recently been found to reach the lower Cauca valley, while an allied form (*Sciurus pyrrhinus* Thomas) is known from Peru. This may be either white-bellied or red-bellied, at the same localities.

List of Species and Subspecies, with their type localities, and statement of number of specimens examined.

Mesosciurus hoffmanni hoffmanni (Peters). "Costa Rica"; here designated as San José, Costa Rica. Specimens examined, 87.

Mesosciurus hoffmanni chiriquensis (Bangs). Divala, Chiriqui, Panama. Specimens examined, 90.

Mesosciurus hoffmanni manavi (Allen). Manavi, Rio de Oro, Ecuador. Specimens examined, 12.

Mesosciurus hoffmanni quindianus (Allen). Rio Frio, Central Andes, Colombia. Specimens examined, 15.

Mesosciurus hoffmanni hyporrhodus (Gray). Santa Fé de Bogotá, Colombia. Specimens examined, 23.

Mesosciurus griseogena griseogena (Gray). "Venezuela" (apud Thomas). Specimens examined, 39.

¹ Type, *Sciurus gerrardi* Gray.

Mesosciurus griseogena meridensis (Thomas). Escorial, Sierra de Merida, Venezuela. Specimens examined, 57.

Mesosciurus chapmani (Allen). Island of Trinidad. Specimens examined, 35.

Mesosciurus chapmani tobagensis (Osgood). Island of Tobago. Specimens examined, 7.

Mesosciurus nesæus (G. M. Allen). Margarita Island, Venezuela. Specimens examined, 3.

Mesosciurus griseimembra (Allen). Buenavista, about 50 miles south-east of Bogotá, Colombia. Specimens examined, 5.

Mesosciurus candalensis (Allen). La Candela, near San Agustin, Huila, Colombia. Specimens examined, 11.

Mesosciurus gerrardi gerrardi (Gray). "New Grenada"; probably near Medellin. Specimens examined, 18.

Mesosciurus gerrardi milleri (Allen). Cocal, Western Andes, Colombia. Specimens examined, 14.

Mesosciurus gerrardi versicolor (Thomas). Cachavi, Esmeraldas, Ecuador. Specimens examined, 16.

Mesosciurus gerrardi morulus (Bangs). Loma del Leon, Panama. Specimens examined, 26.

Mesosciurus gerrardi choco (Goldman). Cana, eastern Panama. Specimens examined, 28.

Mesosciurus gerrardi salaquensis (Allen). Rio Salaqui, northwestern Colombia. Specimens examined, 7.

Mesosciurus gerrardi zulix (Osgood). Orope, Zulia, Venezuela. Specimens examined, 8.

Mesosciurus gerrardi cucuta (Allen). El Guayabal, near San José de Cucuta, Colombia. Specimens examined, 5.

Mesosciurus saltuensis saltuensis (Bangs). Pueblo Viejo, Santa Marta, Colombia; altitude, 8000 feet. Specimens examined, 27.

Mesosciurus saltuensis bondæ (Allen). Bonda, Santa Marta, Colombia; altitude 200 feet. Specimens examined, 60.

Mesosciurus saltuensis magdalene (Allen). Banco, Rio Magdalena, near mouth of Rio Cesar, Colombia. Specimens examined, 2.

Mesosciurus pyrrhinus (Thomas). Garita del Sol, Vitoc, Peru. Specimens examined, 9.

Key to the Species and Subspecies of Mesosciurus.

Size small; average total length 375-410 mm.; underparts red. Subgenus *Mesosciurus*.

Tail without a distinctly black tip.

Upperparts yellowish brown to rufescent brown; underparts dull yellow to orange red.

Size medium.

Pelage soft and thick.....*hoffmanni* (p. 216)

Pelage harsher and thinner.....*chiriquensis* (p. 220)

Similar but underparts redder and tail with more black at base below.
manavi (p. 221)

Size smaller.

Similar in coloration to *hoffmanni*.....*chapmani* (p. 330)

Like *chapmani* but smaller.....*tobagensis* (p. 232)

Size larger; tip of tail blackish.

With (usually) a dorsal black band.....*quindianus* (p. 222)

Without (usually) a dorsal black band.....*hyporrhodus* (p. 223)

Upperparts darker and more olivaceous; underparts whitish, fulvous gray, or deep red.

Inside of limbs dark gray.....*griseimembra* (p. 233)

Inside of limbs fulvous.....*candalensis* (p. 235)

Upperparts, including tail, light ochraceous; below bright orange rufous.
nesæus (p. 233)

Tail red, the tip black for the terminal 50 mm.

Pelage rather short and thin.....*griseogena* (p. 226)

Pelage long and full.....*meridensis* (p. 228)

Size medium; average total length 430-460 mm.; underparts red in *gerrardi* group, white in *saltuensis* group. Subgenus *Histriosciurus*.

Upperparts with a broad black median band from shoulders to base of tail.

Tail black at base, rest red, without black at tip of tail.

Fore limbs, shoulders, flanks, and hind limbs red..*gerrardi* (p. 236)

Fore limbs, shoulders, flanks, and hind limbs ochraceous.

salaquensis (p. 245)

Tail blackish at base, and with more or less black at tip.

Similar in general coloration to *gerrardi*.....*versicolor* (p. 242)

Upperparts dark chestnut, blackish mesially, and feet blackish; base of tail below and anal area black.....*milleri* (p. 241)

Tail with the tip wholly black.

Median dorsal band obsolete; shoulders, flanks, and feet not red.

morulus (p. 243)

Median dorsal band narrow; in general coloration similar to *morulus*.

choco (p. 244)

Tail with the apical fourth or third intense black; fore limbs and feet, flanks, thighs, and hind feet deep red or reddish...*zuliæ* (p. 246)

Similar to *zuliæ* but much paler throughout.....*cucutæ* (p. 247)

Upperparts red; underparts white.

Pelage long and soft.

Upperparts light yellowish red, usually strongly grizzled with black on the back.....*saltuensis* (p. 247)

Lighter colored and less strongly grizzled with black..*bondæ* (p. 249)

Pelage short and hispid.

Upperparts dark red.....*magdalenæ* (p. 251)

Upperparts dark red; tail banded with black; underparts white or red, or mixed white and red.....*pyrrhinus* (p. 252)

Subgenus **Mesosciurus**.**Mesosciurus hoffmanni hoffmanni** (Peters).

Text Fig. 5 (p. 162); Plate VIII, Figs. 1-3; Plate XIII, Figs. 11, 12.

Sciurus æstuans var. *hoffmanni* PETERS, Monatsb. Akad. Wissen. Berlin, 1863 (1864), p. 654 (Costa Rica).—THOMAS, Proc. Zool. Soc. London, 1880, p. 401 (in text), part.

Sciurus æstuans hoffmanni ALLEN, Bull. Amer. Mus. Nat. Hist., III, p. 206, April 17, 1891; *ibid.*, IX, p. 35, March 11, 1897 (Costa Rica).—NELSON, Proc. Washington Acad. Sci., I, p. 98, pl. i, fig. 7, May 9, 1899 (Costa Rica to valley of Upper Rio Cauca).

Sciurus hoffmanni ALLEN, Bull. U. S. Geol. Surv. Terr. (Hayden), IV, No. 4, p. 885, Dec. 11, 1878 (considered distinct from *S. æstuans*); Bull. Amer. Mus. Nat. Hist., XXXI, p. 90, April 19, 1912 (Cauca, Colombia).—LÖNNBERG, Ark. för Zool., VIII, No. 16, p. 25, July 12, 1913 (Nanegal and Gualea, Ecuador).

Sciurus (*Guerlinguetus*) *hoffmanni* ALLEN, Bull. Amer. Mus. Nat. Hist., XX, pp. 44, 66, Feb. 29, 1904, part, (Costa Rica; Chiriqui, Panama; Cauca Valley, Colombia). *Sciurus* (*Guerlinguetus*) *æstuans chiriquensis* Bangs referred to *hoffmanni* at p. 66.

Sciurus æstuans var. *rufoniger* ALLEN, Mon. N. Amer. Rodentia, p. 757, 1877, part (Costa Rica references only. Not of Gray 1842, nor of Pucheran 1845).

Sciurus æstuans ALSTON, Biol. Centr.-Amer., Mamm., p. 132, pl. xiii, June, 1880, part (*Sciurus griseogenys* on plate).—THOMAS, Proc. Zool. Soc. London, 1880, p. 400 (Intac and Balzar Mts., Ecuador).

Macrozous xanthotus GRAY, Ann. and Mag. Nat. Hist. (3), XX, p. 429, Dec. 1867 (Costa Rica. Type examined).

Sciurus griseogenys ALSTON, Proc. Zool. Soc. London, 1878, p. 667, part; Biol. Centr.-Amer., Mamm., pl. xiii, June, 1880.

Sciurus hoffmanni söderströmi STONE, Proc. Acad. Nat. Sci. Philadelphia, LXVI, p. 14, March 31, 1914 ("Mt. Pichincha"). Type examined.

Type locality.—"Costa Rica"; no definite locality indicated. The type region is here assumed to be the vicinity of San José, at altitudes above 3000 feet (see p. 218).

Geographic distribution.—Costa Rica and the Western Andes of Colombia, south through central Ecuador to Bolivia; not known to occur in southern Panama, nor in the lowlands of northwestern Colombia.

Description.—Pelage of medium length and softness. Postauricular patches present but usually not conspicuous.

Upperparts pale yellowish brown to rufescent brown, the hairs dark brown narrowly ringed at the tip with pale yellow varying (in different specimens) to rusty yellow; middle of the back often a little darker than the sides, sometimes a distinctly darker median band; outer surface of legs and feet nearly like the flanks; a narrow yellowish eyering; underparts

orange yellow, varying in different specimens from dull yellow to orange red; chin and throat fulvous gray, paler than the rest of the ventral surface; tail at base, both above and below, like the back; rest of the upper surface of tail with the hairs at base annulated with buffy gray and black, followed by a broad zone of black and broadly tipped with orange, varying in different specimens from pale orange to orange red; tail below with the middle area grizzled yellowish brown and black, the sides and tip broadly edged with the same shades of orange or red as the upper surface; tail tipped normally with orange with the subapical black zone showing through the surface color,—not normally tipped with black as in *griseogena*. Ears rather long and pointed, dusky or blackish on the apical third posteriorly, and fulvous or rusty buff at the base, the basal hairs soft and somewhat elongated, forming a more or less pronounced postauricular patch, varying in prominence with the condition of the pelage in respect to season and wear.

Total length (6 specimens, Volcán de Irazú, Costa Rica), 391 (375–420); head and body, 208 (202–217); tail vertebræ, 199 (167–215); hind foot, 54.5 (52–55).

Skull (6 specimens, Volcán de Irazú, Costa Rica), total length, 51.8 (50.3–53); zygomatic breadth, 30.7 (29.8–32); interorbital breadth, 16.3 (15–17); breadth of braincase, 23.7 (23–24); length of nasals, 15.5 (14.2–16.2); maxillary toothrow, 8.5 (8–9).

(For measurements of additional series of *hoffmanni* and its subspecies see Table III, p. 219).

Specimens examined, 87.—**Costa Rica**, 9: Volcán de Irazú (alt. 6000–10,000 ft.), 9.

Colombia, 67.—*Western Andes* (3000–8000 ft.): Rio Lima, 11 (Am. Mus. 6, Br. Mus. 5); Rio Pescado, 2 (Am. Mus. and Br. Mus.); Rio Zapata, 2 (Am. Mus. and Br. Mus.); Las Pavos, 3 (Am. Mus. 2, and Br. Mus. 1); Castilla Mts., 2 (Am. Mus. and Br. Mus.); Las Tambas, 3 (Am. Mus. 2, and Br. Mus. 1); San Antonio, 9 (Am. Mus.); Cerro Munchique, 8 (Am. Mus.); Las Lomitas, 2 (Am. Mus.); Gallera, 2 (Am. Mus.); La Florida, 2 (Am. Mus.).—*Central Andes*: Miraflores (6200 ft.), 9 (Am. Mus.); La Sierra (6800 ft.), 7 (Am. Mus.); El Eden (8300 ft.), 5 (Am. Mus.).

Ecuador, 20.—Gualea, 5 (Am. Mus.); Zaruma, 4 (Am. Mus.); Palatanga, 4 (Br. Mus.); Chimbo, 2 (Br. Mus.); Baños, 2 (Br. Mus.); Aquabamba and Intac, 1 each (Br. Mus.); "Mt. Pichincha," 1, type of *Sciurus söderströmi* Stone (Mus. Phila. Acad. Sci.); Santa Rosa, 3, Loja, 2 (Am. Mus.).

Remarks.—Typical examples of *hoffmanni* present a wide range of individual variation in not only coloration and measurements but in cranial characters, especially in the form of the nasals, as shown by large series

from each of a dozen or more different localities. The individual variation in coloration and size has already been sufficiently indicated.

The form of the nasals in most mammals is usually considered an important diagnostic feature, but the range of individual variation in most species of squirrels (and particularly in the *hoffmanni* group) is so great that the nasals afford no sure basis for the discrimination of local forms. In average specimens of *hoffmanni* the nasals are squarely truncate posteriorly and terminate practically on a line with the fronto-premaxillary sutures, but they often end a little in front of this line, and sometimes extend behind it. In other specimens they terminate far in front of it, with the posterior border slightly or deeply V-shaped, or even nearly square. In extreme cases the nasals terminate one fifth to one fourth of their length anterior to the fronto-premaxillary suture.

Formerly *hoffmanni*, as shown by the synonymy given above, was considered to be inseparable from *æstuans*, or merely a subspecies of it. While resembling *æstuans* in a general way in coloration, it is a much larger species, with a broader and relatively shorter tail, and is wholly separated from it geographically by the *griseogena* group.

The type locality of *Sciurus æstuans* var. *hoffmanni* was not definitely indicated in the original description, being given as "Costa Rica." Since two forms of the *hoffmanni* group occur in Costa Rica, *chiriquensis* of Bangs ranging from Chiriqui into the low coast districts of Costa Rica, it will be a convenience to restrict *hoffmanni* to the higher altitudes, or to the areas above 3000 feet, and to consider the type locality as San José, in the Volcán de Irazú district. This is warranted by the fact that Dr. Hoffmann, who collected the type, is known to have collected for a considerable period at San José during his explorations in Costa Rica.¹

As thus restricted, specimens of *hoffmanni* from Costa Rica are indistinguishable from representatives of the *hoffmanni* group from the upper Rio Cauca valley, as recognized by Nelson (*l. c.*) in 1891 and by me (*l. c.*) in 1912. Specimens since received show that true *hoffmanni* ranges not only through the southern Western Andes of Colombia but also into the southern part of the Central Colombian Andes, and thence southward in the Andean region through central Ecuador to the northern border of Peru. Series of specimens from widely separated localities in this large area are practically indistinguishable, although it may be possible later to add slightly differentiated local forms to those here recognized, from points in the general area not represented by the material at present available.

¹Cabanis, Uebersicht der im Berliner Museum befindlichen Vögel von Costa Rica. Journ. für Orn., 1860, 1861, 1862, *passim*.

Subspecies *hoffmanni*, as at present known, presents an unusual case of discontinuous distribution among the smaller mammals, since it has thus far not been found in any part of northwestern Colombia. The mammal fauna of the Panama region is now fairly well known, and considerable collections of squirrels are available from the adjoining parts of Colombia and the coast of western Colombia, which regions, however, have not thus far furnished a single specimen related in any way to *hoffmanni*. Aside from several forms of *Microsciurus*, this non-*hoffmanni* region is occupied exclusively by the *Sciurus gerrardi* group of much larger and widely different squirrels; and from no point thus far have specimens of both the *gerrardi* and *hoffmanni* groups been received. In Colombia *hoffmanni* is absent from most of the western slope of the Western Andes, where it ranges from about 3000 to 8000 feet; but it has a closely related geographic representative in the low coast region of Ecuador, just as it has at low levels in Chiriqui and Costa Rica. The *hoffmanni* group ranges eastward from the Central Andes into the northern Eastern Andes to the Bogotá district, where it breaks up into several closely related local forms, some of which may be found later to merge into the *griseogena* group of the Sierra Merida and Codillera de la Silla of Venezuela; but such intergradation seems not as yet fully evident.

The wide hiatus in the present known range of the *hoffmanni* group at Panama and adjoining Colombian districts presents an interesting and difficult problem. Possibly its larger and probably aggressive neighbors of the *gerrardi* group have driven it out of their present range to the higher levels they do not affect. On the other hand it may more probably be due to long past geologic disturbances in the Isthmian area.

Mesosciurus richmondi (Nelson¹), of northeastern Nicaragua and Honduras, is an outlying and the most northern member of the *Mesosciurus* group, allied to but quite distinct from *hoffmanni*, and separated from it by a considerable geographical area where neither species occurs, *hoffmanni* not extending, so far as known, north of Costa Rica.

Sciurus hoffmanni söderströmi Stone (*l. c.*) was based on a skin (without skull or measurements) from "Mt. Pichincha," collected by L. Söderström, and is thus described: "While a member of the *S. hoffmanni* group, this specimen is much more rusty-red, especially across the shoulders and on the fore legs, than any specimens I have seen from Costa Rica or any in a

¹ *Sciurus richmondi* NELSON, Proc. Biol. Soc. Washington, XII, p. 146, June 3, 1898 (Escondido River, Nicaragua); Proc. Washington Acad. Sci., I, p. 100, May 9, 1899.—ALLEN, Bull. Amer. Mus. Nat. Hist., XXIV, p. 660, Oct. 13, 1908 (Nicaragua).

Sciurus (Guerlinguetus) richmondi ALLEN, Bull. Amer. Mus. Nat. Hist., XXVIII, p. 104, April 30, 1910 (Nicaragua).

considerable series with which Mr. Osgood has compared it in the Field Museum. In other respects it does not seem to differ." Through Dr. Stone's kindness I have been able to compare this specimen with others from near the type locality, and also with large series from both western Colombia and Costa Rica. It differs from all the others in being rather more heavily suffused with rufous than average specimens from elsewhere, but a number of others so closely approach it in this respect that it seems more likely to be merely an individual variant than the representative of a local form, in view of the known occurrence of typical *hoffmanni* at Gualea and other localities in the Ecuadorian Andes. In fact it does not differ more from one of the Gualea specimens than the four Gualea specimens do among themselves. Of 2 specimens from Loja, one is in the rufous phase and the other like Gualea specimens; and of 3 from Santa Rosa 1 is in the rufous phase and the others are like average specimens from the Ecuador Andes.

***Microsciurus hoffmanni chiriquensis* (Bangs).**

Sciurus (*Guerlinguetus*) *æstuans chiriquensis* BANGS, Bull. Mus. Comp. Zool., XXXIX, No. 2, p. 22, April, 1902.—ALLEN, Bull. Amer. Mus. Nat. Hist., XX, p. 66, Feb. 29, 1904 (referred to *hoffmanni*).

Type locality.—Divala, Chiriqui, Panama; altitude, near sea level.

Geographic distribution.—The low coast regions of Costa Rica and western Panama, south to Chiriqui and adjacent islands.

Description.—Similar to *hoffmanni* of the interior highlands of Costa Rica (Volcán de Irizú region), but slightly smaller, with harsher, shorter, and thinner pelage. There are no very appreciable color differences, except a general tendency to a more rufous tone of the upperparts and redder underparts.

The wide range of individual color variation in both forms is so extensive that specimens of the two forms from widely separated localities are often indistinguishable in coloration, although in general there is an appreciable average difference in coloration as well as in the character of the pelage. (For measurements see Table III, p. 219.)

Specimens examined, 90.—**Panama**, 80: Divala, Chiriqui, 14 (type and 13 topotypes, Mus. Comp. Zool.); Bouquete, Chiriqui, 19 (Am. Mus. 4, Br. Mus. 6, Mus. Comp. Zool. 9); Bogava, 12 (Br. Mus. 4, Mus. Comp. Zool. 8); Boqueron, 23 (Am. Mus.); Veragua, 2 (Br. Mus.); Tacoume, 1 (Br. Mus.); Cebaco Island, 5 (Br. Mus.); Sevilla and Insoleta Islands, each 1 (Br. Mus.); "Isthmus of Panama," 2 (Br. Mus.).

Costa Rica, 10: Boruca, 4; Rio Sicsicola, 2, Cuábre, 1, Tuis, 1, Pozo Azul, 1, Sta. Clara, 1 (all Am. Mus.).

Remarks.—As indicated above, *chiriquensis* may be regarded as a rather slightly differentiated form of *hoffmanni*, as the latter is here restricted, confined to the humid tropical lowlands of Costa Rica and Chiriqui, characterized mainly by thinner and more hispid pelage and the slightly more rufous tone of the coloration. The characters given by Bangs, based on Divala (Chiriqui) specimens, are the reverse of the actual conditions, the words “more” and “less” in the expressions “more olivaceous” and “less brick-red” having been apparently accidentally transposed. The name, however, may be retained for the lowland form, in contradistinction from the form of the higher elevations of the interior, to which it seems convenient to restrict the name *hoffmanni*, so far as the Central American representative of the *hoffmanni* group are concerned.

***Mesosciurus hoffmanni manavi* (Allen).**

Guerlinguetus hoffmanni manavi ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 589, Oct. 8, 1914.

Type locality.—Manavi, Rio de Oro, Ecuador.

Geographic distribution.—Coast region of western Ecuador.

Description.—“Similar to *G. hoffmanni* in size and general coloration, but with the proximal half or two thirds of the tail below nearly black, the hairs basally black narrowly ringed with fulvous giving a slightly grizzled effect, followed by a broad zone of black and a slight tipping of reddish orange; apical half or third of the tail below black slightly grizzled with fulvous or orange, the hairs broadly tipped with orange red; whole upper surface of the tail grizzled black and orange red, the surface color of the apical third almost wholly orange red.

“Total length (type), 410 mm.; head and body, 230; tail vertebrae, 180; hind foot (c. u. in dry skin), 52. Skull, total length, 52; zygomatic breadth, 31; interorbital breadth, 16; breadth of braincase, 24; length of nasals, 15; diastema, 13; maxillary tooththrow, 8.8.” — Allen, *l. c.*

Specimens examined, 12.—**Ecuador**: Manavi, 5; Esmeraldas, 3, Narinjo, 4 (Am. Mus.).

Remarks.—Differs from true *hoffmanni* of the elevated interior of Ecuador and the Western Andes in Colombia in the underparts being redder and the tail much blacker, especially on the under surface.

Mesosciurus hoffmanni quindianus (Allen).

Guerlinguetus hoffmanni quindianus ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 587, Oct. 8, 1914.

Type locality.—Rio Frio, western slope of Central (or Quindio) Andes; altitude 3500 feet.

Geographic distribution.—Central Andes of Colombia, in the region of Salento and Laguneta, from about 3500 feet to about 10,000 feet.

Description.—"Upperparts with the mid-dorsal region black, extending (in different specimens) from the nape or shoulders to the base of the tail; rest of the upperparts finely grizzled yellowish and black varying (in different specimens) to ochraceous and black; outer surface of limbs and feet like the flanks; underparts ochraceous orange varying (in different specimens) to orange red; inside of limbs like the ventral surface; tail above black at the extreme base (for about 30 to 50 mm.), then orange (pale orange to orange red in different specimens) and tipped with black (usually for the terminal 40 to 50 mm.); under surface of tail grizzled fulvous and black, with black base and tip, and broadly edged with orange; the hairs individually black at base, then broadly banded with orange, followed by a broad band of black, and a very broad terminal band of orange; ears medium, clothed with very short hairs similar in color to the adjoining pelage.

"Total length (collector's measurements), 397 mm.; head and body, 215; tail vertebræ, 182; hind foot, 55. Six topotypes, total length, 400 (375–440); head and body, 221 (202–230, 1 at 242); tail vertebræ, 179 (146–198); hind foot, 56 (53–58). Eleven specimens from Salento (altitude 9000 feet), total length, 395 (390–418); head and body, 218 (205–226); tail vertebræ, 176 (162–203); hind foot, 56 (54–58).

"Skull (type), total length, 56; zygomatic breadth, 31.5; interorbital breadth, 16; breadth of braincase, 24; length of nasals, 16.4; maxillary toothrow, 8.6. Four topotypes, total length, 54.4 (53–55); zygomatic breadth, 31.3 (30–32); interorbital breadth, 16.1 (15.5–17); breadth of braincase, 23.4 (22.8–23.8); length of nasals 16 (15.5–16.5); maxillary toothrow, 8.2 (8–8.5). Salento and Laguneta skulls have practically the same measurements, the skulls from these four localities exceeding in size those of true *hoffmanni* from any of the numerous localities in Central and South America from which series of specimens have been received." — Allen. *l. c.*

Specimens examined, 15.—**Colombia**: Rio Frio, 6 (type and 5 topotypes); Salencio (Nóvita trail), 1; Salento, 2; Laguneta, 5; Passad e Torres, 1 (all Am. Mus.). [See Addenda, p. 308.]

Remarks.—The Laguneta series, from near Quindio Pass, is aberrant,

approaching typical *hoffmanni*, the mid-dorsal region being only slightly darker than the flanks in two, while the other two agree with the type. Specimens from El Eden, on the eastern slope of the Central Andes, are indistinguishable from specimens of *hoffmanni* from Las Lomitas, San Antonio, and other points in the Western Andes, and also from those from Miraflores in the Central Andes. Specimens from near Bogotá (eastern slope of the Eastern Andes) are referable to *M. hoffmanni hyporrhodus* (Gray). They show, however, a tendency to a darkening of the mid-dorsal region, several specimens from Fusugasugá and Panamá being in this respect similar to typical examples of *quindianus*. Both forms agree in the deep orange red of the belly and the upper surface and edges of the tail. The relationships of these two forms, as regards coloration, may be expressed as follows: *quindianus* is normally a black-backed form, with occasional specimens in which the dorsal band is poorly developed; *hyporrhodus* is normally without a dark dorsal band, with occasional specimens in which it is more or less shown. It is pretty evident that both intergrade with *hoffmanni* to the southward in both the Eastern and Central Andes and probably in the Western Andes.

***Mesosciurus hoffmanni hyporrhodus* (Gray).**

Sciurus hyporrhodus GRAY, Ann. and Mag. Nat. Hist. (3), XX, p. 419, Dec. 1867 (Santa Fé de Bogotá).

Type locality.— Santa Fé de Bogotá, Colombia. Type, No. 41.919, British Museum. Parzudaki.

Geographical distribution.— Bogotá district, Eastern Andes, Colombia.

Description.— Upperparts dull yellowish to reddish olive (in different specimens), the latter phase prevailing, the middle of the back sometimes a little darker than the sides; underparts orange yellow to deep orange red (in different specimens), the latter phase prevailing; tail at base, both above and below, like the back; middle two thirds of the tail heavily washed with orange rufous (varying in tone in different specimens), the hairs basally ringed with buffy yellow and black, the black greatly prevailing, with long orange yellow or orange red tips; under surface of tail more or less similar to the upper; tip of the tail with a broad subapical area of black, the extreme tip of the hairs some shade of orange; ears nearly concolor with the top of the head, with or without a conspicuous postauricular buffy patch of soft hairs; upper surface of the feet nearly like the sides, the hairs being minutely tipped with fulvous or rufous.

Total length (4 specimens, Fusugasugá), 393 (378–408); head and body, 220 (195–245); tail vertebræ, 194 (172–211); hind foot (c. u.) 59 (56–62).

Skull (4 specimens, same as above), total length, 52.9 (51.6–54.3); zygomatic breadth, 31.2 (31–32); interorbital breadth, 16.9 (16–18); breadth of braincase, 23.7 (23.3–25); length of nasals, 16.6 (15–18); diastema, 13.3 (13–14); maxillary toothrow, 8.8 (8.4–9). Three specimens from Panamá Largo (near Bogotá) give similar cranial and external measurements and agree in coloration with the *Fusugasugá* series.

Specimens examined, 23.—**Colombia**: Bogotá, 2, type and 1 specimen from Macanal, “near Bogotá” (Br. Mus.); *Fusugasugá* (alt. 6000 ft.), 7 (Am. Mus.); Panamá Largo, 3 (Am. Mus.); Monte Redundo, 1 (Am. Mus.); Quitame, 4 (Am. Mus.); Anolaima, 6 (Am. Mus.).¹

Remarks.—*Mesosciurus hoffmanni hyporrhodus* is similar to typical *hoffmanni* in general coloration, but with a larger skull. The type has the axillæ marked with white (not mentioned in the description), as sometimes happens in true *hoffmanni*. My notes on the type state: “Less dark and more fulvous above than average *hoffmanni*; similar to deep rufous-bellied *hoffmanni* below, and tail similar to average *hoffmanni*.” Gray’s description emphasizes “the softness and length of hair and hairy ears,” but these are largely seasonal features.

The specimens of this form recorded above are all from localities near Bogotá, at altitudes of 6000 to 8000 feet. The Quitame specimens are winter (February) specimens, in very full coat, the pelage being thick and soft and the ears more hairy than in summer specimens, with the tufts of soft fulvous fur at the base of the ears well developed. These specimens indicate that Gray’s type was a winter specimen.

Specimens of the *hoffmanni* group taken at different localities in the Colombian Andes show that the fluffy fulvous tufts at the posterior base of the ears are largely a seasonal feature, being conspicuously present in specimens taken in February, March and April, and practically absent or obsolete in August, September, October and November specimens. Similar tufts are well known to be a seasonal feature in many species of arboreal squirrels.

G. hoffmanni hyporrhodus is slightly larger than either true *hoffmanni* or *griseogena*, but it makes a distinct approach to the latter in coloration, especially through the increased amount of black at the tip of the tail, as compared with *hoffmanni*. Some of the specimens from the vicinity of Bogotá are, in fact, not easy to distinguish from *griseigena* without recourse to the labels. For the present, however, it seems better to recognize the two groups as specifically distinct.

¹ Probably most, if not all, of the following 11 specimens from near Bogotá, formerly examined in the British Museum but not now available for reexamination, are referable to *hyporrhodus*: Plains near Bogotá, 2; El Cofre, 2; La Palma, 2; Munzo Mines, 4; Quebrada de Murone, 1. All were collected by G. O. Childs, probably at or near his estate near Bogotá.

Table III.—Measurements of Species and Subspecies of Subgenus *Mesosciurus*.

Species, localities, and by whom collected and measured	External Measurements					Cranial Measurements							
	Number of specimens	Total length	Head and body	Tail vertebrae	Hind foot	Number of specimens	Total length	Zygomatic breadth	Interorbital breadth	Breadth of braincase	Length of nasals	Maxillary tooth-row	
<i>hoffmanni</i> Volcan de Irazú, Costa Rica M. A. Carriker, Jr.	Aver. Min. Max.	6	391 375 420	208 202 217	199 167 215	54.5° 52 55	6	51.8 50.3 53	30.7 29.8 32	16.3 15 17	23.7 23 24	15.5 14.2 16.2	8.5 8 9
<i>chiriquensis</i> Various localities in Costa Rica Carriker and Cherrie	Aver. Min. Max.	6	409 400 420	216 207 222	193 188 200	54° 53 55	8	51.9 50.4 53	30.6 29.7 31.7	16.5 15.5 17.5	23.7 23 24	15.3 14 16	8.6 8.2 9
<i>chiriquensis</i> (Type and paratypes) Divala, Chirique W. W. Brown, Jr.	Aver. Min. Max.	18	424 390 440	236 210 255	184 170 220	54° 50 56	18	52.1 50 54	30.4 28 32	16.3 15 17	22.6 21.5 24	15.5 15 17	8.6 8 9
<i>chiriquensis</i> Boquete, Chirique J. H. Batty	Aver. Min. Max.	10	382 365 415	208 195 220	172 160 190	51° 49 52	10	50.9 49.8 52	29.7 29 31	16 15 16.8	23.5 23 24	14.8 14 15.6	8.4 8 8.8
<i>manavi</i> Manavi, Ecuador W. B. Richardson	Aver. Min. Max.	3	392 370 410	224 210 230	173 160 180		5	50.9 49.8 52	30.7 30 31.2	17 16 18	24 24 24	15.2 15 15.5	8.5 8 9
<i>quindianus</i> Rio Frio, Col. L. E. Miller	Aver. Min. Max.	6	400 375 440	221 202 230	179 146 198	56° 58 58	4	54.5 53 55	31.3 30 32	16.1 15.5 17	23.4 22.8 23.8	16 15.5 16.5	8.2 8 8.5
<i>quindianus</i> Salento, Col. L. E. Miller	Aver. Min. Max.	11	395 390 418	218 205 226	176 162 203	56° 54 58	4	54 53 55.5	31.4 30 33	16 15 17	23.5 22 25	16.4 15.5 17	8.6 8.2 9
<i>hyporhodus</i> Fusugusaga, Col. G. M. O'Connell	Aver. Min. Max.	6	393 378 408	220 195 245	191 172 210	57.6° 56 62	5	52.9 51.6 54.3	31.2 31 32	16.9 16 18	23.7 23.3 25	16.6 15 18	8.8 8.4 9

Mesosciurus griseogena griseogena (Gray).

Macroxus griseogena GRAY, Ann. and Mag. Nat. Hist. (3), XX, p. 429, Dec. 1867 (here a composite species).

[Sciurus] griseogena THOMAS, Ann. and Mag. Nat. Hist. (7), VII, p. 193 (in text), Feb. 1901 (type locality fixed as "Venezuela").

Sciurus griseogena ROBINSON and LYON, Proc. U. S. Nat. Mus., XXIV, No. 1246, pp. 144-146, Oct. 3, 1901 (San Julián, Venez.; description and notes on habits).—OSGOOD, Field Mus. Nat. Hist., Zool. Ser., X, No. 4, p. 26, Oct. 20, 1910 (mountains near Maracay, Aragua, Venezuela).—ALLEN, Bull. Amer. Mus. Nat. Hist., XXX, p. 255, Dec. 2, 1911 (Las Quiguas, San Esteban, Guarico, and Paramo de Rosas, northwestern Venezuela).

Sciurus griseogenys ALSTON, Proc. Zool. Soc. London, 1878, p. 667, part (the Venezuelan references only).

Sciurus æstuans var. *rufoniger* ALLEN, Mon. N. Amer. Rodentia, p. 757, 1877, part (the reference to the Venezuela record of Gray's *Macroxus griseogena* only. Not *S. rufoniger* of Pucheran 1845, nor of Gray 1842).

Sciurus hoffmanni ALLEN, Bull. U. S. Geol. Surv. (Hayden), IV, No. 4, p. 885, Dec. 11, 1878, part (the references to Gray's *Macroxus griseogena* only).

Sciurus æstuans var. *hoffmanni* THOMAS, Proc. Zool. Soc. London, 1880, p. 401 (in text), part (*S. griseogenys*, = *Macroxus griseogena* Gray, considered to be "a very well marked variety" of *S. æstuans* but name *griseogenys* stated to be antedated by *hoffmanni* Peters).

Sciurus æstuans ALSTON, Biol. Cent.-Amer., Mammals, p. 132, June, 1880, part (the Venezuelan references only).

Sciurus griseogena klagesi THOMAS, Ann. and Mag. Nat. Hist. (8), XIV, p. 240, Sept. 1914 (Galifaré, near Caracas, Venezuela).

Type locality.—"Venezuela," by designation of Thomas, 1901 (*l. c.*).

Geographic distribution.—Northwestern Venezuela.

Description.—Pelage short and close. Postauricular patches usually absent. General tone of upperparts yellowish olivaceous varying (in specimens from the same locality, sex, and season) to reddish olivaceous, the hairs plumbeous narrowly annulated at the tip with pale yellow and black varying (in different specimens) to ochraceous and black; flanks and outer surface of shoulders and fore limbs (especially the latter) brighter colored than back; ventral surface (in different specimens) pale orange yellow to deep reddish orange; chin, nose, and cheeks grayish buff; basal fourth to third of tail, both above and below, like the back; middle half of tail above (more or less in different specimens) deep red, varying from orange red to dark chestnut red, with little or no black visible; tip of tail deep black without red; median line of tail below grizzled rufous and black, the edges red; feet usually with a yellowish or ochraceous wash, due to the tipping of the hairs with these tints, but sometimes nearly plain dark olivaceous.

Total length (10 specimens, 6 males, 4 females, from San Julián, collected

and measured by Captain Wirt Robinson, U. S. A.), 395.6 (383–412 mm.); head and body, 205 (195–216); tail vertebræ, 193.5 (182–199); hind foot (c. u.), 51.4 (50–53).

Skulls of the same specimens, total length, 50.4 (50–51.7); zygomatic breadth, 29 (28–30); interorbital breadth, 15.9 (15–16.2); breadth of braincase, 22.4 (22–23); length of nasals, 15.6 (15–16.5); diastema, 12.1 (12–12.5); maxillary toothrow, 8.5 (8.2–8.8).

Specimens examined, 39.—**Venezuela**: 1, type, by designation of Thomas, Dyson coll., without definite locality (Br. Mus.); San Julián, 1, San Esteban, 2 (Br. Mus.); San Julián, 20 (Robinson coll., Nat. Mus.); San Julián, 2 (Robinson coll., Mus. Comp. Zoöl.); without definite locality, 1 (Nat. Mus.); San Julián, 1, Macuto, 1, mountains near Maracay, 2 (Field Mus.); San Julián, 2, Guiguas, 3, and San Esteban, 3 (Am. Mus.).

Remarks.—As shown by the above-cited references, *Mesosciurus griseogena griseogena* has had a checkered nomenclatorial history. When first described by Gray it was assigned a range extending from Mexico through Central America to Venezuela and Bogotá, and was formerly considered referable by Allen, Alston, and Thomas (1877–1880) to *Guerlinguetus æstuans*, either as a synonym or as a variety, all the small tropical American squirrels, whether red-bellied or white-bellied, then being considered as merely forms of *æstuans*. In 1901 Thomas, when describing his *Sciurus griseogena meridensis*, designated “Venezuela” as the type locality, and indicated on the label one of Dyson’s specimens as the type, Dyson’s specimens (cited by Gray) best agreeing with Gray’s description. The exact locality of Dyson’s specimen has not, to my knowledge, been indicated, but some of the birds he collected in Venezuela have been recorded by Sclater¹ as having been collected at Coriana, near Cariaco, Cariaco, Galipan (altitude 8000 ft.), and Cumaná, and hence in the Cumaná Mountains, to the eastward of the Cordillera de la Silla.

In 1900 Captain (now Colonel) Wirt Robinson, U. S. A., collected 27 specimens of this squirrel at San Julián, on the northern coast of Venezuela, a few miles east of La Guaira, near sea level. All the specimens were taken between July 13 and August 10, and 17 of the 27 specimens have been examined by me in the present connection. In order authoritatively to determine the species a specimen was sent by Robinson and Lyon to Mr. Oldfield Thomas of the British Museum for comparison with Gray’s type of his *Macroxus griseogena*. Thomas reported: “The squirrel is very typical of *S. griseogena* Gray, the specimen, No. 102721, being more exactly like the type than any others of the large numbers we have here” (Robinson and

¹Proc. Zool. Soc. London, 1855, pp. 88, 237, 251, 259, and elsewhere.

Lyon, *l. c.*, p. 144). This specimen is still in the British Museum and was again compared by me with the type of *griseogena* and with other material from localities in northern Venezuela (8 specimens) and from the Merida district (12 specimens, including the type of *Sciurus griseogena meridensis* Thomas). My notes record that the coloration of the type of *griseogena* was found to be "exactly similar" to that of the specimens from San Esteban, La Guaira, and San Julián, with which it was compared.

Both *M. griseogena* and *M. g. meridensis* are subject to a wide range of individual variation in coloration, especially in the color of the ventral surface, which varies in specimens from the same locality from pale orange yellow to deep orange red. Also the intensity and amount of the fulvous suffusion of the upperparts varies widely, and is of course correlated with the color of the underparts.

The type of *Sciurus griseogena klagesi* Thomas was collected near where the large Robinson and Lyon series was taken.

In the light of present material the *griseogena* group proves to be not sharply distinguishable on the one hand from *chapmani*, nor on the other from some of the forms of the wide-ranging *hoffmanni* group. The difference in size between any of these closely related forms is very slight, while in coloration the chief difference is the greater extent of the black on the tip of the tail in the *griseogena* group as compared with *chapmani* and true *hoffmanni*. *M. h. hyporrhodus* of the Bogotá district is a large, intermediate, highly colored form, with nearly as much black at the tip of the tail as in *griseogena*, and leads into *M. h. quindianus*, which intergrades with true *hoffmanni* of western Colombia.

Robinson and Lyon's excellent description (*l. c.*) of *griseogena* was the first satisfactory account of the species, Gray's original description being very inadequate.

Guerlinguetus griseogena meridensis (Thomas).

Sciurus griseogena meridensis THOMAS, Ann. and Mag. Nat. Hist. (7), VII, p. 192, Feb. 1901.—ALLEN, Bull. Amer. Mus. Nat. Hist., XXX, p. 225 (in text), Dec. 2, 1911 (Paramo de Rosas, alt. 10,800 feet).

Sciurus griseogena tamæ OSGOOD, Field Mus. Nat. Hist., Zoöl. Ser., X, No. 5, p. 48, Jan. 10, 1912 (Paramo de Tama, Colombia-Venezuela boundary, alt. 6000-7000 feet).

Type locality.—Escorial, Sierra de Merida, Venezuela; altitude 2500 m.

Geographic distribution.—Venezuelan Andes and their extensions northward.

Description.—Similar to *G. griseogena griseogena* in size and general col-

oration, but with the pelage much longer and softer; fluffy, fulvous, post-auricular patches strongly developed; underparts deeper orange red, with a tendency to pure white axillar and inguinal patches, with sometimes a white median line; upper parts decidedly paler, the general tone an olivaceous gray, the annulations at the tips of the hairs clay color instead of yellow to ochraceous.

Total length (6 specimens, 3 males, 3 females, Sierra de Merida, topotypes, measured by the collector), 395 (380–410); head and body, 213 (190–220); tail vertebræ, 182 (170–190); hind foot (s. u.) 50.

Four specimens from Paramo de Tama (*S. g. tamæ* Osgood): "Total length, 396 (385–416); head and body, 216 (209–223); tail vertebræ, 180 (176–193); hind foot (c. u.) 54 (53–55)." — Osgood, *l. c.*

Skull (6 specimens, Sierra de Merida, same specimens as above), total length, 50.7 (48.5–52); zygomatic breadth, 29.4 (29–30); interorbital breadth, 15.9 (15–16.2); breadth of braincase, 23.3 (23–24); length of nasals, 16.2 (15.6–17); diastema, 12.4 (12–13); maxillary tooththrow, 8.8 (8.3–9.2).

The *S. g. tamæ* series (3 skulls), total length, 52 (51–52.5); zygomatic breadth, 30.3 (30–30.5); interorbital breadth, 16 (15.8–16.2); breadth of braincase, 23.3 (23–24); diastema, 12.1 (11.5–13); maxillary tooththrow, 8.3 (8–8.6).

Specimens examined, 57.—**Venezuela**: Escorial, Sierra de Merida, 4, type and 3 others (Br. Mus.); same locality, 10 (Nat. Mus.); same locality, 38 (Am. Mus.); Paramo de Rosas, near Guarico, 1 (Am. Mus.). **Colombia**: 4 (type and 3 topotypes of *S. g. tamæ*) Paramo de Tama, Colombia-Venezuela boundary (Field Mus.).

Remarks.—*Guerlinguetus griseogena meridensis* is the interior mountain form of *G. g. griseogena* of the northern coast mountains of Venezuela, from which it differs in the greater length and softness of the pelage, and the better development of the fluffy postauricular patches. The paler color of the upperparts and the deeper, redder tone of the ventral surface are additional features of differentiation, as are also the frequent development of patches of pure white on the ventral surface. These patches are very irregular as to size and shape; they are mainly inguinal and axillary in position, but appear also on the median line as small, more or less linear spots, which occasionally develop so as to form a continuous broad median line of white. In 33 specimens of typical *griseogena* only one is marked with white below, and this merely shows a tendency to whiteness at the axillæ. In a series of 12 well-made topotype skins of *meridensis*, from the Escorial de Merida, only 2 are prominently marked with white on the ventral surface. In a series of 26 flat skins (hunter's pelts) from Merida, bought by the American Museum of the Brinceño brothers with other natural history material, 15 have more

or less white on the ventral surface and 11 have none. Two of the three topotypes of *meridensis* in the British Museum also have small axillar and pectoral patches of pure white. In the topotype series of *S. g. tamæ* three of the four specimens have more or less white on the underparts, the amount and position of the white varying more or less with each. It is apparently an incipient tendency to white underparts, and occurs in many species of both American and Old World red-bellied squirrels, and in some species of South American *Oryzomys* and other Muridæ, and has little or no diagnostic importance, being evidently albinistic in character.

The *meridensis* form of *griseogena* seems to be restricted to the higher portions of the mountains, from the Cordillera de Merida northward, from probably about 3000 to 8000 feet. The *Sciurus griseogena tamæ* Osgood from the Paramo de Tama (6000–7000 ft.), does not seem separable from *meridensis* of Sierra de Merida. Other specimens have been examined from the intermediate Paramo de Rosas (from about altitude 7000 feet), near Guarico, and it probably occurs interruptedly at all altitudes above 3000 feet where conditions are favorable.

Mesosciurus chapmani (Allen).

Sciurus cestuans (err. typ.), THOMAS, Journ. Trinidad Field Nat. Club, I, No. 7, p. 9, April, 1893. Trinidad.

Sciurus æstuans hoffmanni ALLEN and CHAPMAN, Bull. Amer. Mus. Nat. Hist., V, pp. 209, 233, Sept. 21, 1893; *ibid.*, IX, p. 17, Feb. 26, 1897. Caparo, Trinidad. Not *hoffmanni* of Peters, 1864.

Sciurus chapmani ALLEN, Bull. Amer. Mus. Nat. Hist., XII, p. 16, March 4, 1899.

Sciurus (*Guerlinguetus*) *æstuans quebradensis* ALLEN, Bull. Amer. Mus. Nat. Hist., XII, p. 217, Dec. 20, 1899. Quebrada Secca, Venezuela.

Type locality.—Caparo, Trinidad.

Geographic distribution.—Island of Trinidad, Paria Peninsula, and the northern coast of eastern Venezuela, probably west to near Barcelona.

Description.—Pelage short and soft. Tail rather shorter than head and body. Upperparts nearly uniform dull yellowish olivaceous, the hairs plumbeous at base, annulated subapically with pale fulvous; hind limbs and feet like the dorsal surface; fore limbs a little more yellow than the flanks; a narrow yellowish eyering; postauricular patches apparently absent; ears concolor with the head; underparts orange, varying from pale orange to reddish orange, restricted in the females to the middle of the abdomen, the mammæ being surrounded by pale areas, more or less connected into pale lateral bands; chin and throat paler, the chin grayish buff,

the throat brighter, passing into the bright orange-colored pectoral region; tail grizzled pale buffy gray and black, both above and below, the tips of the hairs reddish orange giving a strong superficial wash of red, including the tip.

Total length (6 adults from Trinidad, collector's measurements), 376 (367-390); head and body, 203 (197-208); tail vertebrae, 174 (162-192); hind foot (c. u.), 47 (45-48). A series of 9 skins from Cristobal Colon, Venezuela, collected and measured by Leo E. Miller: total length, 383 (360-405); head and body, 191 (173-200); tail vertebrae, 195 (180-215); hind foot (c. u.), 47.6. A series of 6 specimens (in Br. Mus.) from Ipuré, Cumaná, collected and measured by E. André: total length, 377 (371-381); head and body, 200 (192-206); tail vertebrae, 177 (173-180); hind foot (s. u.), 46 (44-48).

Skull (4 adults, Trinidad), total length, 49 (48-50); zygomatic breadth, 29 (28-30); interorbital breadth, 16 (15.5-16.5); breadth of braincase, 21.9 (21.5-22); length of nasals, 15 (14.5-15.5); diastema, 12 (12-12); maxillary toothrow, 8 (8-8). Seven adult skulls from Cristobal Colon, Venezuela, total length, 49.2 (48-51); zygomatic breadth, 29 (28-30); interorbital breadth, 16.3 (15.5-17.5); breadth of braincase, 22.3 (21.5-23); length of nasals, 14.6 (14-15); diastema 12 (11.7-12.5); maxillary toothrow, 8.2 (8-8.5).

Specimens examined, 35.— **Island of Trinidad**, 9: Princetown, 7; Caparo, 1 (type); Carenage, 1 (all Am. Mus.).— **Venezuela**, 22: 1 (Br. Mus.); Cristobal Colon, 15 (Am. Mus.); Quebrada Secca, 3, type and topotypes of *Sciurus quebradensis* (Am. Mus.); Guanta, 1 (Nat. Mus.); Ipuré, Cumaná, 6 (Br. Mus.).

Remarks.— *Microsciurus chapmani* bears a general resemblance to *Guerlinguetus æstuans*, but is larger, with a relatively much shorter tail; upperparts yellowish olivaceous instead of reddish brown; ventral surface paler and chin buffy instead of grayish. It has no close resemblance to *M. griseogena*, its near neighbor in western Venezuela.

My *Sciurus quebradensis*, from the northern coast of Venezuela, does not, in the light of present material, seem to require nomenclatural recognition. The large series from the Paria Peninsula does not differ materially from Trinidad specimens, averaging perhaps slightly paler. The type and topotypes of *quebradensis*, from near Cumaná, are so nearly like the Paria Peninsula specimens as not to require separation. A single specimen from Guanta (No. 63213, Nat. Mus.), an immature female, is aberrant in the intense orange-rufous of the whole ventral surface and in the stronger suffusion of the fore limbs with rufous.

Mesosciurus chapmani tobagensis (Osgood).

Sciurus tobagensis Osgood, Field Mus. Nat. Hist., Zoöl., X, No. 4, p. 27, Oct. 20, 1910.

Type locality.— Island of Tobago, B. W. I.

Geographic distribution.— Island of Tobago, B. W. I.

Description.— Slightly smaller than *M. chapmani* but practically indistinguishable in color; there is a tendency to a little more black on the tip of the tail, but this proves an inconstant feature, 3 out of 9 Trinidad specimens having the tail tip as black as the Tobago specimens, while the majority of the Paria Peninsula specimens have the tail tip as black as any of the 5 specimens (type and topotypes) from Tobago; some have more black and others no distinct darkening of the tail tip.

“Total length, 330; head and body, 165; tail vertebræ, 165; hind foot (c. u.), 45”; measurements of the type, an immature female, as given by the author from the dry skin. Four topotypes are without flesh measurements. The hind foot (c. u.), in the skin of the type and 4 topotypes, measures 44 (42–45), or about 2 mm. less than in *chapmani*.

The total length of the skull cannot be given, the type and topotype skulls all lacking the occipital region. The available measurements of 4 adult skulls are as follows: zygomatic breadth (2 skulls only), 28 (27.5–28.5); interorbital breadth (4 skulls), 15.3 (15–15.5), breadth of braincase, 21.7 (21–22); length of nasals, 14.1 (14–14.3); diastema, 11.3 (11.2–11.5); maxillary tooththrow (2 skulls), 8, 8.

Specimens examined, 7.— **Island of Tobago, B. W. I.**: 2, type and paratype (Field Mus.); 3, Nat. Mus.; 2, Br. Mus.

Remarks.— The original description states: “The heavy black tip of the tail is the principal character distinguishing this form [*tobagensis*] from *S. chapmani*” (Osgood, *l. c.*). The type is a young female in full, fresh pelage, and is rather more richly colored than any of the four topotypes in the National Museum, now before me, especially in respect to the ventral surface.

The main basis for the recognition of this form is its insular habitat and slightly smaller size as compared with the Trinidad and mainland representatives of the species, rather than the darkening of the tip of the tail, which is an inconstant character, especially prevalent in the Paria Peninsula series.

Mesosciurus nesæus (*G. M. Allen*).

Sciurus æstuans hoffmanni ROBINSON, Proc. U. S. Nat. Mus., XVIII, p. 651 (in text), Aug. 12, 1896. Margarita Island, Venezuela. Incidental reference.

Sciurus nesæus G. M. ALLEN, Proc. Biol. Soc. Washington, XV, p. 93, April 25, 1902.—OSGOOD, Field Mus. Nat. Hist., Zoöl., X, No. 4, p. 26, Oct. 20, 1910. Margarita Island.

Type locality.—El Valle, Margarita Island, Venezuela.

Geographic distribution.—Known only from Margarita Island, Venezuela.

Description.—Pelage long and soft. Upperparts light ochraceous, sparingly sprinkled with black; underparts bright orange-rufous; tail externally, both above and below, ochraceous, the hairs with a narrow median and a broad subapical annulation of black.

Total length (2 specimens, collector's measurements), ♂ 380, ♀ 405; head and body, 218, 217; tail vertebræ, 162, 188; hind foot, 45, 50; ear, 18, 18. Skull (same specimens), total length, ♂ 50, ♀ 51; zygomatic breadth, 28.3, 29; interorbital breadth, 17, 16.2; breadth of braincase, 22.5, 22; length of nasals, 15, 15; diastema, 12, 12; maxillary toothrow, 9, 8.8.

Specimens examined, 3.—**Venezuela**: Margarita Island, 3 (Field Mus., 2, Br. Mus., 1).

Remarks.—*Mesosciurus nesæus* is a surprisingly distinct form; in coloration it is unique among South American Sciuridæ, having no close resemblance to any of them. In size and proportions it is intermediate between its two mainland neighbors, *M. griseogena* and *M. chapmani*, and may have been derived from either, perhaps more probably from the former. It has evidently been long isolated from any mainland stock.

Mesosciurus griseimembra (*Allen*).

Guerlinguetus griseimembra ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 589, Oct. 8, 1914.

Type locality.—Buenavista, eastern slope of Eastern Andes, about 50 miles southeast of Bogotá, Colombia; altitude 4500 feet.

Geographic distribution.—Eastern slope of the Eastern Andes, from near Bogotá south to Andalucia.

Description.—"Upperparts finely grizzled ochraceous orange and black, not appreciably darker on the median dorsal area; underparts washed with pale ochraceous buff, strongest over the pectoral region, paler on the lower

abdomen, lateral edges grayish, forming sometimes an ill-defined gray lateral line; chin and throat dull buffy gray; fore limbs entirely dark gray, the tips of the hairs lighter (whitish or buffy in different specimens); hind limbs externally like the body, internally gray like the fore limbs; ears colored like the adjoining surface, with a small patch of soft fulvous hairs at the posterior base; tail above washed with pale ochraceous, the general effect grizzled ochraceous and black, with a broad subterminal band of black, but base concolor with the back; under surface of the tail similar to the upper, broadly edged with ochraceous.

"Total length [type] (collector's measurements), 402; head and body, 219; tail vertebræ, 183; hind foot, 55. Type and 3 topotypes, total length, 394 (377-411); head and body, 213 (188-225); tail vertebræ, 181 (162-192); hind foot, 56 (55-58).

"Skull [type] total length, 51; zygomatic breadth, 31; interorbital breadth, 16; breadth of braincase, 22.7; length of nasals, 15.5; maxillary toothrow, 8. Four skulls (type and 3 topotypes, all adult), total length, 51.2 (50.3-53); zygomatic breadth, 30.6 (30-31); interorbital breadth, 16.1 (15-17); breadth of braincase, 22.7 (22-23.2); length of nasals, 15.5 (15-16); maxillary toothrow, 8.2 (8-8.6)." — Allen (l. c.).

Specimens examined, 5.— **Colombia**: Buenavista, 4; Andalusia, 1 (all Am. Mus.).

"The distinctive feature of *M. griseimembra* is the entirely gray fore limbs and the gray inner surface of the hind limbs, in which it differs strikingly from any of the forms of *M. hoffmanni*. In general coloration some specimens closely approach true *hoffmanni*, but the underparts average much paler, and the tail is paler and less heavily washed with ochraceous. It differs still more in coloration from *hyporrhodus*, specimens of which have been received from nearby localities in the Bogotá district to the northward; it is also smaller, the skull especially being smaller and more delicate. It is very much smaller than *quindianus* of the Central Andes (the skull 3 mm. shorter, and all other cranial measurements in proportion), and widely different in coloration.

Remarks. — "The four specimens of the type series vary considerably in the coloration of the underparts, ranging from a strong wash of ochraceous yellow (in one specimen) to a slighter wash of ochraceous buff. The single specimen from Andalusia is the palest of the five, and the gray of the limbs is the deepest and strongest, probably indicating that the extreme phase of the species may be looked for to the southward of the type locality." — Allen (l. c.).

Mesosciurus candalensis (Allen).

Guerlinguetus candalensis ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 590, Oct. 8, 1914.

Type locality.—La Candela, near San Agustín, Huila, Colombia; altitude 6500 feet.

Geographic distribution.—Southern part of the western slope of the Eastern Andes, Huila, Colombia, at altitudes of 4000 to 6500 feet.

Description.—"Upperparts (type) minutely punctated with pale orange yellow and dark brown, the hairs being blackish with minute yellow tips, the mid-dorsal region slightly darker than the flanks; underparts with the tips of the hairs white on the throat, pectoral region and middle of the lower abdomen, and pale ochraceous over the mid-abdominal region; lower border of the sides of the neck, outer surface of fore limbs, edge of thighs and outer surface of hind limbs washed with ochraceous; inner surface of fore limbs grayish white like the breast; inner surface of hind limbs with a broad central line of whitish bordered with a wash of ochraceous; tail above heavily washed with red or orange red, black for about 40 mm. at the tip; under surface of tail centrally grizzled with pale ochraceous and black, with a submarginal band of black, and a narrow edging of red, the tip of the tail black; ears colored like the surrounding surface, with barely an indication of a postauricular patch of soft fulvous hairs.

"Total length (type, collector's measurements), 380; head and body, 190; tail vertebræ, 190; hind foot, 53. Eight specimens (type and 7 topotypes), total length, 390 (380–420, only 1 above 400); head and body, 208 (190–230); tail vertebræ, 181 (160–200); hind foot (in dry skin), 52.8 (51–55).

"Skull (type), total length, 51.2; zygomatic breadth, 29; interorbital breadth, 16; breadth of braincase, 22.6; length of nasals, 15.5; maxillary tooththrow, 8.5. Three adult skulls (type and 2 topotypes), total length, 51.3 (51–52.5); zygomatic breadth, 29.5 (29–30); interorbital breadth, 16 (16–16); breadth of braincase, 23 (22.6–23.3); length of nasals, 15.3 (15–15.5); maxillary tooththrow, 8.4 (8.2–8.8)." — Allen, *l. c.*

Specimens examined, 11.—**Colombia**: La Candela, 8, type and 7 topotypes; La Palma, 3 (all Am. Mus.).

Remarks.—"The specimens referred to *G. candalensis* agree in the coloration of the upperparts and of the tail, but present a wide range of individual variation in the coloration of the underparts, which vary from nearly uniform clear grayish white to orange red over the whole abdominal area, with the upper chest and throat buff. In 3 of the specimens the

underparts are almost wholly grayish white, with a tendency to a pale buffy wash over the middle of the belly; in 7 others the underparts are washed with pale orange yellow with the throat and chest mostly white; in one the whole undersurface is rich orange red. The specimen selected as type is of the medium phase of coloration. It may be added that the white on the underparts is plainly not albinistic, as in many normally red-bellied squirrels, the white being limited to the apical portion of the hairs, the basal portion being plumbeous.

"The nearest relative of *M. candelensis* is *M. griseimembra*, adjoining it to the northward in the Eastern Andes, which is similar in size and cranial characters, but radically different in coloration. In *candelensis* the legs and feet are not gray but like the adjoining parts of the body; the coloration of the upperparts is many shades darker, the yellow tips to the hairs being much shorter, and the tail is superficially dark red instead of pale ochraceous.

"It is interesting to note, in respect to its nearest geographical allies, that the range of *M. griseimembra* nearly joins it to the northeastward, while typical *hoffmanni* is abundant 50 miles to the westward at Almaguer and La Sierra, and also northward in the Western Andes, with which, however, *candelensis* has no near relationship." — Allen, *l. c.*

Subgenus **Histriosciurus** subgen. nov.¹

Mesosciurus gerrardi gerrardi (Gray).

Plate VIII, Figs. 4, 5; Plate XIII, Figs. 13, 14.

Sciurus gerrardi GRAY, Proc. Zool. Soc. London, 1861, p. 92, pl. xvi ("New Grenada"). — ALLEN, Monogr. North Amer. Rodentia, 1877, p. 766; Bull. Amer. Mus. Nat. Hist., XXXI, p. 90, April 19, 1912 (Rio San Jorge, Colombia).

Macroxus gerrardii GRAY, Ann. and Mag. Nat. Hist. (3), XX, 1867, p. 430. Same as *Sciurus gerrardi* Gray, 1861.

Sciurus variabilis ALSTON, Proc. Zool. Soc. London, 1878, p. 665, part, not of Is. Geoffroy. — ALLEN, Bull. U. S. Geol. and Geogr. Survey Terr. (Hayden), IV, No. 4, p. 884, Dec. 11, 1878, part, not of Is. Geoffroy.

Type locality. — "New Grenada"; exact locality not known, but doubtless Antioquia, Colombia (probably near Medellin). Type and topotype in British Museum. [See Addenda, p. 308.]

Geographic distribution. — Coast region of western Colombia.

Description. — Pelage short, coarse and stiff with very little underfur. Median upperparts, from top of head to base of tail (including its extreme

¹ Type *Sciurus gerrardi* Gray.

Table IV.—*Measurements of Species and Subspecies of Subgenus Mesosciurus.*

		Number of specimens	Total length	Head and body	Tail vertebrae	Hind foot	Number of specimens	Total length	Zygomatic breadth	Interorbital breadth	Breadth of braincase	Length of nasals	Maxillary toothrow
<i>griseimembra</i> Buenavista, Col. G. M. O'Connell	Aver.	4	394	213	181	56.2°	4	51.2	30.6	16.5	22.7	15.5	8.2
	Min.		377	188	162	55		50	30	15	22	15	8
	Max.		411	225	192	58		53	31	17	23	16	8.6
<i>candulensis</i> La Candela, Col. L. E. Miller	Aver.	11	393	209	182	52.8°	6	51.3	29.8	16	23.2	15.1	8.6
	Min.		380	190	160	50		50.5	29	15.5	23	15	8
	Max.		420	230	200	55		52.5	30.8	16.3	23.6	15.5	9
<i>griseigena</i> San Julien, Ven. Wirt Robinson	Aver.	10	396	205	193	51.4°	10	50.4	29	15.9	22.4	15.6	8.5
	Min.		383	195	182	50		50	28	15	22	15	8.2
	Max.		412	216	199	53		51.7	30	16.2	23	16.5	8.8
<i>meridensis</i> Merida, Ven. G. Brinceño	Aver.	6	395	213	182	50°	6	50.7	29.4	15.9	23.3	16.2	8.8
	Min.		380	190	170	—		48.5	29	15	23	15.6	8.3
	Max.		410	220	190	—		52	30	16.2	24	17	9.2
<i>chapmani</i> Trinidad F. M. Chapman	Aver.	6	376	203	174	47°	4	49	29	16	21.9	15	8
	Min.		367	197	162	45		48	28	15.5	21.5	14.5	8
	Max.		390	208	192	48		50	30	16.5	22	15.5	8
<i>chapmani</i> Cristobal Colon, Ven. L. E. Miller	Aver.	9	383	191	195	47.6	7	49.2	29	16.3	22.3	14.6	8.2
	Min.		360	173	180	—		48	28	15.5	21.5	14	8
	Max.		405	200	215	—		51	30	17.5	23	15	8.4
<i>tobagensis</i> Tobago Isl.	Aver.	1	330	165	165	45°	4	—	28	15.3	21.7	14.1	8
	Min.							—	27.5	15	21	14	8
	Max.							—	28.5	15.5	22	14.3	8
<i>nestus</i> Santa Margrita Isl., Ven.	Aver.	2	392.5	217.5	175	47.5	2	50.5	28.7	16.6	22.3	15	8.9
	Min.		380	218	162	45°		50	28.3	17	22.5	15	9
	Max.		405	217	188	50		51	29	16.2	22	15	8.8

basal portion) black, forming a broad median band, not sharply defined laterally from the sides of the body; sides of head, neck, shoulders, flanks, and thighs red, deepest on the shoulders and there often nearly meeting at the mid-dorsal line; underparts deep, dark red, varying in different specimens to deep orange, with or without (usually without) irregular small spots or streaks of clear white; outside and inside of limbs like the adjoining parts; tail above black at the base for the proximal two or three inches, the rest deep red, usually including the tip, but the terminal hairs are usually black basally, the black portion often visible through the surface wash of red, and sometimes the extreme tip is distinctly black; under surface of tail grizzled ochraceous and black for the basal two thirds, followed by a zone of black extending apically for two to three inches or more (in different specimens), or the median area may be almost wholly black as far as the apical third or fourth of the tail, the rest red; the hairs individually at the base are narrowly banded with ochraceous and black, giving a grizzled effect to the median area, followed by a broad zone of black, which is very broad proximally and narrows toward the tip of the tail, where the black is often wholly concealed by the long red tips of the hairs.

The above may be taken as a description of the average condition in typical *gerrardi*, but it is hard to find two specimens that wholly agree in coloration, even in a series from the same locality, while specimens from remote localities can be found that are so nearly alike as to be almost indistinguishable. The black of the median dorsal area is apt to be more or less finely punctated with red, and the thighs are usually paler than the shoulders, the hair tips being ochraceous or ochraceous red instead of deep red (or even brilliant red) as on the shoulders. The type of *gerrardi* is paler red, with the hair tips on the flanks, thighs, and sides of the lower back more ochraceous than is indicated in the above description, but, with the exception of the wholly white belly, the type is like many of the specimens I have examined from the coast region of western Colombia. Occasional specimens are more or less spotted with white on the ventral surface (never two in the same manner), and one (No. 32701, San Jorge) has the belly white washed lightly with red in places, where the tips of the hairs are red and the base white.

Total length, average 450 mm.; head and body, 225; tail vertebræ, 225; hind foot, 57.

Skull (No. 34130, Bagado), total length, 57; zygomatic breadth, 35; interorbital breadth, 18.5; breadth of braincase, 25; length of nasals, 19; maxillary toothrow, 9.6.

Unfortunately there is no series of specimens from the type region of *gerrardi* with trustworthy field measurements, nor is a series of measurable skulls available at this writing.

Specimens examined, 18.—**Colombia**: Medellin, 2 (Br. Mus. and Nat. Mus.); "New Granada," 2, type and paratype of *S. gerrardi* (Br. Mus.); Baudo, 2 (Am. Mus.); Bagado, 1 (Am. Mus.); Juntus de Tamaná, 1 (Am. Mus.); Sisto, 1 (Field Mus.); Rio Sipi, Chocó, 3 (Br. Mus.); "Valdivia, Lower Rio Cauca," 6 (Br. Mus.). [See Addenda, p. 308.]

Remarks.—*Sciurus gerrardi*, with its subspecies, has a range which extends along the Pacific coast from central Ecuador north to Panama, and east in the coast region of northern Colombia to Lake Maracaibo. It has become differentiated into a number of local forms, the extremes of which are very unlike, but which completely intergrade. One extreme is *S. gerrardi morulus* of Panama, with the upperparts grizzled ochraceous and black instead of red and black, and the black dorsal area obsolete or greatly reduced; the other is *S. gerrardi zulæ* with the sides bright red and the dark dorsal area very broad and glossy black. Both intergrade with true *gerrardi* of the west coast region of Colombia.

The nomenclature of this group is much involved, several names having been more or less current for the typical form. The earliest name that has been applied to squirrels of the *gerrardi* group is *Sciurus variabilis* Geoffroy (Guérin's Mag. de Zool., X, 1832, Classe 1^{re}, Mamm., pl. iv and text), which, based on three specimens from "Amérique," is not satisfactorily identifiable, and therefore not available. Most of the description applies very well to white-bellied specimens of typical *gerrardi* of the present paper, except that the tail is not "toujours beaucoup plus noire à la face postérieure qu' à l'antérieure," nor does the description agree with the colored plate. In the plate the lower back and rump are represented as red like the thighs and flanks, instead of being black as in the red and black forms of *gerrardi*. The species was based on specimens presented, with many others, by M. Plée, and presumed to have come from America, "car plusieurs de ces objects appartenaient à la Colombie, plusieurs aux Antilles et quelques-uns aux Etats-Unis." As indicative that the squirrels may have come from Colombia, the same collection contained a monkey which was described by Geoffroy in the same volume (*l. c.*, pl. vii and text) as *Stentor chrysurus* (= *Alouatta seniculus*), which he states is known to occur in Colombia, and to be common in the valley of the Rio Magdalena ("vallée de la Madeline"). Some years since I discussed at length (Bull. Amer. Mus. Nat. Hist., XII, 1899, p. 212, and *ibid.*, XX, 1904, pp. 434, 435) Geoffroy's *Sciurus variabilis* with reference to the large red-backed, white-bellied squirrel of the Santa Marta district, and reached the conclusion: "Indeed, it seems now safe to assume that the real type locality of *S. variabilis* is the Magdalena River of Colombia, at some point quite remote from the coast...."

On reëxamination of the subject, however, in the light of the present abundant squirrel material, I can find no form, nor even a single specimen, which agrees with the description and figure of *Sciurus variabilis*. The squirrels of this group from the Lake Maracaibo district (*Sciurus versicolor zuliae* Osgood) have the basal fourth and the distal third of the tail deep black and the rest red (not the basal two thirds of the tail black and the rest red); the rump is black and not red; the belly is red, with sometimes irregular small spots of white, instead of the underparts wholly white, as only rarely and sporadically occurs in any of the *gerrardi* squirrels.

With a region of intergrades between the two forms, *zuliae* passes into *Sciurus variabilis morulus* Bangs of the Rio Atrato and Panama regions, which has the black dorsal area much reduced, and the shoulders and entire sides of the body with the hair tips ochraceous and not red; only the extreme base of the tail black and the rest red; the belly red with small irregular spots of white in occasional specimens, not white. To the southward *morulus* passes into typical *gerrardi*, which has the mid-dorsal area black, the rest of the upperparts with the hair tips red, and red underparts; but with no red, in this nor in any other subspecies of the *gerrardi* group, on the lower back and rump, as represented in the figure of *S. variabilis*. These being the facts of the case it seems necessary to discard the name *Sciurus variabilis* as indeterminable.

The type of *Sciurus gerrardi* Gray, in the British Museum (No. 53. 12. 7. 2, ex coll. Verreaux), from "New Grenada," has been identified by Thomas (on label) as "closely agrees with the original figure of *variabilis* Geoff., and may be probably accepted as typical."¹ The lower back is not quite so black as in most specimens from western Colombia and the coast region of northern Ecuador, but (except for the white belly) it agrees quite as well with the average condition of a series of some 40 specimens from this general region as does the type of *versicolor*, and is quite as typical.

The type of *versicolor*, from Cachabi (or Cachavi), northern Ecuador (alt. 500 ft.), has a red belly, but the dark dorsal band so characteristic of this large series as a whole, is almost obsolete, and the tail is yellow (due apparently to bleaching) instead of deep red, and the tip of the tail has more black than most specimens of the series. Except for the yellow instead of deep red tail, the type is similar to numerous specimens from the Chocó region of Colombia.

¹ The type locality is assumed by Thomas (verbally communicated to me) to be near the mouth of Rio Magdalena, which is unforested and not a squirrel country.

Mesosciurus gerrardi milleri (Allen).

Plate VIII, Figs. 9, 10; Plate XIII, Figs. 17, 18.

Sciurus milleri ALLEN, Bull. Amer. Mus. Nat. Hist., XXXI, p. 91, April 19, 1912.

Type locality.—Cocal, western slope of the Western Andes, Colombia; altitude 4000 feet.

Geographic distribution.—The known range extends from Cocal southwest along the western slope of the southern part of the Western Andes to Ricuarte (altitude 5000 feet).

Description.—Similar to *M. gerrardi gerrardi* in general coloration, but rather larger, with the base of the tail, both above and below, and the outer surface of the hind legs and feet black.

Typical *gerrardi* has the under surface of the base of the tail ochraceous or orange, the hind legs red like the sides of the body, and the upper surface of the hind feet with the hairs tipped with red. Typical *milleri* has the black of the lower back extending laterally over the thighs and outer surface of the hind legs; the upper surface of the hind feet is deep black, and the under surface of the proximal third of the tail is wholly black to the base.

Unfortunately the type of *milleri*¹ is not typical of the subspecies to which the name is applied, and might be referred to true *gerrardi* as an individual variant, were it not that all of the 8 specimens from Barbacoas and Ricuarte, about 100 miles southwest of Cocal have all the distinctive features of the type of *milleri* greatly intensified. If the type could be now chosen one of the Ricuarte specimens would be selected, in which the forelimbs and sides of the body are redder, the base of the tail and the hind feet blacker.

Three adult males from Barbacoas, total length, 457 (450–470); head and body, 247 (240–250); tail vertebræ, 210 (200–230); hind foot, 59 (58–60). Adults from Ricuarte agree in measurements with the Barbacoas specimens.

Three adult male skulls (1 from Ricuarte, 2 from Barbacoas), all the adults that are available for measurement: Total length, 56.5 (56–57); zygomatic breadth, 33.6 (33–34); interorbital breadth, 18.5 (17.5–19.5); breadth of braincase, 25.3 (25–25.5); length of nasals, 18.6 (18.5–18.6); maxillary tooththrow, 9.3 (9.2–9.5).

¹ The collector's measurements of the type given in the original description should be corrected to read: Total length, 416; head and body, 223; tail vertebræ, 193, the collector, it has since been learned, having measured the tail to the tip of the hairs instead of to the end of the vertebræ.

Specimens examined, 14.—**Colombia**: Cocal, 2, type and topotype (Am. Mus.); Ricuarte, 4 (Am. Mus.); Barbacoas, 8 (Am. Mus.).

Remarks.—The occurrence of this strongly marked local form between the ranges of typical *gerrardi* and subspecies *versicolor* is quite unexpected. So far as now known, the range of subspecies *gerrardi* is the coast lowlands in the Chocó district, from Quibdo southward. [See Addenda, p. 308.] Barbacoas specimens are referable to *milleri*, which subspecies is otherwise known only from two localities on the western slope of the southern part of the Western Andes, Cali and Ricuarte, at altitudes of about 3000 to 5000 feet.

Mesosciurus gerrardi versicolor (Thomas).

Text Fig. 6 (p. 163).

Sciurus versicolor THOMAS, Ann. and Mag. Nat. Hist. (7), VI, p. 385, Oct. 1900.

Type locality.—Cachabi (or Cachavi), Province of Esmeraldas, Ecuador; altitude 528 feet ("160 m.").

Geographic distribution.—Northwestern Ecuador, from sea level to about 3500 feet.

Description.—Similar in coloration to *M. gerrardi gerrardi*, but smaller. Some specimens are indistinguishable from true *gerrardi*, and it is difficult to give a distinctive diagnosis of either, owing to the wide range of individual variation, but the southern form (*versicolor*) appears to average much smaller than typical *gerrardi*.

Eight specimens from near the type locality (San Xavier, Pambilor, and Carondelet, altitude 60 to 160 feet), collected and measured by G. Fleming, give the following: Total length, 420 (404–444); head and body, 219 (200–237); tail vertebræ, 197 (190–216); hind foot (s. u.), 54 (53–56). Skulls of the same specimens, total length, 54.5 (53–56.3); zygomatic breadth, 32.8 (31–34); interorbital breadth, 18.3 (17–19); breadth of braincase, 24.7 (24–25.5); length of nasals, 16.6 (15–17.3).

Specimens examined, 16.—**Ecuador**: Cachavi, 2, type and paratype (Br. Mus.); Paramba, 2 (Br. Mus.); San Xavier, 5 (Br. Mus. 2, Nat. Mus. 3); Pambilor, 2 (Nat. Mus.); Carondelet, 3 (Nat. Mus.); Esmeraldas, 2 (Am. Mus.).

Remarks.—*M. gerrardi versicolor* is not easy to characterize so that it may be readily distinguished from frequent specimens of true *gerrardi*, owing to the wide range of individual variation common to both forms, through which specimens from northwestern Ecuador may be found which are practically indistinguishable from others from the Chocó of Colombia, yet there is a slight average difference in both color and size. Besides this

their ranges are separated by that of the intervening form *milleri*, which in some respects is quite different from either *gerrardi* or *versicolor*. Thomas, in describing *versicolor*, took an Ecuador specimen for the type, but referred to this form nearly all of the Colombia specimens in the British Museum which I have referred above to *gerrardi*. On finding it necessary to take the name *gerrardi*, on the ground of its priority over *versicolor*, I at first presumed that *versicolor* would lapse into synonymy, but in working out the group it became evident that *versicolor* could be accepted for the most southern of the known forms of the *gerrardi* group. A specimen in the American Museum from Esmeraldas is almost an exact counterpart of the type of *versicolor*, while another specimen from the same locality is like average specimens from the Chocó of Colombia, except that it has a much larger area of black at the tip of the tail than is often met with in true *gerrardi*.

Mesosciurus gerrardi morulus (Bangs).

Text Fig. 14, showing mammæ (p. 165).

Sciurus variabilis morulus BANGS, Proc. New England Zool. Club, II, p. 43, Sept. 20, 1900.—MILLER, Bull. 79, U. S. Nat. Mus., p. 338, 1912; GOLDMAN, Smiths. Misc. Coll., LX, No. 22, pp. 4, 5 (in text), Feb. 28, 1913.

Type locality.—Loma del Leon, Panama.

Geographic distribution.—Humid tropical lowlands of central and western Panama.

Description.—Upperparts varying (in different specimens from the same locality) from light ochraceous buff to deep ochraceous buff or even ochraceous orange, finely lined with dusky, the hairs individually being black basally, ringed near the tip with ochraceous; median dorsal area slightly or not distinctly darker than the sides, but showing a tendency to a poorly defined dusky dorsal band; underparts ochraceous rufous, usually uniform but varied in some specimens with small spots of white in the axillæ, inguinal and pectoral regions, or along midline of belly; outside of fore limbs usually deeper ochraceous than the sides of the body or the thighs; inside of fore and hind limbs like the ventral surface; tail above at base nearly uniform with the middle of the back, or slightly darker in some specimens, the middle portion (about one half to two thirds of the total length) reddish ochraceous, with a long black tip, about equal in length to the dark basal portion but much blacker.

Total length (type), 450; head and body, 235; tail vertebræ, 215; hind foot, 56; ear, 24. Skull, total length, 55; zygomatic breadth, 33.6; inter-orbital breadth, 24; nasals, 18; maxillary toothrow, 9.5.

Total length (average of 20 specimens, collector's measurements), 448 (413–457); head and body, 232 (220–246); tail vertebræ, 220 (205–236); hind foot, 61 (59–64).

Skull (7 specimens), total length, 57 (55–59); zygomatic breadth, 33.6 (33–34.5); interorbital breadth, 18 (17–19); breadth of braincase, 24.4 (23–25); length of nasals, 17.6 (17–18.3); maxillary tooththrow, 9.2 (9–9.6).

Specimens examined, 26.—**Panama**: Lion Hill, 3 topotypes (Mus. Comp. Zoöl.); Gatun, 14 (11 Nat. Mus., 3 Am. Mus.); Rio Indio, near Gatun, 6; Tabernilla, 2; Porto Bello, 1 (all in Nat. Mus.).

Remarks.—This is the extreme phase of the *gerrardi* group as regards coloration, the usual median black dorsal band being merely incipient or obsolete, and the coloration of the upper parts pale ochraceous, finely lined with black. It is also the most western, occupying the lowlands of the central and western parts of Panama. To the eastward in Panama it grades into *M. gerrardi choco* (Goldman). The limit of its range to the westward has not been determined, but it apparently does not reach Chiriqui, where it is replaced by *M. hoffmanni chiriquensis*.

Mesosciurus gerrardi choco (Goldman).

Sciurus variabilis choco GOLDMAN, Smiths. Misc. Coll., LX, No. 22, p. 4, Feb. 28, 1913.

Type locality.—Cana (altitude 3500 feet), eastern Panama.

Geographic distribution.—Eastern Panama, "from sea level in the Tyra Valley to over 5000 feet altitude on the summits of the Pirri Range."—Goldman, *l. c.*

Description.—Similar in coloration to *Mesosciurus gerrardi morulus* but general coloration slightly more refescent, and with a well developed dorsal band of black, barely indicated in *morulus*. Also similar in size and cranial characters.

Total length (average of 10 specimens, collector's measurements), 446 (430–465); head and body, 235 (220–249); tail vertebræ, 212 (207–223); hind foot, 61.3 (58–62).

Seven skulls, total length, 56 (54.5–58); zygomatic breadth, 33.3 (32–35); interorbital breadth, 18.5 (17.5–20); breadth of braincase, 24.4 (23–25.6); length of nasals, 18 (17–19); maxillary tooththrow, 9 (9–9).

Specimens examined, 28.—**Panama**: Cana, 5, type and 4 paratypes; Mt. Pirri, 6; Cerro Azul, 3; Marracante (sea level), 2; Boca de Cupe, 1 (all Nat. Mus.). **Colombia**: Chepigana, 4; El Real, 7 (Amer. Mus.).

Remarks.—As already noted, this subspecies intergrades to the west-

ward with *morulus*. While the average difference is appreciable, the two forms are not strongly differentiated, some of the specimens being not readily separable except by the labels. The dorsal band in *choco* is usually strongly developed and in some specimens is clear glossy black. The base of the tail is also darker, both above and below, and the black tip of the tail is longer and more intensely black. It intergrades to the southward in the Atrato district of northwest Colombia with *M. gerrardi salaquensis*, in which the black dorsal band is broader, the shoulders, thighs, and sides redder, and the black tail tip absent.

***Mesosciurus gerrardi salaquensis* (Allen).**

Sciurus gerrardi salaquensis ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 592, Oct. 8, 1914.

Type locality.—Rio Salaqui, northwestern Colombia.

Geographic distribution.—Known only from the drainage of the Rio Atrato.

Description.—"Similar to *S. gerrardi choco* in coloration and other external features, but tail without a black tip, and sides of body more ferruginous. Upperparts with a broad median black band extending from the shoulders posteriorly over the proximal third of the tail; sides ochraceous lined with black; outside of fore limbs orange red, inside like the ventral surface; thighs and outside of hind limbs paler than shoulders and fore limbs; underparts deep orange red, with irregular blotches and lines of white (in type a large pectoral area, axillæ, and a narrow median line white); tail above, proximal third black, rest bright red without black at the tip; under surface of tail for proximal third, and median area to end of vertebræ, grizzled ochraceous and black, distal two thirds and the tip broadly fringed with bright red. An adult female and a young female from the type locality are like the type."—Allen, *l. c.*

Total length (type, from skin), 470 mm.; head and body, 240; tail vertebræ, 230; hind foot, 60. Unfortunately the skull is badly broken, but apparently presents no tangible differences from the skulls of neighboring forms of the *gerrardi* group.

Specimens examined, 7.—**Colombia**: Rio Salaqui, 3 (type and 2 topotypes, Am. Mus.); Rio Atrato, 1, Nercua, 3 (Nat. Mus.). [See Addenda, p. 308.]

Remarks.—*Salaquensis* intergrades with subspecies *choco* of eastern Panama. To the southward along the coast it evidently intergrades with true *gerrardi*, as shown by specimens from Baudo and Bagado, through the great increase in intensity of the red on the flanks and limbs.

Mesosciurus gerrardi zuliæ (Osgood).

Sciurus versicolor zuliæ OSGOOD, Field Mus. Nat. Hist., Zool., X, No. 4, p. 26, Dec. 20, 1910; *ibid.*, X, No. 5, p. 47, Jan. 10, 1912.

Type locality.—Orope, Zulia, Venezuela. Type, No. 16584, ♂ ad., Field Mus. Nat. Hist.

Geographic distribution.—Known only from the lowlands of the lower Lake Maracaibo drainage, where it has been taken on both sides of the lake.

Description.—Median upperparts black—dull black on head and shoulders, deep black posteriorly; top and front of head and shoulders with the hairs minutely tipped with red, the amount of red variable in different specimens from nearly obsolete to a strong wash; lower edge of flanks deep red, varying from none (in the type) or a narrow lateral line to a broad band extending half way up the sides of the body and over the shoulders (rarely nearly meeting on the midline between the shoulders) and over the outer aspect of the thighs; underparts deep red (sometimes orange red), frequently with narrow streaks or small spots of white; outer and inner sides of limbs like the adjoining parts; upper surface of fore and hind feet red, varying in different specimens from light orange red to dark red; ears nearly naked, dark brown tinged (usually) with reddish; tail above with the proximal fourth black, in continuation of the black of the back; the apical third is wholly intense black, the intermediate portion red; under surface of tail black, only the middle portion broadly fringed with red.

Seven specimens (collector's measurements), from localities near the lower end of Lake Maracaibo: Total length, 434 (400–455); head and body, 226.5 (210–240); tail vertebræ, 210 (190–221); hind foot, 54.5 (50–57). Seven skulls (same specimens), total length, 56.3 (55–58); zygomatic breadth, 32.5 (31–35); interorbital breadth, 18 (17–19); breadth of braincase, 23.5 (23–24.5); length of nasals, 17.5 (16.5–19); maxillary toothrow, 9 (8.8–9.3).

Specimens examined, 8.—**Venezuela**: Orope, Depart. Zulia, 2 (type and paratype); Rio Aurare, 3; Encontrados, east of lower end of Lake Maracaibo, 2; Empalado Savannas (near the last-named locality), 1 (all Field Mus.).

Remarks.—The type is exceptional in almost altogether lacking red on the flanks and on the shoulders, where it is present in the paratype, but less pronounced than in most of the specimens from other localities. The four localities at which specimens were collected are all in the Maracaibo drainage, near the mouth of the lake.

Mesosciurus gerrardi cucutæ (Allen).

Sciurus variabilis OSGOOD (not of Thomas), Field Mus. Nat. Hist., Zool., X, No. 5, p. 47, Jan. 10, 1912.

Sciurus gerrardi cucutæ ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 592, Oct. 8, 1914.

Type locality.—El Guayabal, 10 miles north of San José de Cucuta, Colombia, near the Venezuelan boundary.

Geographic distribution.—Known only from the vicinity of San José de Cucuta, Colombia.

Description.—Similar to *M. gerrardi zuliæ* but much paler, the black of the upperparts duller and less glossy, the red of the underparts orange instead of orange red, the black on base of tail above and at tip more restricted and less intense.

"Type (collector's measurements), total length, 433 mm.; head and body, 215; tail vertebrae, 218; hind foot, 57. Skull, total length, 54; zygomatic breadth, 31.2; interorbital breadth, 17.4; breadth of braincase, 23.5; length of nasals, 16.5; maxillary tooththrow, 9." — Allen, *l. c.*

Specimens examined, 5.—**Colombia**: El Guayabal, near San José de Cucuta, 5, type and 4 topotypes (Field Mus.).

Remarks.—"A single specimen from Rio San Jorge (alt. 1000 ft.), closely resembles *zuliæ* in general coloration, including the orange red feet so distinctive of *zuliæ*, *cucutæ* and true *gerrardi*. The proximal fourth of the upper surface of the tail is black, but the black at the tip of the tail is very restricted, consisting of only the terminal hairs. The bright red of the shoulders extends to the mid-dorsal line, as happens sometimes in both true *gerrardi* and *zuliæ*. It is probable that this specimen represents a geographical form occurring in northern and northwestern Colombia connecting *gerrardi* directly with *zuliæ*. Further material is necessary to determine the point, no other specimens from this large area being at present available." — Allen, *l. c.*

Mesosciurus saltuensis saltuensis (Bangs).

Sciurus variabilis saltuensis BANGS, Proc. Biol. Soc. Washington, XII, p. 185 Nov. 16, 1898.

Sciurus saltuensis ALLEN, Bull. Amer. Mus. Nat. Hist., XX, p. 431, Nov. 28, 1904.

Type locality.—Pueblo Viejo, Santa Marta, Colombia; altitude 8000 feet.

Geographic distribution.—Sierra de Santa Marta, Colombia, at altitudes

of 5000 to 8000 feet. Rare at 8000 feet, and probably not ranging much above this altitude.

Description.—Similar to *M. saltuensis bondæ* (see below) but averaging much darker. Size and pattern of coloration exactly similar. Pelage thicker and softer, particularly on the ventral surface. (For measurements see Table V, p. 248.)

Specimens examined, 27.—**Colombia**: Pueblo Viejo, 2, type and paratype (Mus. Comp. Zool.); San Sebastian, 1, paratype (Mus. Comp. Zool.); El Libano (5500 ft.), 1 (Am. Mus.); Valparaiso (4500 ft.), 8 (Am. Mus.); Minca (2000 ft.), 8 (Am. Mus.); Cincinnati, 7 (Pittsburgh Mus.).

Remarks.—The Minca specimens are not typical; the locality is at the "lower border of the main mountain forests." Two series of specimens are labeled as having been collected at Minca, one of 8 specimens by M. A. Carriker, Jr., and one of 7 specimens by H. H. Smith. The Carriker specimens and one of the Smith specimens resemble typical *saltuensis* much more than they do *bondæ* of the more arid coast lowlands, but 6 of the Smith specimens are almost typical *bondæ*. Although all of both series are labeled Minca, probably they were really collected at different points varying considerably in elevation, Minca being "at the lower border of the main mountain forest, which here adjoins dry forest and open grass lands" (Smith).

***Mesosciurus saltuensis bondæ* (Allen).**

Plate VIII, Figs. 7, 8; Plate XIII, Figs. 15, 16.

Sciurus variabilis ALSTON, Proc. Zool. Soc. London, 1878, p. 665, part, the Santa Marta, Colombia, specimens.

Sciurus variabilis variabilis BANGS (not of Geoffroy), Proc. Biol. Soc. Washington XII, pp. 183–185, Nov. 16, 1898; Proc. New England Zool. Club, I, p. 91, Feb. 23 1900 (Santa Marta region, Colombia, alt. 500–600 ft.). *Sciurus variabilis* I. Geoffroy is here wrongly restricted to the "form of the coast of Colombia, in the Santa Marta District."

Sciurus saltuensis bondæ ALLEN, Bull. Amer. Mus. Nat. Hist., XII, pp. 213–217, Dec. 20, 1899; *ibid.*, XX, pp. 432–435, Nov. 28, 1904.

Type locality.—Bonda, altitude 200 feet, Santa Marta, Colombia.

Geographic distribution.—The arid coast region of the Santa Marta district of Colombia, north of the Sierra de Santa Marta, from sea level to about 2000 feet elevation.

Description.—Pelage long and soft. Two distinct seasonal pelages, differing in coloration.

General color of upperparts, in the full breeding pelage, including the outer surface of limbs and tail, deep red varying in different specimens from

yellowish red to chestnut red; underparts, including inside of limbs, pure white; sides of head and throat fulvous; top of head with many of the hairs subapically annulated with black, giving a somewhat darker cast in contrast with the back; also hairs of lower back and basal part of tail annulated subapically with black; tail entirely deep red on both surfaces, the hairs usually red to the base, but sometimes broadly annulated near the base with black, the black subbasal zone gradually increasing in breadth on the apical third of the tail; the white on the inside of the limbs varies in extent, being sometimes nearly absent and sometimes extending to the ankles and wrists.

In the short new pelage the upperparts are usually yellowish red annulated with black, giving generally a more or less olivaceous effect, the fore limbs, the inner edge of the thighs and a narrow lateral line clear yellowish red. The young in first pelage are usually like the adults in the short new coat.

Measurements of 13 males and 16 females (collected and measured by members of the H. H. Smith Santa Marta expedition), all from Bonda: Total length, *males*, 472 (439–520) mm., *females*, 477 (448–500); head and body, *males*, 472, *females*, 477; tail vertebræ, *males*, 227 (205–255), *females*, 223 (215–250). Measurements of 10 specimens (males and females, collected and measured by W. W. Brown, Jr., for the Bangs Brothers,¹ at Santa Marta, 7 miles from Bonda): Total length, 476 (460–500); head and body, 237 (230–350); tail vertebræ, 240 (225–250); hind foot, c. u., 56.1 (53–60).

Ten adult skulls (all but two with the teeth considerably worn) from Bonda give the following: Occipitonasal length, 56.3 (55–58); zygomatic breadth, 31.5 (31–32); interorbital breadth, 18.5 (18–19); breadth of braincase, 23.5 (22.5–24.5); length of nasals, 18 (17.5–19); diastema, 13.6 (13–14); maxillary tooththrow, 9.3 (9–9.7).

The Bonda specimens show not only a wide range of individual variation in color, but also a large amount of seasonal variation in the length of the pelage as well as in its coloration. In the perfectly developed breeding pelage a broad mantle of long red hair covers the shoulders and extends along the flanks, which is absent in the early stages of the shorter, yellower and more annulated coat of the succeeding pelage. This is demonstrated by specimens in molt, in which both pelages are shown. The long red hair of the upperparts probably comes in gradually and not by a second full molt.

¹ Cf. O. Bangs, Proc. Biol. Soc. Washington, XII, p. 186, Nov. 16, 1898. These are the first 10 specimens of Bangs's table of measurements.

It may be noted that while the total length in the Smith specimens is practically the same as in the Brown specimens, the ratio of the length of the tail vertebræ to the total length is about 2.5 % less in the former than in the latter, due undoubtedly to different methods of taking the length of the tail.

A single specimen (♀ ad.) from Don Diego, at mouth of Don Diego River (sea level), is melanistic. The upperparts are very dark, the hairs being merely slightly tipped with ochraceous, black prevailing on the median area; the usual white area below is bordered with a narrow line of black, which also outlines the white on the inside of the limbs, and the throat is black. The tail is of the normal deep red, but elsewhere red has been largely replaced with black.

Specimens examined, 60.—**Colombia**: Bonda, 46¹ (36, Am. Mus., 10, Nat. Mus.); Minca, 4 (Am. Mus.); "South America," 1 (Nat. Mus.); Minca, 8 (Pittsburgh Mus.); Don Diego, 1, melanistic (Am. Mus.).

Remarks.—Mr. Bangs's application of the name *Sciurus variabilis* Geoffroy to the Santa Marta squirrel proves to have been wholly unjustifiable.² To no large Colombian squirrel is it hardly less applicable than to this species. The type in all probability came from somewhere in north-western Colombia but as yet no specimens are known to which the description and figure are applicable. The probability is that the name was based on some at present unknown phase of the *Sciurus gerrardi* group, carelessly and improperly described and very erroneously figured, and until some form more closely agreeing with the alleged characters has been discovered than is now known it seems best to treat Geoffroy's name as indeterminable, for reasons already fully given in the present paper (*antea*, pp. 239, 240). The name has been applied by authors to all of the large South American squirrels with red backs and white bellies, from northern Colombia and Panama to Peru and Brazil.

***Mesosciurus saltuensis magdalenæ* (Allen).**

Sciurus saltuensis magdalenæ ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 593, Oct. 8, 1914.

Type locality.—Banco, Rio Magdalena, a few miles above mouth of Rio Cesar, Colombia; altitude 50–100 feet.

Geographic distribution.—Known only from the type locality.

Description.—"Pelage short, coarse and rigid, almost without underfur. Upperparts uniform deep red except front and sides of head, which are orange yellow; underparts and proximal portion of inside of limbs pure white; chin orange yellow, passing into orange red on the throat, sharply contrasting with the white of the lower throat and chest; tail wholly intense

¹ The Bonda specimens, originally 60 in number, were all collected by the H. H. Smith Expedition, but some have since been sent to other Museums, including 10 to the U. S. National Museum.

² Cf. Allen, Bull. Amer. Mus. Nat. Hist., XII, p. 216; *ibid.*, XX, p. 434, and *antea*, p. 239.

dark red from base to tip, both above and below; upper arms and thighs deep red like the upperparts; fore and hind feet orange red.

"In a second specimen (topotype) the red of the flanks and limbs is still darker, the hairs of the back subapically narrowly ringed with black, thus distinctly darkening the median dorsal area, which is extended over the proximal third of the tail.

"Total length (type), 434 mm.; head and body, 245; tail vertebræ, 189; hind foot, 56; topotype (♂ ad.), 422, 238, 184, 60. The skull has been temporarily mislaid; measurements of it may be given later." — Allen, *l. c.*

Specimens examined, 2.—**Colombia**: Banco, Rio Magdalena, near mouth of Rio Cesar, 2, type and topotype (Am. Mus.).

Remarks.—Similar in pattern of coloration to *M. saltuensis bondæ*, but the pelage is coarse and hispid instead of long and soft, and the red is much darker and more vivid. The type locality is at the mouth of the Rio Cesar, which has its source in the Sierra de Santa Marta. Doubtless squirrels of the *saltuensis* group will be found at favorable localities throughout the course of the Rio Cesar, the mouth of which is in the humid tropical, while the region about Bonda is arid, the change in the character of the pelage and the intensification of the color in *magdalenæ* being doubtless due to its more humid environment.

Mesosciurus pyrrhinus (Thomas).

Sciurus variabilis TSCHUDI (not of Geoffroy), Fauna Peruana, I, Therologie, pp. 155, 160, pl. x.—ALLEN, Mon. N. Amer. Rodentia, 1877, p. 768, part, only the reference to Tschudi.—THOMAS, Proc. Zool. Soc. London, 1893, p. 337 (Chanchamayo, Peru).

Sciurus pyrrhinus THOMAS, Ann. and Mag. Nat. Hist. (7), II, p. 265, Sept. 1898.

Type locality.—Garita del Sol, Vitoc, Peru.

Geographic distribution.—Eastern slope of the Andes in central Peru, latitude 9° to 12° south (Tschudi), from the lower edge of the cedar region to the upper forest region, about 2000–5000 feet (Tschudi).

Description.—Similar in size, cranial and external features to *Mesosciurus saltuensis bondæ*, but much darker red above, and either white or red or patchy red and white below.

Pelage long, thick and soft. Superficially dark red above from nose to end of tail, the hairs annulated narrowly on apical half with red and black, giving a grizzled red-black general effect; basal half of tail with more black than the apical half; underparts bright red with small irregular patches of white on throat, axillæ, lower breast and inguinal region; tail below annulated with three bands of black and two of rufous, the outer one wider and broadly fringed with red.

Table VI.—Measurements of Species and Subspecies of Subgenus *Histrosciurus*.

Species, localities, and by whom collected and measured	External measurements					Cranial Measurements							
	Number of specimens	Total length	Head and body	Tail vertebrae	Hind foot	Number of specimens	Total length	Zygomatic breadth	Interorbital breadth	Breadth of braincase	Length of nasals	Diastema	Maxillary toothrow
<i>saltuensis</i> Sierra de Santa Marta, Colombia W. W. Brown, Jr.	Aver. 10 Min. 476 Max. 500	476 460 500	237 230 250	240 225 250	56.1° 53 60	10	54.4 53.5 54	30.5 30 31	18 17.5 19	23.8 23 24.5	17.1 16 18		
<i>bondæ</i> Bonda, Sta. Marta, Colombia H. H. Smith	Aver. 29 Min. 471 Max. 520	471 439 520	244 234 270	227 205 250	— — —	10	56.3 55 58	31.5 31 32	18.5 18 19	23.5 22.5 24.5	18 17.5 19	13.6 13 14	9.3 9 9.7
<i>magdalenæ</i> Rio Cesar, Col. G. M. O'Connell	Aver. 2 Min. 428 Max. 434	428 422 434	235 238 242	187 184 189	58° 56 58								
<i>pyrrhinus</i>	Type	448	240	208	59	type	52	33.5	18	—	16.5	15.2	9.6

In 9 specimens examined, all from central Peru, the ventral surface is wholly red in 1, wholly white in 4, and red patched with white in 4 others.

"Head and body, 240 mm.; tail, 208; hind foot (wet), 59; ear (wet), 21.

"Skull: greatest length, 52; basilar length, 46; greatest breadth, 33.5; nasals, 16.5×8.4 ; interorbital breadth, 18; intertemporal breadth, 19; diastema, 15.2; palate length from hensilon, 26.7; length of upper tooth-series, 9.6." — Thomas, *l. c.*

Specimens examined, 9.—**Peru**: Chanchamayo, 7, including type (Br. Mus.); Chanchamayo, 2 (Field Mus.).

Remarks.—*Mesosciurus pyrrhinus* presents a remarkable similarity to *M. saltuensis bondæ*, considering the remoteness of their ranges, which are separated by more than 2000 miles. In size, cranial characters, pelage, pattern of coloration, and in color, they are so similar that were their ranges contiguous there would be no reasonable ground for not considering their relationship as merely subspecific. In the *saltuensis* group the ventral surface is white, in *pyrrhinus* it may be either white or red, or a patchy mixture of both, and there is a stronger mixture of black in the basal third or half of the tail.

This species was described and figured (both the red-bellied and white-bellied phases) by Tschudi (*l. c.*), under the untenable name *Sciurus variabilis*, who states that it is abundant in the forest of the eastern slope of the Andes between latitudes 9° to 12° south.

Genus *Guerlinguetus* Gray.

Text Figs. 8, 15 (pp. 163, 165); Plate IX, Figs. 4–6; Plate XIII, Figs. 19–24.

Guerlinguetus GRAY, London Med. Repos., XV, p. 304, April, 1821 (genus).—NELSON, Proc. Washington Acad. Sci., I, pp. 30, 98, pl. i, fig. 7, May 9, 1899, part (subgenus).—MILLER, Bull. 79, U. S. Nat. Mus., p. 334, part (subgenus).

Macroxus F. CUVIER, Dents de Mamm., pp. 161, 162, 255, pl. lvi, 1823.—LESSON, GRAY, TROUESSART, and others, in part. Type, by designation of Thomas, 1897, *Sciurus æstuans* Linné.

Type (by tautonymy), *le guerlinguet* Buffon = *Myoxus geurlingugus* Shaw = *Sciurus guerlinguetus* Gray = *Sciurus æstuans* Linné.

Size small; mammæ, 8; tail long, about 50% of total length.

Premolars, $\frac{1}{1}$. Skull long and narrow; dorsal outline less convex than in *Leptosciurus*, *Notosciurus*, and in most forms of *Mesosciurus*; malar narrow, slightly expanded vertically on the upper border, which is depressed behind the malar process; m^1 and m^2 of the usual sciurid type (nearly as in typical *Sciurus*), with the cusps on the outer border well developed, as are also the intervening cusplets, differing thus strongly from those of *Leptosciurus*,

presenting four distinct crenulations on the outer border; p^4 and m^3 have the crown cup-shaped, the crenulations on the outer border obsolete.

Geographic distribution.—The lower drainage areas of the Amazon and Orinoco rivers, the northern coast region of Brazil, and the forested parts of the Brazilian Highlands south to Paraná and São Paulo. (See Map, p. 301.)

Remarks.—*Guerlinguetus* is most nearly related to *Mesosciurus*, from which it is readily distinguishable by the possession of 8 mammae instead of 6, and by the much longer and narrower tail. In the general form of the skull and in the character of the dentition there is no very marked difference. The nasals, however, are shorter, their length being about 82% of the interorbital breadth instead of from 94% or more as in *Mesosciurus*; the skull is also narrower in comparison with the length, but the difference, while fairly constant, is too slight to be very impressive when reduced to percentage.

Guerlinguetus, as here restricted, comprises *G. æstuans* and *G. alphonsei* with their respective subspecies, which constitute the typical section of the genus. *G. ingrami* is aberrant, but is better referred here than to any of the other groups here recognized as generic. It differs from the typical forms in being distinctly larger, in the coarser, longer pelage, and somewhat in style of coloration. The skull is much narrower in proportion to the length, and the teeth differ markedly in respect to the shape and the character of the crown surface of m^3 , which has a high anterior conical cusp. (Cf. Plate XIII, Figs. 23, 24.) *G. ingrami* differs also in the physical character of its habitat, its distribution comprising the mountainous parts of southeastern Brazil, in contrast with the excessively humid tropical forests of the Amazon and Orinoco. *G. ingrami* could well be separated from the *æstuans-alphonsei* group as a separate subgenus of *Guerlinguetus*, on the basis of the above-stated differences.

Species and Subspecies of Guerlinguetus, with type localities and statement of number of specimens examined.

Guerlinguetus æstuans æstuans (Linné). Guiana. Specimens examined, 17.

Guerlinguetus æstuans gilvicularis (Wagner). Borba, Brazil. Specimens examined, 18.

Guerlinguetus æstuans macconnelli (Thomas). Near base of Mount Roraima, British Guiana. Specimens examined, 1, the type.

Guerlinguetus æstuans quelchii (Thomas). Kanucha Mountains, British Guiana. Specimens examined, 5.

Guerlinguetus æstuans venustus subsp. nov. Southern base of Mount Duida, Venezuela. Specimens examined, 1.

Guerlinguetus alphonsei alphonsei (Thomas). San Lourenço, near Pernambuco, Brazil. Specimens examined, 11.

Guerlinguetus alphonsei paraensis (Goeldi). Para, Brazil. Specimens examined, 23.

Guerlinguetus ingrami (Thomas). Tunnel, southern Minas Geraes, Brazil. Specimens examined, 50.

Key to the Species and Subspecies of Guerlinguetus.

Size smaller; pelage short and thin.

Tail washed with rufous.

Upperparts grizzled ochraceous rufous and black; below rufous or orange rufous..... *æstuans* (p. 256)

Similar to *æstuans* but smaller and paler..... *gilvicularis* (p. 257)

Similar to *gilvicularis* but paler..... *quelchii* (p. 259)

Upperparts more olivaceous, underparts orange buff... *macconnelli* (p. 259)

Tail washed with white.

Upperparts olivaceous gray; below buff, whitish laterally... *alphonsei* (p. 261)

Upperparts more ochraceous..... *paraensis* (p. 261)

Size larger; pelage long and full.

Tail washed with pale fulvous..... *ingrami* (p. 262)

***Guerlinguetus æstuans æstuans* (Linné).**

Plate IX, Figs. 4-6; Plate XIII, Figs. 19, 20.

Sciurus æstuans LINNÉ, Syst. Nat., ed. 12, I, 1766, p. 88 (Surinam).—DESMAREST, Nouv. Dict. d'Hist. Nat., nouv. éd., X, 1817, p. 109 (= *Le grand Guerlinguet*, Buffon, Hist. Nat., Suppl., VII, 1789, p. 262, pl. lxxv).—ALSTON, Proc. Zool. Soc. London, 1878, p. 668, part.—THOMAS, Ann. and Mag. Nat. Hist. (8), VI, p. 185, Aug. 1910 (Supinam River, Demerara).

Sciurus æstuans var. *æstuans* ALLEN, Mon. N. Amer. Rodentia, p. 756, Aug. 1877, part; Bull. U. S. Geol. Surv. Terr. (Hayden), IV, No. 4, p. 885, Dec. 11, 1878, part.

Sciurus æstuans var. *guianensis* PETERS, Monatsb. K. P. Akad. Wissen. Berlin, 1863 (1864), p. 655 (British Guiana).

Macroxus æstuans GRAY, Ann. and Mag. Nat. Hist. (3), XX, p. 432, Dec. 1867, part.

Myoxus guerlingugus SHAW, Gen. Zool., II, pt. 1, 1801, p. 171, pl. clvi, 1801 (= *le grand Guerlinguet* of Buffon).

Type locality.—Surinam.

Geographic distribution.—The Guianas.

Description.—Pelage short, soft. Tail vertebræ equal to or slightly longer than head and body. Postauricular patches buffy yellow, restricted to a small area close to the posterior base of the ear; usually inconspicuous and sometimes absent. Upperparts grizzled ochraceous rufous and black,

the hairs black coarsely annulated near the tip with ochraceous rufous; a narrow yellow eye-ring; chin, throat, and inside of fore limbs grayish brown with a buffy wash; chest and abdomen orange or orange rufous; tail above black washed with orange, the hairs basally grizzled dull yellowish and black, subapically broadly banded with black and tipped with orange; tail not tipped with black; under surface of tail grizzled orange and black; feet dusky grayish brown minutely punctated with fulvous or rufous.

Total length, 365 mm.; head and body, 180; tail vertebræ, 185; hind foot (s. u.), 44, c. u., 47. Skull, total length, 45; zygomatic breadth, 27; interorbital breadth, 16; breadth of braincase, 21; length of nasals, 12; diastema, 11; maxillary toothrow, 7. (Measurements of an old female from Bonasica, Essequibo River, British Guiana. For additional measurements see Table VII, p. 264).

Specimens examined, 17.—**British Guiana**: Surinam River, 8; Bartica Grove, 3 (all Br. Mus., coll. F. V. McConnell); Kaieteur Falls, 1 (Am. Mus.); Potaro Landing, 2 (Am. Mus., 1; Brit. Mus. 1); Potaro Highlands, 1 (Br. Mus.). **French Guiana**: Ipousin, Approague River, 1 (Br. Mus.).

Remarks.—*Sciurus æstuans* was the first South American squirrel recognized in systematic zoölogy, it having been technically named by Linné in 1766. His description was very brief and quite insufficient for satisfactory identification. The habitat of the species was given as "Surinam"; and by common consent the name has come to be assigned to one of the small squirrels of the Guianas. The name as employed for nearly a century was a 'blanket name' for practically all of the small squirrels of tropical America. The group has since been separated into numerous species and subspecies, some of them widely different from *æstuans* as now restricted.

Typical *æstuans* is poorly represented in the museums of this country; the present description is based on the series in the British Museum, but only one of them has measurements taken before skinning.

There is, as usual, a considerable range of individual variation in coloration and size, but the above description is believed to represent the average conditions.

***Guerlinguetus æstuans gilvicularis* (Wagner).**

Plate IX, Fig. 8; Plate XIII, Figs. 21, 22.

Sciurus gilvicularis WAGNER, Arch. f. Naturg., 1842, ii, p. 43; *ibid.*, 1845, i, p. 148; Abhandl. math-phys. Cl. Akad. München, V, 1850, p. 283.

Sciurus gilviventris PELZELN (ex Natterer), Verhandl. z.-b. Gesell. Wien, XXXIII, Beiheft, 1883, p. 59 (Borba, Brazil).

Sciurus æstuans gilvicularis ALLEN, Bull. Amer. Mus. Nat. Hist., XX, p. 340,

Oct. 8, 1904 (Suapuré, La Union, and El Llagual, Venezuela); *ibid.*, XXVIII, p. 146, May 27, 1910 (Rio Mocho, Venezuela).

Sciurus (Guerlinguetus) æstuans gilvicularis ALLEN, Bull. Amer. Mus. Nat. Hist., XXX, p. 255, Dec. 2, 1911 (Rio Mocho).

Sciurus æstuans gilvicularis THOMAS, Ann. and Mag. Nat. Hist. (8), XI, p. 87, Jan. 1912. Faro, near mouth of Rio Yamundá, Lower Amazon.

Type locality.—Borba, Brazil, near mouth of Rio Madeira.

Geographic description.—Amazonas, from near the mouth of the Rio Madeira westward to an unknown distance, and the valley of the middle portion of the Rio Orinoco; probably also the drainage areas of the Rio Branco and Rio Negro.

Description.—Pelage short and thin, very close and short on the feet and ears. Similar in general coloration to *Guerlinguetus æstuans æstuans* but paler and rather smaller, with a narrower tail. Upperparts finely grizzled light ochraceous buff (Ridgway) and black; eye-ring narrow, pale buff; underparts dark ochraceous orange, most intense on the chest and upper abdomen, somewhat paler posteriorly and much paler on throat; limbs externally like the dorsal surface, internally like the ventral surface; tail above coarsely grizzled with buff and black and broadly edged with buff, varying in intensity in different specimens; underside of tail with the median area finely grizzled with buff and black, the hairs with a broad subapical zone of black, edged with a broad fringe of buff.

The above description is based on 6 specimens from the type region, including specimens from Santarem, Obidos, and the lower Rio Yamundá. A series of specimens from the Rio Caura and middle Orinoco region are similar.

Total length, adult male, 337 mm.; head and body, 166; tail vertebrae, 167; hind foot, c. u., 45. Five specimens from the lower Rio Caura, total length, 342 (329–357); head and body, 169 (155–177); tail vertebrae, 173 (165–178); hind foot, 45 (43–47).

Five skulls (lower Rio Caura region), total length, 44.4 (43.5–47); zygomatic breadth, 25.4 (25–26); interorbital breadth, 14.6 (13.3–15.3); breadth of braincase, 20 (19–21); length of nasals, 12.7 (12–13.5); diastema, 11.1 (11–11.5); maxillary toothrow, 7 (6.4–8).

Specimens examined, 18.—**Brazil**: Santarem, 3 (Am. Mus. 2, Mus. Comp. Zoöl. 1); Obidos, 4 (Mus. Comp. Zoöl.); Faro, Rio Yamundá, 3 (Field Mus. 1, Am. Mus. 2).

Venezuela: Suapure, Rio Caura, 5; Rio Mocho, 1; La Union, 1; El Llagual, 1 (all in Am. Mus.).

Remarks.—Wagner in his later full description of *Sciurus gilvicularis* (l. c., 1850) made his comparison of *gilvicularis* with what is now known as

Sciurus ingrami Thomas, instead of with *S. æstuans* as now restricted, his *æstuans* being the *Sciurus æstuans* of Wied, which is clearly the *Sciurus ingrami* of Thomas, as is evident from his reference to the absence of the "weisse Längslinie längs der Bauchmitte, welche sich bei *Sc. æstuans* findet."

On the other hand, *Sciurus gilvicularis* Wagner is very closely related in all features to true *æstuans*, of which it seems at best only a fairly well differentiated subspecies, with which it is connected geographically through *Sciurus quelchi* and *S. macconnelli* Thomas, which are not very clearly distinguishable from true *æstuans*.

Pelzeln renamed the species *gilviventris*, he preferring, probably for sentimental reason, Natterer's manuscript name to the one previously published by Wagner.

***Guerlinguetus æstuans macconnelli* (Thomas).**

Sciurus macconnelli THOMAS, Ann. and Mag. Nat. Hist. (7), VIII, p. 148 (foot-note), August, 1901.

Type locality.—Near base of Mount Roraima, British Guiana.

Geographic distribution.—Known only from the type locality.

Description.—Like *G. æstuans æstuans* but upperparts possibly browner (brownish olivaceous), and underparts perhaps brighter or deeper orange buff; chin and throat grayish. A buffy postauricular patch, and pelage longer and fuller than in either *æstuans*, *gilvicularis*, or *quelchii*, in correlation with its different environment.

Type unique, with an imperfect tail (only basal third present), and a fragmentary skull.

Remarks.—Judging from the imperfect type specimen, the only one seen, this may probably rank as a local form of the *æstuans* group, limited probably to the basal portion of Mount Roraima.

***Guerlinguetus æstuans quelchii* (Thomas).**

Sciurus quelchii THOMAS, Ann. and Mag. Nat. Hist. (7), VIII, p. 147, August, 1901.

Type locality.—Kanuka Mountains, British Guiana, near the Brazilian boundary (59° W., 3° N.); altitude 240 to 300 m.

Geographic distribution.—Known only from Kanuka Mountains in southwestern British Guiana and from the Serro do Lua in northern Brazil.

Description.—Similar to *G. æstuans æstuans* but paler both above and

below than either *æstuans* or *gilvicularis*. Upperparts finely grizzled yellowish and black, giving an olivaceous gray effect; underparts pale ochraceous buff, much paler on throat; tail as in *æstuans* but paler; no postauricular patches.

Total length (type, collector's measurements), 343 mm.; head and body, 178; tail vertebræ, 165; hind foot, c. u., 47. The two topotypes are smaller and not quite mature. Skull, type (from Thomas, *l. c.*), total length, 45; zygomatic breadth, 27.5; interorbital breadth, 16; nasals, 10.5×6.2 ; diastema, 11.5; maxillary tooththrow, 6.8.

Two adult females from Serra do Lua (near Boa Vista, Amazonas), total length, 355, 362; head and body, 164, 172; tail vertebræ, 181, 190; hind foot, c. u., 46, 46. Skulls of the same specimens, total length, 44.7, 45.6; zygomatic breadth, 26, 25.8; interorbital breadth, 15, 15.8; breadth of braincase, 21, 20.5; length of nasals, 11, 11; diastema, 11, 11; maxillary tooththrow, 7, 7.

Specimens examined, 5.—**British Guiana**: Kanuka Mountains, 3, type and topotypes (Br. Mus.). **Brazil**: Serro do Lua (near Boa Vista, Amazonas), 2 (Field Mus.).

Remarks.—This is a pale form, intermediate between *G. æstuans æstuans* and *G. æstuans gilvicularis*.

Guerlinguetus æstuans venustus subsp. nov.

Type, No. 36155, ♀ ad., Boca Sina (altitude 440 ft.), Rio Cunacunumá (southern base of Mount Duida), Venezuela, March 19, 1913; Leo E. Miller.

Pelage and coloration as in *G. æstuans æstuans*, but size smaller. Upperparts grizzled rufous and black, the hairs blackish annulated narrowly with rufous at the tip; underparts orange, chin and throat ochraceous buff; tail coarsely grizzled orange and black, both above and below, the tip black with the ends of the hairs orange; limbs externally like the upperparts, internally like the ventral surface; ears small, clothed with short orange-tipped hairs; postauricular patches absent.

Total length, —; head and body, 165; tail, — (imperfect); hind foot, c. u., 43. Skull, total length, 42.5; zygomatic breadth, —; interorbital breadth, 15; breadth of braincase, 21; length of nasals, 14; diastema, 11; maxillary tooththrow, 7.3.

Represented only by the type, a young adult female.

This form, in its coloration, closely resembles specimens of true *æstuans* from the coast region of British Guiana, and hence is very unlike the pale *gilvicularis* of the lower Rio Caura region and the middle Rio Orinoco. The only known specimen has the tail imperfect, and the skull is slightly broken.

Guerlinguetus alphonsei alphonsei (Thomas).

Sciurus roberti THOMAS, Ann. and Mag. Nat. Hist. (7), XII, p. 463, Oct. 1903. Not *Sciurus thaiwanensis roberti* Bonhote, 1901.

Sciurus alphonsei THOMAS, Ann. and Mag. Nat. Hist. (7), XVIII, p. 442, Dec. 1906. *S. roberti* Thomas, 1903, renamed.

Type locality.—San Lourenço, near Pernambuco, Brazil; altitude 50 m.

Geographic distribution.—Coast region at Pernambuco, Brazil; extent of range unknown.

Description.—Pelage short and close, as in the *æstuans* group. Post-auricular patches absent. General color effect above dark olivaceous gray, the hairs blackish tipped with pale fulvous, the hair tips varying in some specimens to ochraceous (as strong as in average *æstuans*); underparts with chest and upper abdomen buff; throat, inguinal and anal regions, inside of limbs and outer borders of ventral surface whitish; tail above at base like the back, apical three fourths blackish with the tips of the hairs white, giving a general dark gray effect, the hairs basally annulated narrowly with black and buff, with a broader subapical zone of black and long white tips; lower surface of tail with the median area grizzled buff and black, and a broad subapical zone of black fringed with white; ears clothed with very short hairs, nearly of the color of the head and body; upper surface of feet with very short hairs, of the same color as the body, as in the *æstuans* group.

Total length, 8 specimens (type and topotypes), collector's measurements, 353 (340–360 mm.); head and body, 181 (165–185); tail vertebrae, 178 (170–190); hind foot, s. u., 44 (42–45).

Skull (type), total length, 46 mm. (Thomas, *l. c.*). The only skull (a topotype) available for measurement at this writing is badly broken, and affords only the following: interorbital breadth, 16; nasals, 13 × 6; palatal length, 22.5; diastema, 11; maxillary tooththrow, 8.

Specimens examined, 9.—**Brazil**: San Lourenço, near Pernambuco, 9 (Br. Mus. 8, Am. Mus. 1).

Remarks.—In size, character of pelage, general coloration, and in all other features very similar to the *gilvularis* phase of the *æstuans* group, except that the ventral surface is much paler and the tail is washed with clear white instead of fulvous.

Guerlinguetus alphonsei paraensis (Goeldi).

Sciurus æstuans paraensis GOELDI, Bol. Mus. Goeldi, IV, p. 70, Feb. 1904.

Type locality.—Para, Brazil.

Geographic distribution.—Lower Rio Tocantins; extent of range not known.

Description.— Type and cotype (in British Museum) similar in general features to *G. alphonsei alphonsei*, but more ochraceous, both above and below; but a series of 15 specimens from the immediate vicinity of the type locality presents a wide range of variation in the coloration of both the upper and lower surfaces of the body. The type is strong buff below while the cotype is mostly silvery white below. In other specimens the median area of the ventral surface varies from white tinged with pale buff to pale orange. In some specimens the upperparts are as rufous as in typical *æstuans*, in others grayish olivaceous, indistinguishable in tone from that of average specimens of *alphonsei*. In the more intensely colored specimens the basal portion of the hairs of the tail are more strongly ochraceous than in the paler specimens, in correlation with the general coloration. But the tail appears to be always washed with white as in *alphonsei*, instead of with fulvous as in *gilvularis*, from which some specimens of the series are otherwise indistinguishable.

Fourteen specimens (11 from Igarape Assú, practically the type locality, and 3 from Cametá, lower Rio Tocantins), measured by the collector: total length, 338 (325–353) mm.; head and body, 170.5 (163–180); tail vertebrae, 171 (158–177); hind foot, s. u., 42 (40–45).

Skull (adult female), total length, 44.2; zygomatic breadth, 26; interorbital breadth, 15.6; breadth of braincase, 20; length of nasals, 12; diastema, 11; maxillary toothrow, 7.

Specimens examined, 23.— **Brazil**: Para, 3, type and 2 cotypes (Br. Mus. 2, Am. Mus. 1); Igarape Assú, 13 (Br. Mus. 11, Field Mus. 2); Cametá, lower Rio Tocantins, 6 (Br. Mus. 3, Field Mus. 1, Am. Mus. 2).

Remarks.— *G. alphonsei paraensis* is closely related to typical *alphonsei*, differing from it slightly and inconstantly in color, and in decidedly smaller size.

In the brief and very inadequate original description of *paraensis* the only comparison made was with the squirrel of the Serra dos Orgãos of southern Brazil (near Rio de Janeiro), referred to as "*Sciurus æstuans* L.," but which was of course the very distinct *S. ingrami* Thomas.

Guerlinguetus ingrami Thomas.

Plate IX, Figs. 9, 10; Plate XIII, Figs. 23, 24.

Sciurus æstuans WIED (not of Linné), Beitr. Naturg. Brasilien, II, 1826, p. 431 (southeastern Brazil).— BURMEISTER, Thiere Brasiliens, I, 1854, p. 146.— HENSEL, Abhandl. Akad. Wissens. Berlin, 1872 (1873), p. 26 (not of Linné), Rio Grande do Sul, Brazil.— ALLEN, Mon. N. Amer. Rodentia, 1877, p. 756 (part, only the specimens from southeastern Brazil); Bull. U. S. Geol. and Geogr. Surv. Territories

(Hayden), IV, No. 4, p. 885, Dec. 11, 1878 (part).—ALSTON, Proc. Zool. Soc. London, 1878, p. 668 (part). Also, in part, of most authors prior to 1900.

Sciurus ingrami THOMAS, Ann. and Mag. Nat. Hist. (7), VII, p. 368, April, 1901; *ibid.*, IX, p. 60, Jan. 1902 (Serro do Mar, Paraná, Brazil).

Type locality.—Tunnel, southern Minas Geraes, Brazil; altitude 1200 m.

Geographic distribution.—Southeastern Brazil, from southeastern part of Bahia to eastern Rio Grande do Sul.

Description.—Pelage thick, rather long and soft; no obvious postauricular patches; tail vertebræ somewhat shorter than head and body.

Upperparts finely grizzled dull buffy and black, giving an olivaceous effect; hairs blackish at base, narrowly annulated near the tip with yellowish and black and tipped with pale yellowish; underparts with the chin and throat white, the chest and belly ochraceous buff, varying in intensity in different specimens, often with a narrow white median line, and the inguinal and scrotal areas whitish; limbs externally like the upperparts; internally the fore limbs are whitish, the hind limbs fulvous; tail long and narrow, the hairs broadly ringed with black and yellow, the tips pale yellow or whitish, the general effect being a coarse grizzle of black and pale yellow on both surfaces; ears rather narrow and pointed, thinly clothed with short fulvous or pale rufous hairs.¹

Total length (type, collector's measurements), 375 mm.; head and body, 190; tail vertebræ, 185; hind foot, s. u., 44; ear from notch, 21. Twenty-four adults (Br. Mus., 14 males, 10 females), total length, 366 (350–380), head and body, 186 (175–200); tail vertebræ, 184 (170–190); hind foot; s. u., 44 (40–46); ear, 22.5 (20–25).

Skull (type), total length, 49; zygomatic breadth, 28; interorbital breadth, 16; length of nasals, 15; diastema, 13; maxillary toothrow, 7.3 (from Thomas, *l. c.*). Three adult female skulls, Victoria, São Paulo, Brazil (U. S. Nat. Mus.), occipitonasal length, 47 (45.6–48); zygomatic breadth 27.8 (27.5–28.3); interorbital breadth, 15 (14.5–15.5); breadth of braincase, 21.3 (21–22); length of nasals, 13.3 (13–14); diastema, 11.7 (11–12); maxillary toothrow, 7.1 (7–7.4).

Specimens examined, 50.—**Brazil**: Southern Minas Geraes, Paraná, and São Paulo (Robert), 26 (Br. Mus.); Espirito Santo, 1 (Nat. Mus.); Roça Novo, Serro do Mar, Paraná, 1 (Field Mus.); Santa Rita, Bahia, 1 (Mus. Comp. Zool.); Cantogallo, and other points near city of Rio de Janeiro, 15 (alcoholic,² Mus. Comp. Zool.); Alambary, Rio Grande do Sul, 3 (Nat.

¹ Three specimens from Alambary (Victoria), São Paulo, differ from all the others in presenting the peculiar reddish tone of specimens made up from alcoholic material, and the condition of the feet also indicates that this has been the case.

² This is the alcoholic series referred by me in 1877 (Mon. N. A. Rodentia, pp. 757, 761, 762) to *Sciurus aestuans* var. *aestuans*, of which measurements are given on p. 761, and on which my description of var. *aestuans* was based. These specimens have been reexamined in the present connection.

Table VII.—Measurements of Species and Subspecies of *Guertinguetus*.

Species, localities, and by whom collected and measured		Number of specimens	Total length	Head and body	Tail vertebrae	Hind foot	Number of specimens	Total length	Zygomatic breadth	Interorbital breadth	Breadth of braincase	Length of nasals	Maxillary tooth-row
<i>estuans</i> British Guiana	Aver. Min. Max.						4	45.4 44 47.3	26.8 26 27	15.3 14.4 15.6	21.5 20 21	12.7 12 14	7.2 7 7.5
<i>gibbularis</i> Lower Caura, Ven. S. M. Klages	Aver. Min. Max.	5	342 329 357	169 155 177	173 165 178	45° 43 47	7	44.5 43 47.3	25.5 24.6 26.5	14.6 13.3 15.3	20 19 20.5	12.7 12 13.5	7 6.4 8
<i>quelchi</i>		1	343	178	165	47	1	45	27.5	16	—	10.5	6.8
<i>alphonsei</i> Pernambuco, Brazil A. Robert	Aver. Min. Max.	8	353 340 360	181 165 185	178 170 190	44° 42 45							
<i>paraensis</i> Lower Tocantins, Brazil A. Robert	Aver. Min. Max.	8	338 325 353	171 163 180	171 158 177	42° 40 45	1	44.2	26	15.6	20	12	7
<i>ingrami</i> Southern Minas Geraes, Brazil A. Robert	Aver. Min. Max.	24	366 350 380	186 175 200	184 170 190	44° 40 46	3	47 45.6 48	27.8 27.5 28.3	15 14.5 15.5	21.3 21 22	13.3 13 14	7.1 7 7.4

Mus.); São João, Rio Grande do Sul, 1 (Phila. Acad.); "Brazil," 2 (Nat. Mus. 1, Am. Mus. 1).

Remarks.—*Guerlinguetus ingrami* is not closely related to the *G. æstuans* group, from which it differs markedly in the character of the pelage, in coloration and in its much larger size. It has a superficial resemblance to Gray's *Macroxus leucogaster* in coloration and in character of pelage, but differs widely from it in the structure of the molar teeth, and in having 8 mammæ instead of only 6. It is less nearly related to the "*cuscinus*" group.

Genus **Hadrosciurus** gen. nov.

Text Fig. 9 (p. 163); Plate XII, Figs. 4–6; Plate XIV, Figs. 7, 8.

Type, *Sciurus flammifer* Thomas.

Size large, tail very long and bushy, about 53 % of the total length; general form strong and heavy; mammæ, 8.

Premolars, $\frac{1}{1}$. Skull moderately broad and heavy; rostrum short, with short broad nasals, their length about 20 % of the total length of the skull, and about 66 % of the interorbital breadth; dorsal outline flattened, nearly as in *Urosciurus* and *Simosciurus*; zygomatic arches convex, broadest opposite the postorbital processes; malar strongly developed, expanded at the middle to form a prominent superior process; dentition heavy, the molariform series broader and heavier than in any other South American squirrel; postorbital processes heavily developed. In general effect the skull is strong and massive, but its breadth is relatively less than in typical *Sciurus*.

Geographic distribution.—Valley of the Orinoco near mouth of Rio Caura. Extent of range not known. (See Map, p. 300.)

Remarks.—In external appearance *Hadrosciurus* has a general resemblance to *Urosciurus*, but the tail is heavier than in most of the species of that genus, in which respect it is only equalled in *U. duida*. The essential cranial characters are the heavy ossification, the relatively great breadth of the zygomatic arches, and the broad heavy malar with its prominent superior process. It resembles *Simosciurus* in the shortness of the rostrum, but not in other general features. In cranial characters it contrasts strongly with the typical forms of *Urosciurus*. The usual crenulation of the outer crown border of the maxillary teeth is well indicated on m^{1-3} in unworn teeth, except that the parastyle is feebly developed.

Remarks.—The only known representative of *Hadrosciurus* is *Sciurus flammifer* Thomas, a striking species in its external features and well distinguished from all its allies by cranial peculiarities.

Hadroskiurus flammifer (Thomas).

Text Fig. 9 (p. 163); Plate XII, Figs. 4-6; Plate XIV, Fig. 7, 8.

Sciurus flammifer THOMAS, Ann. and Mag. Nat. Hist. (7), XIV, p. 33, July, 1904.—ALLEN, Bull. Amer. Mus. Nat. Hist., XX, p. 340, Oct. 8, 1904 (La Union, El Llagual, and Suapure, Venezuela); *ibid.*, XXVIII, p. 146, May 27, 1910 (Rio Mocho, Venezuela); *ibid.*, XXX, p. 254, Dec. 2, 1911 (El Llagual).

Type locality.—La Union, Caura district, Middle Orinoco, Venezuela.

Geographic distribution.—Orinoco basin, from at least Ciudad Bolivar to Suapure.

Description.—Pelage long and coarse with very little underfur. Head and ears bright rufous, the ears with a postauricular patch of soft, light rufous hairs; rest of upperparts grizzled yellow and black, darkening on the lower back and rump to mixed rufous and black; lips and chin yellow orange; rest of underparts clear white, separated from the upperparts by an orange lateral line; outside of limbs bright rufous, inside white like the ventral surface; upper surface of feet orange rufous, lighter than the limbs; basal third of tail black narrowly fringed with orange red; rest of the tail (which is broad and bushy) orange on both surfaces.

The above description is based on a topotype, which agrees in every particular with the type. Five other specimens from La Union (and hence topotypes) are melanistic. In four of them the pattern of coloration is the same as in the type, but the head, lower back and limbs are duller, darker rufous; the rest of the upperparts is a grizzle of pale yellow and black; the underparts are dusky brown with a rufescent tinge, but no two of them are quite alike; tail brownish black (quite black at base) with a slight wash of fulvous, the hairs annulated broadly with brownish black and fulvous, with fulvous tips. The remaining specimen is both albinistic and melanistic, the head and feet being mixed white and rufous, and the ventral surface white with scattered black hairs. Of four specimens from El Llagual three are melanistic and one is like the type, but no two of the melanistic specimens agree in color. A single specimen from Ciudad Bolivar is also melanistic, while six from Suapure are like the type of the species. Of the 17 specimens in the American Museum collection 8 are normal and 9 are melanistic.

Total length (type, ex Thomas, *l. c.*), 598 mm.; head and body, 285; tail vertebræ, 313; hind foot (s. u.), 65, c. u., 70. Ten specimens (La Union and Suapure), total length, 580 (540-610); head and body, 274 (254-289); tail vertebræ, 310 (280-320); hind foot (c. u.), 66.5 (64-67).

Skull (5 topotypes), total length, 65.5 (64-67); zygomatic breadth, 38

(37-39); interorbital breadth, 23 (22-25); postorbital breadth, 20.5 (19-21); breadth of braincase, 26.5 (26-27); nasals, 20.1×9.2 ($19-21.5 \times 9-10$); diastema, 18; maxillary toothrow, 10.5 (10-11).

Specimens examined, 17.—**Venezuela**: La Union, 8 (Br. Mus. 2, type and paratype; Am. Mus. 6); El Llagual, 2 (Am. Mus.); Ciudad Bolivar, 1 (Am. Mus.); Rio Mocho, 1 (Am. Mus.); Suapure, 5 (Am. Mus.).

Remarks.—The geographic relationship of *Hadroskiurus flammifer* to the *Urosciurus* group is little known. *U. duida* occurs on the upper reaches of the main Orinoco, the *U. igniventris* group on the Rio Negro and in the Cundinamarca and Caquetá districts of Colombia, to which *flammifer* is much more nearly related than to *U. tricolor* or *U. duida*.

Genus *Urosciurus* gen. nov.

Text Figs. 10, 16 (pp. 164-165); Plates X and XI; Plate XIV, Figs. 1-6.

Type, *Sciurus tricolor* Poeppig.

Size large; tail long, broad, and bushy, the vertebræ about 50 to 52 % of the total length; mammæ, 8; pelage usually thin and short, often very thin on the ventral surface.

Premolars, $\frac{1}{1}$. Skull long and narrow, of medium depth (about 36 % of total length at m^3), and only moderately convex, the mid-dorsal outline nearly straight; length of nasals 31 to 33 % of total skull length; zygomata evenly convergent anteriorly, the breadth of the skull at m^1 being much less than at the posterior border of the zygomatic fossæ (about 50 % instead of 56 % of total skull length); malar weak, narrow, superior process slightly developed; dentition weak; molars with the cusps on outer border small and low, the intervening cusplets nearly suppressed; lower incisors long, in correlation with the long rostrum.

Geographic distribution.—Drainage basins of the upper Orinoco and middle and upper Amazon. (See map, p. 300.)

Remarks.—The special features of *Urosciurus* are the long, broad tail, which appears to reach its maximum development in *U. duida* (*q. v.*); the gradually anteriorly converging outlines of the skull, from the posterior border of the zygomatic fossæ to the end of the long narrow rostrum; the depressed dorsal outline, the general narrowness of the skull in proportion to its length, and the weak, simple dentition. The genus includes *U. tricolor*, *pyrrhonotus*, *igniventris*, *duida*, and *langsдорffii*, with their respective subspecies. The nasals vary in their posterior extension, reaching further back in *tricolor* than in the *igniventris* and *duida* groups. *U. langsдорffii* is aberrant, but seems better placed here than in any of the other generic groups here recognized, and not sufficiently differentiated to warrant

separation from the typical forms of *Urosciurus*. It also occupies a different faunal area, its range being outside and south of the great Amazonian forest region, which constitutes the principal range of the genus.

Species and Subspecies of Urosciurus, with type localities and statement of number of specimens examined.

Urosciurus tricolor (Pöppig). Maynas, near junction of Huallaga and Marañon Rivers. Specimens examined, 3.

Urosciurus duida (Allen). Southern base of Mount Duida, Venezuela. Specimens examined, 3.

Urosciurus igniventris igniventris (Wagner). Maribitanos, Upper Rio Negro, Brazil. Specimens examined, 5.

Urosciurus igniventris tædifer (Thomas). Bogotá district, Colombia. Specimens examined, 1.

Urosciurus igniventris cocalis (Thomas). Near junction of Rio Coco and Rio Napo, Ecuador. Specimens examined, 2.

Urosciurus igniventris zamoræ (Allen). Zamora, Ecuador. Specimens examined, 1.

Urosciurus pyrrhonotus pyrrhonotus (Wagner). Borba, Brazil, near mouth of Rio Madeira. Specimens examined, 1.

Urosciurus pyrrhonotus castus (Thomas). Chimate, Bolivia. Specimens examined, 1.

Urosciurus langsdorffii langsdorffii (Brandt). "Brasilia" = Cuyabá, Matto Grosso, Brazil. Specimens examined, 16.

Urosciurus langsdorffii urucumus (Allen). Urucum, Matto Grosso, Brazil. Specimens examined, 11.

Urosciurus langsdorffii steinbachi (Allen). Sta. Cruz de la Sierra, Bolivia. Specimens examined, 5.

Key to the Species and Subspecies of Urosciurus.

Skull with rostrum very long and narrow.

Upperparts dark brown or blackish, washed with ochraceous; underparts pale yellowish..... *tricolor* (p. 269)

Upperparts lighter, washed with yellowish gray; underparts dark ferruginous..... *duida* (p. 270)

Skull with rostrum shorter.

Upperparts heavily washed with ochraceous; head ochraceous rufous; underparts ferruginous.

Tail with basal third deep black, rest heavily fringed with reddish orange, concealing the black basal portion of the hairs.

igniventris (p. 271)

Tail with much less black, otherwise similar to *igniventris*.

- tædifer* (p. 272)
- Upperparts with median area from crown to base of tail blackish; underparts pale ochraceous buff.....*cocalis* (p. 273)
- Similar in general coloration but much smaller.....*zamora* (p. 274)
- Upperparts posteriorly washed heavily with reddish; tail as in the *igniventris* group.
- Underparts pale yellowish.....*pyrrhonotus* (p. 275)
- Underparts white.....*castus* (p. 276)
- Upperparts grizzled with pale yellowish and dusky; underparts ochraceous buff.
- langsdoeffii* (p. 276)
- General coloration above darker, with much more black in the tail; size smaller.....*urucumus* (p. 278)
- General coloration paler; size larger.....*steinbachi* (p. 279)

***Urosciurus tricolor* (Pœppig).**

Text Figs. 10, 16 (pp. 164, 165); Plate X, Figs. 1-3.

Sciurus tricolor TSCHUDI (ex Pœppig), Fauna Peruana, I, Therologie, 1844, pp. 156, 160, pl. xi, animal.—Pœppig, in Tschudi, *op. cit.*, p. 157, footnote.—WAGNER, Abhandl. K.-B. Akad. Wissen. München, V, 1850, p. 279.—THOMAS, Ann. and Mag. Nat. Hist. (7), VI, p. 137, July, 1900 (mouth of Rio Coco, Upper Rio Negro).—OSGOOD, Field Mus. Nat. Hist., Zool., X, No. 12, p. 154, April 20, 1914 (Lagunas and Puerto Arturo, Huallaga River, Peru).

? *Sciurus fumigatus* GRAY, Ann. and Mag. Nat. Hist. (3), XX, Dec. 1867, p. 428 ("Upper Amazon"). "May possibly be referable to *S. tricolor*, but its determination must always remain somewhat doubtful."—Thomas, *l. c.*

? *Sciurus brunneoniger* GRAY, Ann. and Mag. Nat. Hist. (3), XX, p. 429, Dec. 1867. Also "a member of the present group, but is not like any properly localized species I have seen."—Thomas, *l. c.*

Type locality.—Maynas, in the angle between the Lower Huallaga and the Marañon.

Geographic distribution.—Northeastern Peru.

Description.—Pelage short, thin and harsh, nearly without underfur; ventral surface very thinly clothed. Mammæ 8 (not 6 as stated by Tschudi).

Upperparts dark reddish or yellowish brown, the hairs black, slightly tipped and subapically narrowly annulated with ochraceous orange or ochraceous red (in different specimens); top of head blackish, darker than the back; front and sides of head orange with a short narrow black nasal stripe; fore limbs externally bright rufous, hind limbs dark rufous; underparts and inner surface of hind limbs varying in different specimens from rufous to yellowish white; tail above for the basal third black more or less grizzled with rufous, rest of upper surface washed with orange, the basal

three fourths of the hairs black, the apical fourth orange; under surface of tail at extreme base grizzled rufous and black, beyond the basal inch black to the tip, broadly fringed for the distal two thirds with orange, including the terminal hairs.

Total length (No. 19672 Field Mus., ♀ ad., Yurimaguas, Peru), 533 mm.; head and body, 273; tail vertebræ, 260; hind foot, 69. Skull (same specimen), total length, 69; zygomatic breadth, 38.7; interorbital breadth, 21; postorbital breadth, 19; breadth of braincase, 24; nasals, 22×8 ; diastema, 21; maxillary toothrow, 10. Another specimen (No. 19673 Field Mus., ♀ ad., Lagunas, Peru), total length, 70.3; zygomatic breadth, 39.3; interorbital breadth, 21; postorbital breadth, 20; breadth of braincase, 24; nasals, 20.5×10 ; diastema, 21; maxillary toothrow, 10.

Specimens examined, 3.—**Peru**: Yurimaguas, 1, and Lagunas, 1 (Field Mus.); Rio Madre de Dios, 1 (Mus. Comp. Zool.).

Remarks.—In common with the other large squirrels of South America *Sciurus tricolor* presents a wide range of individual variation, especially in the color of the ventral surface, which in some specimens is deep rufous, in others yellowish white or nearly clear white. *S. tricolor* differs from the large squirrels of the *langsдорffi-igniventris-pyrrhonotus* group in the form of the skull, which is relatively longer and narrower, with a relatively longer and narrower rostrum, a longer diastema, and longer lower incisors.

***Urosciurus duida* (Allen).**

Text Fig. 11 (p. 164); Plate X, Figs. 4–6; Plate XIV, Figs. 1, 2.

Sciurus duida ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 594, Oct. 8, 1914.

Type locality.—Rio Cunucunumá, southern base of Mount Duida, Venezuela; altitude 700 feet.

Geographic distribution.—Known only from the type locality.

Description.—“Size large, pelage long and soft with abundant underfur; tail very broad. Upperparts (type) blackish washed lightly with pale cream color, the hairs brownish black slightly tipped with cream color, the general surface effect yellowish gray on a brownish black ground color; top of head darker brown, the hairs minutely tipped with pale rufous; sides of head cinnamon brown; lower back and rump scarcely darker than the middle of the back but the hairs are tipped with very pale rufous instead of cream color; underparts dark ferruginous to the base, the upper chest and throat paler; fore limbs and feet intense deep rufous; hind limbs externally chestnut grizzled with black, internally dark ferruginous; upper surface of hind feet reddish orange; tail above black for about the basal fifth, rest

of the upper surface washed lightly with orange yellow, the black subbasal portion of the hairs strongly visible at the surface, the base of the hairs annulated with pale buff; tail below almost wholly intense black for the proximal half, the distal half grizzled black and pale orange yellow, black predominating, and narrowly fringed with pale orange yellow. One of the two topotypes is like the type, in the other the hair tips of the upperparts and the fringe of the tail are a little deeper tone of yellow.

"Total length (type), 560 mm.; head and body, 270; tail vertebræ, 290; hind foot, 65. The lateral hairs of the tail are fully 75 mm. long, and when the hairs are directed laterally give a breadth of fully 6 inches,—about one third greater than in *S. tricolor* or in any member of the *langsдорffii-igniventris-pyrrhonotus* group.

"Skull (type), total length, 66; zygomatic breadth, 38; interorbital breadth, 20; postorbital breadth, 19.3; breadth of braincase, 25; nasals, 22×8.2 ; diastema, 19; maxillary toothrow, 10. Rostrum relatively long and narrow."—Allen, *l. c.*

Specimens examined, 3.—**Venezuela**: Southern base of Mt. Duida, type and 2 topotypes (Am. Mus.).

Remarks.—In the form of the skull *Sciurus duidae* closely resembles *S. tricolor*, especially in the narrow, slender, and relatively long rostrum, but it has no near resemblance to that species in coloration or texture of pelage, in which it most resembles the *igniventris* group, with which, however, the form of the skull denotes no close relationship. A striking feature of this species is its magnificent tail, which is fully one third broader than that of any other South American squirrel.

***Urosciurus igniventris igniventris* (Wagner).**

Plate XIV, Figs. 3, 4.

Sciurus igniventris WAGNER (ex Natterer, MS.), Wiegmann's Arch. f. Naturg., 1842, I, p. 360; Abhandl. math.-phys. Classe, K.-B. Akad. Wissen. München, V, 1850, p. 275.—ALLEN, Mon. N. Amer. Rodent., 1877, pp. 768–773 (part, only the reference to *S. igniventris* Wagner).—THOMAS, Ann. and Mag. Nat. Hist. (7), VI, p. 137, July, 1900, part (Nericagua and Munduapo, Upper Orinoco; not the Bogotá specimens = *S. i. teddifer* Thomas, 1903).

Sciurus morio WAGNER, Abhandl. math.-phys. Classe, K.-B. Akad. Wissen. München, V, 1850, p. 275 (a melanism of *S. igniventris*).

Sciurus variabilis ALLEN, Mon. N. Amer. Rodentia, 1877, p. 768, part.—ALSTON, Proc. Zool. Soc. London, 1878, p. 665, part.

Type locality.—Maribitanos, Upper Rio Negro, Brazil.

Geographic distribution.—Upper Rio Negro and Upper Orinoco, west in Colombia to base of Eastern Andes.

Description.—Upperparts of body grizzled ochraceous and black, the hairs black broadly tipped with ochraceous; top of head, limbs, and whole ventral surface deep red; tail above at base black, the hairs tipped with orange, rest of upper surface orange; tail below deep black for the basal third, and medially the hairs are black at base nearly to the end of the vertebræ, the tips orange or reddish orange, which toward the end of the tail nearly or quite conceal the black.

Total length (3 adult specimens from Florencia and 1 from Murelia, collector's measurements), 530 (520–540 mm.); head and body, 270 (260–280); tail vertebræ, 260 (250–270); hind foot, c. u., 60.

Skull (1 specimen from Murelia), total length, 63; zygomatic breadth, 37; interorbital breadth, 23; postorbital breadth, 21; breadth of braincase, 26.3; nasals, 19×9.6 ; maxillary tooththrow, 9.8.

Specimens examined, 5.—**Colombia**: Florencia, 4; Murelia, 1 (all Am. Mus.); also a number of specimens in the British Museum, with which the above were compared, but which I neglected to record definitely in my notes).

Remarks.—The specimens here recorded from Florencia and Murelia appear to be positively referable to true *igniventris*, which differs from *S. igniventris tædifer* Thomas as indicate below.

***Urosciurus igniventris tædifer* (Thomas).**

Sciurus igniventris THOMAS, Ann. and Mag. Nat. Hist. (7), VI, p. 137, July, 1900 (part, the "Bogotá" specimens only).

Sciurus igniventris tædifer THOMAS, Ann. and Mag. Nat. Hist. (7), XI, p. 487, May, 1903.

Type locality.—"Sabaña Grande, near Bogotá, Colombia." As Sabaña Grande is open pampas country, it can hardly be the true type locality of this large forest squirrel. A single specimen in the American Museum, which agrees perfectly with Thomas's description of *tædifer*, is from Buenavista (altitude 4500 feet), about 50 miles southeast of Bogotá.

Geographic distribution.—Known only from the vicinity of Bogotá.

Description.—Similar to *S. igniventris igniventris*, except that there is less black at the base of the tail, and very much less on the under side of the tail beyond the black basal area.

Total length (1 specimen, collector's measurements, Buenavista), 505 mm.; head and body, 259; tail vertebræ, 246; hind foot (c. u.), 67.

Skull, total length, 63; zygomatic breadth, 37; interorbital breadth, 22; postorbital breadth, 21; breadth of braincase, 27; nasals, 19×9 ; diastema, 17; maxillary tooththrow, 10.

Specimens examined, 1.—**Colombia**: Buenavista (alt. 4500 ft.), 1 (Am. Mus.).

Remarks.—A rather weakly differentiated form of *igniventris*, differing from it in having less black in the tail. Known, however, at present from only two specimens, the type in the British Museum, from near Bogotá, and a specimen from Buenavista in the American Museum.

***Urosciurus igniventris cocalis* (Thomas).**

Sciurus cocalis THOMAS, Ann. and Mag. Nat. Hist. (7), VI, p. 138, July, 1900.—OSGOOD, Field Mus. Nat. Hist., Zool., X, No. 12, p. 153, April 20, 1914 (Yurimaguas, Huallaga River, Peru).

Type locality.—Mouth of Rio Coco, upper Rio Napo, Ecuador.

Geographic distribution.—Upper parts of the tributaries of the Rio Marañon, from the Rio Coco south at least to the Rio Huallaga. Limits of range not known.

Description.—Similar in size and in general coloration to *Urosciurus igniventris igniventris*, but the light tips of the hairs are greatly reduced in extent or quite absent, leaving the black strongly predominant, and the underparts are pale yellow instead of red. Head orange on the sides, red finely varied with black on the top, continuous with the same color on nape, shoulders and flanks (the tipping of the hairs varying in color in different specimens from orange to dark chestnut red); back posteriorly nearly or wholly black, the black extending also over the basal third of the upper surface of the tail; underparts nearly uniform ochraceous buff; fore limbs and feet pale orange; hind limbs chestnut, feet orange red; ears red, paler at base, with a large postauricular patch of soft orange yellow hairs; tail above wholly black at base, the rest at surface orange, the hairs broadly zoned with black subbasally, the black zone visible both above and below on slight displacement of the hairs at the surface, and gradually narrowing on the apical half of the tail.

Total length (2 adult females), 569, 559 mm.; head and body, 266, 276; tail vertebrae, 295, 283; hind foot, c. u., 68, 64.

Skull (same specimens), total length, 63, 62; zygomatic breadth, 38, 37; interorbital breadth, 22.2, —; postorbital breadth, 20, —; breadth of braincase, 25, 25; nasals, 20×9.5 , 19×9 ; diastema, 17; maxillary tooth-row, 10, 10.

Specimens examined, 2.—**Peru**: Yurimaguas, mouth of Rio Huallaga (alt. 600 ft.), 2 (Field Mus.).

Remarks.—At present *Sciurus cocalis* is known from very few specimens and from two localities, mouth of the Rio Coco (type locality), and mouth

of the Rio Huallaga (Osgood). It is less different from *igniventris* than are a number of the subspecies of the *gerrardi* group from each other.

***Urosciurus igniventris zamoræ* (Allen).**

Sciurus igniventris zamoræ ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 594, Oct. 8, 1914.

• *Type locality*.—Zamora, Ecuador; altitude 2000 feet.

Geographic distribution.—Known only from the type locality.

Description.—"Similar to *S. igniventris cocalis* but much smaller, with the whole under surface of the tail black except a narrow orange red border on the apical two thirds, and other color differences.

"Upperparts blackish, the hairs tipped with chestnut, very minutely over the dorsal region, more broadly on the flanks, and with fine punctations of yellow on the head; postauricular patches orange; underparts nearly uniform pale ochraceous buff, brighter on inside of fore and hind limbs and laterally; tail above dull black for the basal third, the hairs strongly tipped with chestnut, the rest bright orange, the hairs black subbasally for half their length with long orange tips; lower surface of tail grizzled red and black for the proximal fourth, the red predominating, followed by a broad band of black extending nearly to the tip of the tail and narrowly fringed with orange, black thus prevailing from near the base, to the tip, with an outer border of orange, the terminal hairs black for half their length; fore limbs and feet externally light yellow; hind limbs externally chestnut, the feet pale orange.

"Total length (in skin), 490 mm.; head and body, 260; tail vertebræ, 230; hind foot, c. u., 61. (The collector's measurements give the total length as 520, which is obviously erroneous, and the tail as 230).

"Skull, total length, 59; zygomatic breadth, 33.5; interorbital breadth, 19; postorbital breadth, 20.5; breadth of braincase, 25; nasals, 16.3 × 9; maxillary toothrow, 9.2. The type is an old male with much worn teeth.

Specimens examined, 1, the type.

Remarks.—" *Sciurus igniventris zamoræ* differs from *cocalis*, its nearest geographical representative, in much smaller size, the total length being about 60 mm. less than in *cocalis*, the total length and zygomatic breadth of the skull 3.5 mm. less, and other cranial measurements proportionally less. While the general coloration is similar to that of *cocalis* there are many minor differences, aside from the color of the tail, which differs in the presence of a much larger amount of black on the under surface. It thus differs in coloration from true *igniventris* as *tædifer* does, but in the opposite direc-

tion, having much more black in the tail instead of less. In addition to this is the marked difference in size, *zamora* being much smaller than any other subspecies of the *igniventris* group. The type locality of *zamora* is 250 to 300 miles from any known locality of *cocalis* and in a quite different environment. Either *zamora* is a small form of *cocalis*, or the type must be construed as a dwarf, and its color differentiation as an individual aberration, although it has the appearance of being in every way a normal adult."—Allen, *l. c.*

***Urosciurus pyrrhonotus pyrrhonotus* (Wagner).**

Plate XI, Figs. 1-3.

Sciurus pyrrhonotus WAGNER (ex Natterer MS.), Wiegmann's Arch. f. Naturg., 1842, I, p. 260; Abhandl. math.-phys. Cl. K.-B. Akad. Wissen. München, V, 1850, p. 277.—PELZELN, Verhandl. K.-K. zool.-bot. Gesells. Wien, XXXIII, Beiheft, 1883, p. 60.

Type locality.—Borba, Brazil, near mouth of Rio Madeira.

Geographic distribution.—Interior of Brazil, from mouth of Rio Madeira southwestward. Exact range unknown.

Description.—Upperparts rust red, paler and more orange red anteriorly, passing into dark fiery red posteriorly; top of head darker; ears red; underparts whitish yellow or ochraceous yellow, lighter on throat and chest, or irregularly patched with white; fore limbs and feet bright red, hind feet orange red; tail above with the basal fourth black, rest of upper surface heavily washed with orange red, the hairs black for their basal half or two thirds, black showing more or less through the red tips; under surface of tail black for the basal third, beyond which the median area is black broadly edged with red, the black decreasing and the red increasing in amount toward the tip, the terminal hairs being black for the basal two thirds and tipped with red.

Total length (1 specimen, ♂ ad., from Calama, on Rio Madeira at mouth of Rio Gy-Paraná), 540 mm.; head and body, 270; tail vertebræ, 270; hind foot, c. u., 72.

Skull (same specimen), total length, 65; zygomatic breadth, 37; inter-orbital breadth, 22; postorbital breadth, 19; breadth of braincase, 23.6; nasals, 18 × 8; diastema, 18; maxillary toothrow, 10.

Specimens examined, 1.—**Brazil**: Calama, Rio Madeira at mouth of Rio Gy-Paraná (Am. Mus., Roosevelt Exped.).

Remarks.—The only specimen available for examination was taken on the Lower Rio Madeira not far from the type locality.

Sciurus pyrrhonotus and *Sciurus igniventris* are apparently representative forms of the same species, for which the name *igniventris* has priority of place on the same page. In size and in pattern of coloration there is a close similarity, the differences being the different shades of color that make up the different areas of the pattern. The rostral part of the skull, however, is much narrower in *pyrrhonotus* than in *igniventris*, with much narrower and shorter nasals.

***Urosciurus pyrrhonotus castus* (Thomas).**

Sciurus pyrrhonotus THOMAS, Ann. and Mag. Nat. Hist. (7), VI, p. 139, July, 1900, part (Yungas and Misiones, upper Marmoré, Bolivia).

Sciurus castus THOMAS, Ann. and Mag. Nat. Hist. (7), XI, p. 488, May, 1903.

Type locality.—Chimate (altitude 700 m.), Bolivia, long. 68° W., lat. 15° S., on the upper Rio Bene.

Geographical distribution.—Known only from the Department of Yungas, upper Rio Bene, Bolivia.

Description.—Similar to *Sciurus pyrrhonotus*, but ventral surface and inside of limbs "pure sharply defined white."

Specimens examined, 1.—"**Brazil**," 1 (Field Mus.).

Remarks.—A specimen in the Field Museum of Natural History (No. 8283), from "Brazil" (bought of E. Gerrard), agrees well with the description of *castus*, except that the ventral surface and inside of the limbs, throat, chest, and greater part of abdomen (especially medially) are clear white, but the pelage is very thin, the skin showing through the hairs; the sides of abdomen posteriorly and the inside of the hind limbs are pale yellow. The basal third of the tail is mixed rufous and blackish, in general effect a little darker than in true *pyrrhonotus*.

***Urosciurus langsdorffii langsdorffii* (Brandt).**

Plate XI, Figs. 4-6.

Sciurus langsdorffii BRANDT, Mém. Acad. Sci. St. Pétersbourg (6), Math. Phys. et Nat., III, pt. 2, 1835, p. 425, pl. xi, animal and skull ("Brasilia").—WAGNER, Suppl. Schreber's Säuget., III, 1843, p. 183; Abhandl. K.-B. Akad. Wissen. München, V, 1850, p. 273, Cuyabá, Matto Grosso, Brazil.—THOMAS, Proc. Zool. Soc. London, 1903 (April 1, 1904), p. 237 (Chapada, Matto Grosso, Brazil).

Sciurus variabilis ALLEN, Mon. N. Amer. Rodentia, 1877, p. 768, part; Bull. U. S. Geol. and Geogr. Survey Terr. (Hayden), IV, No. 2, p. 884, part. (The status of *S. langsdorffii* discussed on pp. 769, 770).—ALSTON, Proc. Zool. Soc. London, 1878, p. 665, part.

Sciurus variabilis var. *langsдорffii* COPE, Amer. Nat., Feb. 1883, p. 135 (Chapada, Matto Grosso).

Type locality.—"Brasilia" = Cuyabá, Matto Grosso, Brazil.

Brandt, in describing *langsдорffii*, gave no definite type locality. Wagner (1850, *l. c.*) found that Natterer's specimens from Cuyabá, Matto Grosso, were like Brandt's type, and restricted the name *langsдорffii* to the Matto Grosso form. Later Thomas (1903, *l. c.*) confirmed this action, stating that a series of specimens from Chapada (only a few miles from Cuyabá), Matto Grosso, represents "the true *S. langsдорffii*." Cuyabá, Matto Grosso, may therefore be taken as the type locality of the species.

Geographic distribution.—Southwestern Brazil (Matto Grosso). Boundaries of range not known.

Description.¹—Upper surface of head grizzled yellowish rufous and black, front and sides of head nearly clear rufous; upperparts of body from nape to rump grizzled yellowish and dusky, the hairs dusky with pale yellowish tips; rump and basal fourth to third of tail grizzled dark rufous (or chestnut) and black; underparts nearly uniform ochraceous buff, in some specimens with a narrow line of small spots of white on the chest; fore limbs and feet externally grizzled pale yellow and dusky, internally orange buff, deeper colored than the ventral surface; hind limbs externally reddish chestnut, feet paler; upper surface of tail for basal third grizzled rufous and black, more or less in contrast with the back; rest of the tail above orange, the hairs black at base with long orange tips, the black showing through when the hairs are disarranged; lower surface of the tail similar to the upper, the hairs black basally and tipped with orange, the black not wholly concealed and in some specimens strongly visible on the median line of the proximal half.

External measurements of 2 Chapada specimens are as follows: Total length, 510, 504 mm.; head and body, 260, 250; tail vertebræ, 257, 254; hind foot (dry skin), 55, 56.

Skull (8 specimens, Chapada), total length, 62 (60.8–64); zygomatic breadth, 36.4 (35–38); interorbital breadth, 20.4 (20–21); postorbital breadth, 18.9 (18.5–19); breadth of braincase, 23.8 (23.3–24.3); nasals, 18.5 × 8.3 (17.3–19 × 7.8–8.7); diastema, 18 (17.5–19); maxillary tooth-row, 9.8 (9.3–10).

Specimens examined, 16.—**Brazil**: Chapada, Matto Grosso, 15 (Nat. Mus., 4; Acad. Nat. Sci. Philadelphia, 10, Am. Mus. 1, coll. H. H. Smith); "South America," 1 (Nat. Mus.).

¹ Based on Chapada, Matto Grosso, specimens, collected by H. H. Smith.

***Urosciurus langsdorffii urucumus* (Allen).**

Sciurus langsdorffii urucumus ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 595, Sept. 8, 1914.

Type locality.—Urucum, Rio Paraguay (at mouth of Rio Tacuary), Matto Grosso, Brazil; altitude 400 feet.

Geographic distribution.—Known only from the vicinity of the type locality, in southwestern Matto Grosso, Brazil.

Description.—"Similar in general to *S. langsdorffii langsdorffii*, but much smaller and darker colored, with much blacker tail. Upperparts dusky brown, the hairs brownish black minutely tipped with yellowish; nose and front of head pale orange with a narrow median stripe of black on the nose; lower back and rump with tips of the hairs inclining to dark rufous; ears externally blackish edged with rufous; postauricular patch of soft rufous hairs conspicuous; underparts nearly uniform ochraceous buff; fore limbs and feet externally grizzled buff and black; hind limbs externally light chestnut, feet grizzled dark rufous and black; tail above for the basal fourth intense black, usually a few of the hairs tipped with chestnut; rest of the upper surface of tail pale orange, the hairs black for the greater part of their length, tipped with pale orange, through which the black basal portion of the hairs is more or less visible; tail below for the basal third or more, and medially often nearly to the end, intense black, fringed with orange for the apical two thirds and at the tip.

"Total length (type, collector's measurements), 500 mm.; head and body, 260; tail vertebræ, 260; hind foot, s. u., 60, c. u., 63. Six adults (all topotypes), total length, 502 (490–530), head and body, 251 (240–260); tail vertebræ, 250 (230–260); hind foot, c. u., 60.5 (60–63).

"Skull (type), total length, 57; zygomatic breadth, 35.2; interorbital breadth, 19; postorbital breadth, 18; breadth of braincase, 23.2; nasals, 17×7 ; diastema, 16; maxillary toothrow, 8.5. Seven skulls (type and 6 topotypes), total length, 59 (57–61); zygomatic breadth, 35 (34.6–36); interorbital breadth, 19.6 (19–21); postorbital breadth, 18.3 (18–19); breadth of braincase, 23.4 (22.6–24); nasals, 18.3×7.4 (17.5–19 \times 7–8); diastema, 16 (16–18); maxillary toothrow, 8.8 (8.3–9.2)." — Allen, *l. c.*

Specimens examined, 11.—**Brazil**: Urucum, 7; Tapirapoan, 4 (Am. Mus., Roosevelt Exped.).

Remarks.—The type locality is about 350 miles south of Cuyabá, the type locality of *langsdorffii*. While the external measurements (on the basis of collectors' measurements) of *urucumus* seem to slightly exceed those of either *langsdorffii* or *steinbachi*, the skulls are markedly smaller, with nar-

rower braincase and weaker dentition, and the total length of the skull is 3 to 4 mm. less, with corresponding differences in all other measurements. The coloration in *urucumus* is much darker than in either *langsдорffi* or *steinbachi*, the light tips to the hairs being shorter and paler, while the black in the tail is more intense and greatly increased in area.

***Urosciurus langsдорffi steinbachi* (Allen).**

Sciurus langsдорffi steinbachi ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 596, Sept. 8, 1914.

Type locality.— Santa Cruz de la Sierra, Bolivia.

Geographic distribution.— Known only from the type locality.

Description.— “Differs from *S. langsдорffi langsдорffi* in much paler coloration throughout, the hairs of upperparts being slightly tipped with pale yellow instead of heavily tipped with orange; the top of the head and nape slightly washed with yellow instead of orange rufous; nose and sides of head dull yellowish instead of deep rufous; thighs rufous instead of chestnut; underparts pale yellow instead of ochraceous yellow, and tail fringed with a lighter shade of yellow.

“Total length (type, collector’s measurements), 505 mm.; head and body, 250; tail vertebræ, 255; hind foot, 55; ear, 32. Five specimens (including type), total length, 491 (475–505); head and body, 254 (250–260); tail vertebræ, 235 (225–255); hind foot, s. u., 55 (55–55).

“Skull (type), total length, 63; zygomatic breadth, 37; interorbital breadth, 23; postorbital breadth, 19; breadth of braincase, 23; nasals, 20×9 ; maxillary toothrow, 9. Five skulls (including type), total length, 60.6 (60.2–61); zygomatic breadth, 36 (35–37); interorbital breadth, 20.6 (20–21); postorbital breadth, 18.6 (18–19); breadth of braincase, 23.6 (23–24); nasals, 18.3×7.9 ($17.8\text{--}19.8 \times 7.6\text{--}8$); maxillary toothrow, 9 (9–9.2).” — Allen, *l. c.*

Specimens examined.— **Bolivia**: Santa Cruz de la Sierra, 5 (Carnegie Mus., Pittsburgh).

Remarks.— Agrees closely in size and in general coloration with subspecies *langsдорffi*, but is readily distinguishable by the absence of the strong rufous color of the head present in both *langsдорffi* and *urucumus*. The type locality is about 300 miles southwest of Chapada, and about the same distance west of the type locality of *urucumus*.

Genus **Simosciurus** gen. nov.

Text Fig. 12 (p. 164); Plate XII, Figs. 1-3; Plate XIV, Figs. 5, 6.

Type, *Sciurus stramineus* Eydoux and Souleyet.

Size large; tail long and narrow, the vertebræ about 52 % of the total length; mammae, 8; pelage very long and thick.

Premolars, $\frac{1}{1}$. Skull short, due mainly to the extremely short rostrum; nasals very broad and short, about 22 % of the total length of the skull, and only about 60 % of the interorbital breadth instead of 90 % as in *Urosciurus*; dorsal profile flattened and nearly straight over the mid-dorsal half of the skull as in *Urosciurus*, not highly convex as in the small and medium-sized South American squirrels; zygomata slightly convergent anteriorly; malar broad and heavy, without superior expansion; dentition of rather more than medium strength, similar in structural details to that of the other large South American squirrels.

Geographic distribution.—Southwestern Ecuador and northwestern Peru. (See map, p. 300.)

Remarks.—The distinctive features of *Simosciurus* are the extremely short rostrum, giving the skull a peculiar snub-nosed effect, the correlatively very short and broad nasals, and the heavily developed zygomata. While the tail is long, the numerous specimens at hand show it to be narrow and lightly haired in comparison with *Hadrosciurus* and *Urosciurus*. The genus is thus far represented by only *Sciurus stramineus* and its several subspecies, geographically restricted to a comparatively limited area in southwestern Ecuador and northwestern Peru bordering the Gulf of Guayaquil.

Species and Subspecies of Simosciurus, with type localities and statement of number of specimens examined.

Simosciurus stramineus stramineus (Eydoux and Souleyet). Omatope, Peru. Specimens examined, 8.

Simosciurus stramineus neboxii (I. Geoffroy). Near Payta, Peru. Specimens examined, 5.

Simosciurus stramineus guyanus (Thomas). Balzar Mountains, western Ecuador. Specimens examined, 0.

Simosciurus stramineus zarumæ (Allen). Zaruma, southwestern Ecuador. Specimens examined, 1.

Key to the Subspecies of Simosciurus.

With a nuchal white patch.

Upperparts yellowish gray, underparts whitish gray.....*neboxii* (p. 282)

Upperparts deep yellowish rufous, underparts brownish gray..*zarumæ* (p. 284)

With no nuchal white patch.

Upperparts dark, washed with yellowish gray; underparts dark brown.

stramineus (p. 281)

Upperparts pale, underparts dark brown washed mesially with gray.

guayanus (p. 283)

***Simosciurus stramineus stramineus* (Eydoux and Souleyet).**

Text Fig. 12 (p. 164); Plate XII, Figs. 1-3; Plate XIV, Figs. 5, 6.

Sciurus stramineus EYDOUX and SOULEYET, Voy. Bonite, Zool., I, 1841, p. 73, pl. ix.—TSCHUDI, Fauna Peruana, Therologie, 1844, p. 159.—ALSTON, Proc. Zool. Soc. London, 1878, p. 664 (part).—ALLEN, Bull. U. S. Geol. and Geogr. Surv. Territories (Hayden), IV, No. 4, p. 883, Dec. 11, 1878.—THOMAS, Ann. and Mag. Nat. Hist. (7), V, pp. 150, 151, Jan. 1900 (in text).

Sciurus hypopyrrhus ALLEN (not of Wagler), Mon. N. Amer. Rodentia, 1877, p. 746 (part, only the Guayaquil specimens).

Macroxus fraseri GRAY, Ann. and Mag. Nat. Hist. (3), XX, p. 430, Dec. 1867. Ecuador. (Cf. Thomas, l. c., p. 150).

Type locality.—Omatope, Peru.

Geographic distribution.—Western slope of the Andean region of northwestern Peru and southwestern Ecuador.

Description.—Pelage full, rather coarse, with abundant underfur; tail narrow and long. Mammæ 8 (variable in different specimens, the full number not always being functionally developed). Very variable in coloration through purely individual differentiation.

Upperparts (an average specimen from Guayaquil), hairs deep black for the basal seven eighths, narrowly tipped with pale yellowish gray on the nape, shoulders, front half of the dorsal region and sides of body; lower back, rump, and basal sixth of tail with the hairs broadly tipped with dark rufous; top of head and nose black, the hairs minutely punctated with rufous; sides of head dull hazel with a blackish wash; underparts dark rusty brown, with whitish hair tips over the median area; fore limbs externally with the hair tips pale rufous, deepening to clear rufous at the carpus and base of metacarpals, passing into black on the toes; fore limbs internally like the ventral surface, passing into dark rufous at the carpal joint; hind limbs externally like the lower back and base of tail, the feet black slightly varied with dark rufous proximally; tail at extreme base (both above and below) mixed dark chestnut and black; rest of the tail black washed with white, the hairs black with white or pale yellowish white tips.

Two other Guayaquil specimens differ from the above in having the posterior half of the dorsal area, hind limbs, and base of tail chestnut rufous, and the underparts much darker — brownish black with the hair tips

rufous instead of whitish, and the feet deep black. In still another specimen the rump, hind limbs, and base of tail are pale yellowish rufous, the underparts rusty brown with the hair tips lighter, and the fore and hind feet pale rufous with only the toes black, those of the hind feet mixed rufous and black. Three of the above mentioned four specimens are profusely spotted on the fore-back, shoulders, limbs, throat and breast, with irregularly distributed tufts of projecting stiff white hairs, due probably to injuries caused by bites of insects. They are more or less commonly seen in all the squirrels, both large and small, occurring in the humid tropical coast belt from Peru northward to Central America.

Another series of 4 specimens from Daule, situated about 50 miles northwest of Guayaquil, parallels the 4 specimens from Guayaquil in respect to individual color variation. In one the ventral surface is quite heavily washed with rufous; in another the feet are rufous to the base of the toes, and in others the rufous of the tarsal and carpal regions extends on to the proximal portion of the foot.

The only external measurements available are the collector's measurements of the Daule specimens, 3 adult females: total length, 585 (570-620 mm.); head and body, 283 (260-320); tail vertebræ, 303 (300-310); hind foot, 60 (all 60). An adult male from Guayaquil, total length, 630; head and body, 300; tail vertebræ, 330; hind foot, 65.

Five skulls (Guayaquil, 1, Daule, 4; 2 ♂♂, 3 ♀♀), total length, 58 (57-60); zygomatic breadth, 32.2 (32-33); interorbital breadth, 19 (18-20); postorbital breadth, 17.5 (17-18); breadth of braincase, 22.7 (22-23.5); nasals, 16×8.6 ($15-17 \times 8-9$); diastema, 14.2 (14-14.5); maxillary toothrow, 10.3 (10-10.5). The skull is small relatively to the external measurements, with heavy dentition, and short, broad nasals, their breadth at the front border about one half of the length.

Specimens examined, 8.—**Ecuador**: Guayaquil, 4 (Am. Mus. 1, Nat. Mus. 2, Mus. Comp. Zool. 1); Daule, 4 (Am. Mus.).

Remarks.—This was the first described form of the large, long-tailed squirrels peculiar to the western slope of the Andean region of Ecuador and Peru, of which several others have since been recognized.

***Simosciurus stramineus nebouxii* (Is. Geoffroy).**

Sciurus nebouxii IS. GEOFFROY, Voy. de la Venus, Zool., 1855, p. 165, pl. xii.—ALLEN, Mon. N. Amer. Rodent., 1877, p. 773.

Sciurus stramineus ALSTON, Proc. Zool. Soc. London, 1878, p. 664, part.—ALLEN, Bull. U. S. Geol. and Geogr. Surv. Territories (Hayden), IV, No. 4, p. 883, part.

Sciurus stramineus nebouxii THOMAS, Ann. and Mag. Nat. Hist. (7), V, p. 151, Jan. 1900 (in text).

Type locality.—Near Payta, Peru.

Geographic distribution.—Northwestern corner of Peru. Recorded from Sapotillo (Thomas, *l. c.*), Tumbes, and Payta.

Description.—Similar to *Simosciurus stramineus stramineus*, but coloration much lighter throughout and with a white nape patch. Upperparts yellowish gray, passing into pale fulvous on the lower back and extreme base of the tail; a large patch (about 30 mm. square) of yellowish white or clear white on the nape, the hairs white to the base; underparts whitish gray, passing into white on the throat and (in some specimens) on the inside of the fore limbs; fore limbs externally like the back, internally like the ventral surface; upper surface of fore feet intense black, with no fulvous wash at the wrists; hind limbs externally washed with fulvous like the lower back, increasing in intensity at the ankles; upper surface of feet intense black; tail above at extreme base more or less suffused with fulvous; rest of the tail (both surfaces) black heavily washed with white, usually faintly tinged with fulvous.

The above is a description of the coloration in a series of four specimens; another specimen varies from this standard in having the lower back more strongly washed with fulvous, which increases in intensity on the outer surface of the hind limbs.

Two specimens (adult females) from Marsopon, collected and measured by P. O. Simons: total length, 530, 540 mm.; head and body, 250, 265; tail vertebrae, 280, 275; hind foot, s. u., 60, 62; ear, 36, 39.

Two skulls from Tumbes: total length, 58.2, 55.5; zygomatic breadth, 33, 32; interorbital breadth, 19, 19; postorbital breadth, 17, 17; breadth of braincase, 22, 22.5; nasals, 18 × 9, 16 × 8; diastema, 14, 13.2; maxillary toothrow, 10, 10.

Specimens examined, 5.—**Peru**: Marsopon, 2 (Br. Mus.); Tumbes, 3 (Mus. Comp. Zool.).

Remarks.—Differs from true *stramineus* in lighter coloration through the greater length of the light hair tips, both above and below, the absence of fulvous or rufous at the wrists, the much paler tint of the suffusion of the hind limbs and lower back, and the presence of a large squarish white patch on the nape.

***Simosciurus stramineus guyanus* (Thomas).**

Sciurus stramineus guyanus THOMAS, Ann. and Mag. Nat. Hist. (7), V, p. 150, Jan. 1900.

Type locality.—Balzar Mountains, Upper Palenque River, western Ecuador.

Geographic distribution.—Known only from the type locality, "west of Guayaquil," Ecuador.

Description.— Similar to *S. stramineus stramineus* but general coloration lighter, nearly as in *S. s. nebourii*, from which it differs in having no nuchal patch of white.

Total length (from skin), 580 mm.; "head and body, 270; tail, 310; hind foot (wet), 57; ear (wet), 26." — Thomas, *l. c.*

Specimens examined, 0.— **Ecuador**: No specimens are at present available for study, but the type and topotype were casually examined at the British Museum in April, 1913.

Remarks.— In coloration, except in the absence of the white nuchal patch and the rufous wrists and ankles, *guayanus* closely resembles *nebourii*, being much lighter colored throughout than true *stramineus*. It differs from *zarumæ* in the absence of a white nape patch and in gray instead of rufous upperparts.

***Simosciurus stramineus zarumæ* (Allen).**

Sciurus stramineus zarumæ ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 597, Sept. 8, 1914.

Type locality.— Zaruma, southwestern Ecuador; altitude 6000 feet.

Geographic distribution.— Known only from the type locality.

Description.— "Like *S. stramineus nebouri* in the presence of a large white nape patch, but widely different in general coloration from either typical *stramineus* or *nebouri*.

"Upperparts (except the white nape patch) washed with yellowish rufous, more heavily and more intensely (approaching tawny) on the posterior half of the back and hind limbs, more lightly on the head and anterior half of back, the black basal portion of the pelage wholly concealed by the long rufous tipping of the hairs, which on the lower back occupies the apical half; nose and outside of fore limbs grayish; underparts gray, passing into white on the throat, upper breast, inside of fore limbs and inguinal region; upper surface of fore and hind feet intense black, wrists rufous, especially the inner surface, and the rufous on the hind limbs extends slightly beyond ankles; tail rufous all around where it joins the body, the rest black heavily washed with white.

"Total length (collector's measurements), 540 mm.; head and body, 220; tail vertebræ, 320; hind foot, 60. Skull, total length —; zygomatic breadth, —; interorbital breadth, 19; postorbital breadth, 17; breadth of braincase, 23; nasals, —; diastema, 14; maxillary toothrow, 10. The nasals and zygomatic arches are unfortunately broken.

Remarks.— "Although represented by only a single specimen, the color differences are so profound that, taken with the geographical conditions, it is hard to believe that they do not denote a strongly marked form of the *stramineus* group. The rufous tips of the hairs on the lower back are as long as the dark basal portion." — Allen, *l. c.*

Species, localities, and by whom collected and measured	External measurements						Cranial measurements						
	Number of specimens	Total length	Head and body	Tail vertebrae	Hind foot	Number of specimens	Total length	Zygomatic breadth	Interorbital breadth	Breadth of braincase	Length of nasals	Maxillary toothrow	Diastrama
<i>H. flammeifer</i> Caura district, Venezuela Klages and Carriker	Aver.	580	274	310	66.5°	5	65.5	38	23	26.5	20	10.5	
	Min.	540	254	280	64		64	37	22	26	19	10	
	Max.	610	289	320	67		67	39	25	27	21	11	
<i>U. tricolor</i>	1	533	273	260	69°	2	69	38.7	21	24	22	10	21
							70.3	39.3	21	24	20	10	
<i>U. duida</i>	3	570	270	300	66°	Type	66	38	20	25	22	10	19
Mt. Duida, Ven. Leo E. Miller	Aver.	560	270	290	65								
	Min.	580	270	310	67								
	Max.												
<i>U. igniventris</i>	3	530	270	260	65°	1	63	37	23	26.3	19	9.8	
Peru	Aver.	520	260	250	63°								
W. H. Osgood	Min.	540	280	270	67								
	Max.												
<i>U. i. tedijfer</i>	1	505	259	246	67°	1	63	37	22	27	19	10	
<i>U. i. cocalis</i>	2	569	266	295	68°	2	63	38	22.2	25	20	10	
		559	276	283	64		62	37	—	25	19	10	
<i>U. i. zamorae</i>	1	490	260	230	61°	1	59	33.5	19	25	16.3	9.2	
<i>U. langsdorffii</i>						8	62	36.4	20.4	23.8	18	9.8	18
Chapada, Brazil H. H. Smith	Aver.						60.8	35	20	23.3	17.3	9.3	17.5
	Min.						64	38	21	24.3	19	10	19
	Max.												
<i>U. l. steinbachi</i>	5	491	254	235	55°	5	60.6	36	20.6	23.6	18.3	9	
Southwest Bolivia	Aver.	475	250	225	55		60.2	35	20	23	17.8	9	
J. Steinbach	Min.	505	260	255	55		61	37	21	24	19.8	9.2	
	Max.												
<i>U. l. urucumius</i>	6	502	251	250	60.5°	7	59	35	19.6	18.3	18.3	8.8	17
Matto Grosso, Brazil	Aver.	490	245	230	60		57	34.6	19	18	17.5	8.3	16
Leo E. Miller	Min.	530	260	260	63		61	36	21	19	19	9.2	18
	Max.												
<i>S. stramineus</i>	3	586	283	303	60°	5	58	32.2	19	22.7	16	10.3	14.2
	Aver.	570	260	300	60		57	32	18	22	15	10	14
	Min.	620	320	310	60		60	33	20	23.5	17	10.5	14.5
	Max.												
<i>S. s. nebourii</i>	2	535	258	278	61°	2	56.7	32.5	19	22.3	17	10	13.6
	Aver.	530	250	275	60		55.2	32	19	22	16	10	13.2
	Min.	540	265	280	62		58.2	33	19	22.5	18	10	14
	Max.												
<i>S. s. guayamus</i>	Type	580	270	310	57°		—	—	19	23	—	10	14
<i>S. s. zurumae</i>	Type	540	220	320	60°		—	—	19	23	—	10	14

EXPLANATION OF PLATES VII-XIV.

PLATE VII.

All figures nat. size.

Figs. 1-3. *Nannosciurus whiteheadi* Thomas. No. 32628, Am. Mus., ♀ ad., Sarawak, Borneo.

Figs. 4-6. *Microsciurus similis similis* (Nelson). No. 32499, Am. Mus., ♀ ad., Cocal, Western Andes, Colombia.

Figs. 7, 8. *Leptosciurus pucheranii pucheranii* (Fitzinger). No. 34681, Am. Mus., ♂ ad., near Bogotá, Colombia.

Figs. 10-12. *Leptosciurus ignitus irroratus* (Gray). No. 16560, Am. Mus., ♀ ad., Inca Mines, Peru.

Figs. 13-14. *Leptosciurus leucogaster* (Gray). Collector's No. 448, Carnegie Mus., Pittsburgh, ♀ ad., Prov. del Sara, Bolivia.

PLATE VIII.

All figures nat. size.

Figs. 1-3. *Mesosciurus hoffmanni hoffmanni* (Peters). No. 18089, Amer. Mus., ♂ ad., Mt. Irazú, Costa Rica.

Figs. 4, 5. *Mesosciurus gerrardi gerrardi* (Gray). No. 34130, Am. Mus., ♀ ad., Bagado, Colombia.

Figs. 7, 8. *Mesosciurus saltuensis bondæ* (Allen). No. 15230, Am. Mus., ♀ ad., Minca, Santa Marta, Colombia.

Figs. 9, 10. *Mesosciurus gerrardi milleri* (Allen). No. 32512, Am. Mus., ♀ ad., Cocal, Western Andes, Colombia.

PLATE IX.

All figures nat. size.

Figs. 1-3. *Notosciurus rhoadsi* Allen. *Type*. No. 12725, Mus. Acad. Nat. Sci. Philadelphia, ♂ juv., Pagama Forest, Chunchi, Ecuador.

Figs. 4-6. *Guerlinguetus æstuans æstuans* (Linné). No. 36492, Am. Mus., ♂ ad., Bonasica, Essequibo River, British Guiana.

Fig. 8. *Guerlinguetus æstuans gilvularis* (Wagner). No. 12297, Mus. Comp. Zool., ♂ ad., Obidos, Brazil.

Figs. 9, 10. *Guerlinguetus ingrami* (Thomas). No. 36488, Am. Mus., ♂ ad., Alambary, São Paulo, Brazil.

PLATE X.

All figures nat. size.

Figs. 1-3. *Urosciurus tricolor* (Poeppig). No. 19672, Field Mus., Chicago, ♀ ad., Yurimaguas, Peru.

Figs. 4-6. *Urosciurus duida* (Allen). Type. No. 36153, Am. Mus., ♀ ad., Rio Cunucunumá, base of Mt. Duida, Venezuela.

PLATE XI.

Figs. 1-3. *Urosciurus pyrrhonotus pyrrhonotus* (Wagner). No. 37076, Am. Mus., ♂ ad., Calama, lower Rio Madeira, Brazil.

Figs. 4-6. *Urosciurus langsdorffii langsdorffii* (Brandt). No. 4837, Mus. Acad. Nat. Sci. Philadelphia, ♂ ad., Chapada, Matto Grosso, Brazil.

PLATE XII.

Figs. 1-3. *Simosciurus stramineus stramineus* (Eyndoux and Souleyet). No. 34687, Am. Mus., ♂ ad., Daule, Ecuador.

Figs. 4-6. *Hadrosociurus flammifer* (Thomas). No. 17562, Am. Mus., ♂ ad., La Union, Venezuela.

PLATE XIII.

All figures $\frac{3}{4}$.

Fig. 1. *Nannosciurus whiteheadi* Thomas. No. 34687, Am. Mus., ♂ ad., Sarawak, Borneo. Direct crown view of maxillary tooththrows.

Fig. 2. Same specimen as Fig. 1. Oblique view of left maxillary tooththrow.

Fig. 3. *Microsciurus similis similis* (Nelson). No. 32499, Am. Mus., ♀ ad., Cocal, Western Andes, Colombia. Direct crown view of maxillary tooththrows.

Fig. 4. Same specimen as Fig. 3. Oblique view of left maxillary tooththrow.

Fig. 5. *Leptosociurus pucheranii pucherannii* (Fitzinger). No. 32839, Am. Mus., ♂ ad., near Bogotá, Colombia. Direct crown view of maxillary tooththrows.

Fig. 6. Same specimen as Fig. 5. Oblique view of left maxillary tooththrow.

Fig. 7. *Leptosociurus ignitus ignitus* (Gray). No. 1253, Am. Mus., Yungas, Bolivia. Direct crown view of left maxillary tooththrow.

Fig. 8. Same specimen as Fig. 7. Oblique view of left upper maxillary tooththrow.

Fig. 9. *Leptosociurus leucogaster* (Gray). Collector's No. 448, Carnegie Mus., Pittsburgh, ♀ ad., Prov. del Sera, Bolivia. Direct crown view of left maxillary tooththrow.

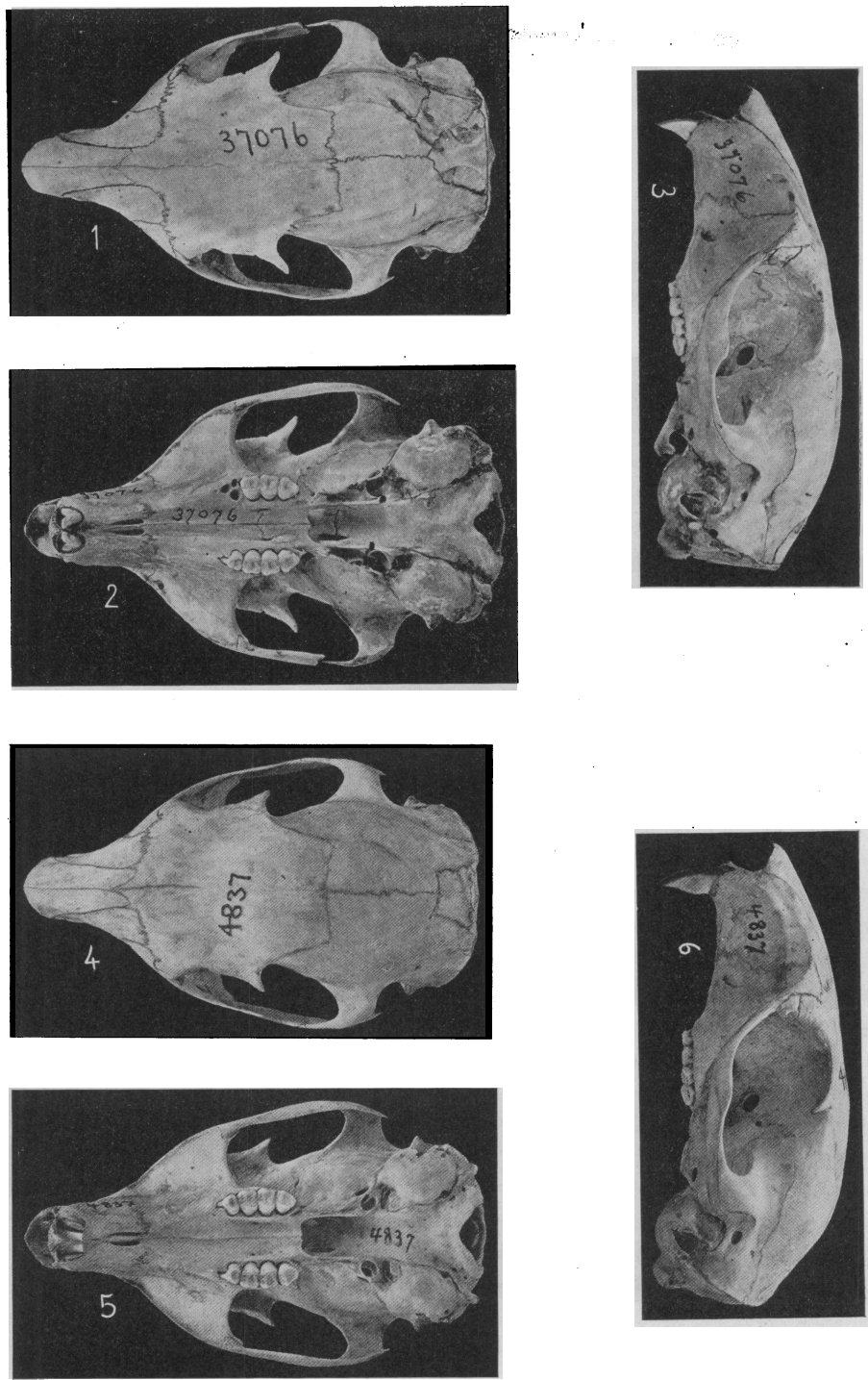
Fig. 10. Same specimen as Fig. 9. Oblique view of left maxillary tooththrow.

Fig. 11. *Mesosociurus hoffmanni hoffmanni* (Peters). No. 18094, Am. Mus., ♂ ad., Mt. Irazú, Costa Rica. Direct crown view of maxillary tooththrows.

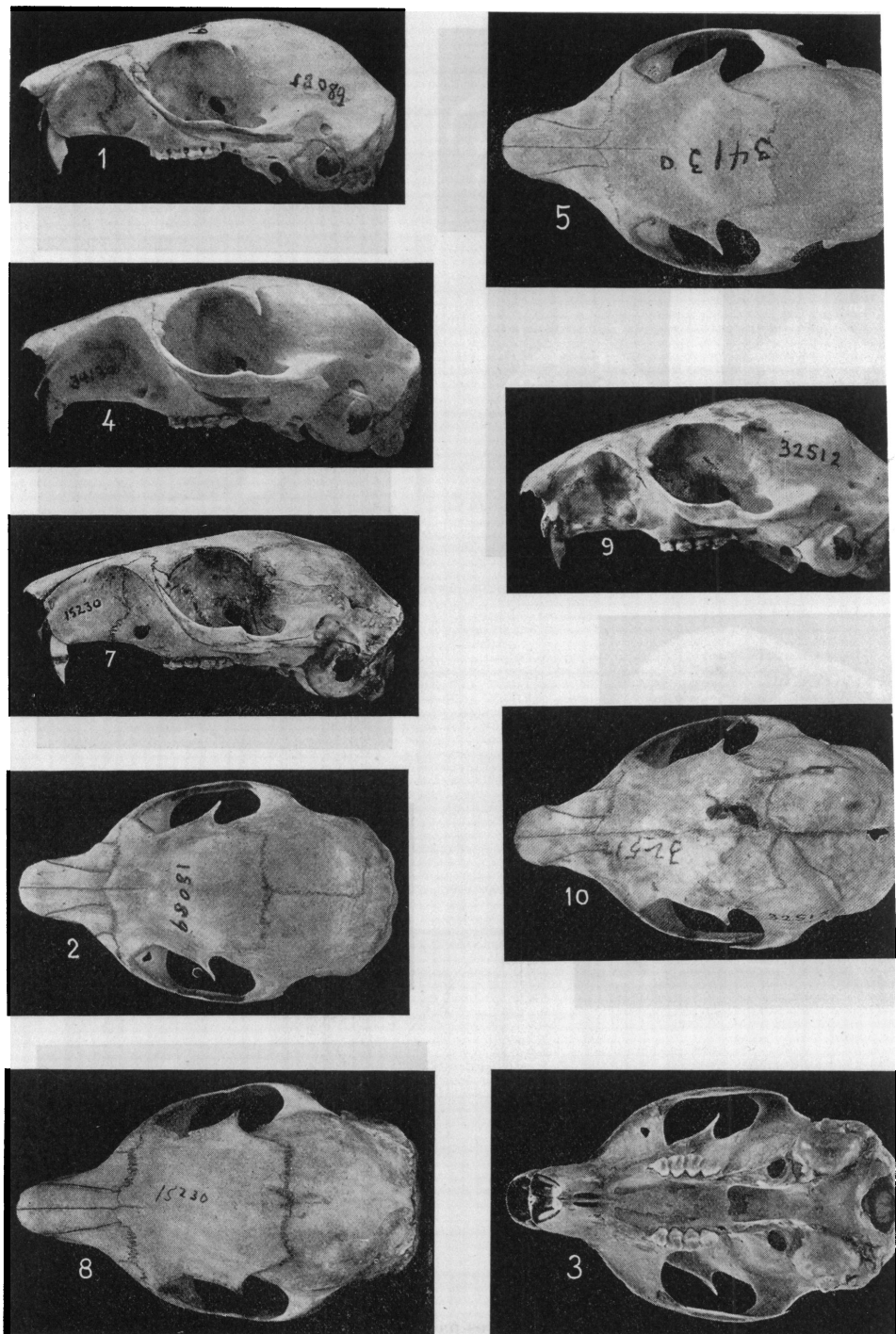
- Fig. 12. Same specimen as Fig. 11. Oblique view of left maxillary tooththrow.
- Fig. 13. *Mesosciurus gerrardi gerrardi* (Gray). No. 34130, Am. Mus., ♀ ad., Bogotá, Colombia. Direct crown view of left maxillary tooththrow.
- Fig. 14. Same specimen as Fig. 13. Oblique view of left maxillary tooththrow.
- Fig. 15. *Mesosciurus saltuensis bondæ* (Allen). No. 11184, Am. Mus., ♀ ad., Minca, Santa Marta, Colombia. Direct crown view of left maxillary tooththrow.
- Fig. 16. Same specimen as Fig. 15. Oblique view of left maxillary tooththrow.
- Fig. 17. *Mesosciurus gerrardi milleri* (Allen). No. 32512, Am. Mus., ♀ ad., Cocal, Western Andes, Colombia. Direct crown view of left maxillary tooththrow.
- Fig. 18. Same specimen as Fig. 15. Oblique view of left maxillary tooththrow.
- Fig. 19. *Guerlinguetus æstuans æstuans* (Linné). No. 34657, Am. Mus., ♂ ad., Potario Landing, British Guiana. Direct crown view of maxillary tooththrow.
- Fig. 20. Same specimen as Fig. 19. Oblique view of left maxillary tooththrow.
- Fig. 21. *Guerlinguetus æstuans gilvularis* (Wagner). No. 12297, Mus. Comp. Zool., ♂ ad., Obidos, Brazil. Direct crown view of left maxillary tooththrow.
- Fig. 22. Same specimen as Fig. 21. Oblique view of left maxillary tooththrow.
- Fig. 23. *Guerlinguetus ingrami* (Thomas). No. 36487, Am. Mus., ♂ ad., Alambary, São Paulo, Brazil. Direct crown view of left maxillary tooththrow.
- Fig. 24. Same specimen as Fig. 23. Oblique view of left maxillary tooththrow.

PLATE XIV.

- Fig. 1. *Urosciurus duida* (Allen). No. 36153, Am. Mus., ♀ ad., near Mt. Duida, Venezuela. Direct crown view of maxillary tooththrows.
- Fig. 2. Same specimen as Fig. 1. Oblique view of left maxillary tooththrow.
- Fig. 3. *Urosciurus igniventris igniventris* (Wagner). No. 34375, Am. Mus., Florencia, Caquetá, Colombia. Direct crown view of left maxillary tooththrow.
- Fig. 4. Same specimen as Fig. 3. Oblique view of left maxillary tooththrow.
- Fig. 5. *Simosciurus stramineus stramineus* (Eydoux and Souleyet). No. 34687, Am. Mus., ♀ ad., Daule, Ecuador. Oblique view of left maxillary tooththrow.
- Fig. 6. Same specimen as Fig. 5. Direct crown view of maxillary tooththrows.
- Fig. 7. *Hadrosociurus flammifer* (Thomas). No. 16944, Am. Mus., ♂ ad., La Union, Venezuela. Oblique view of left maxillary tooththrow.
- Fig. 8. Same specimen as Fig. 7. Direct crown view of left maxillary tooth row.

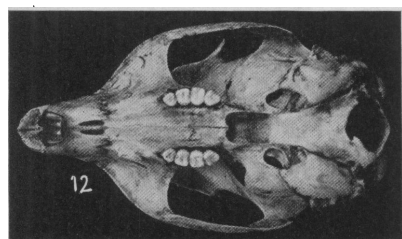
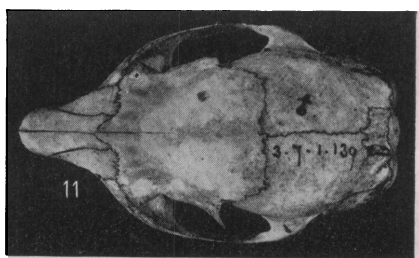
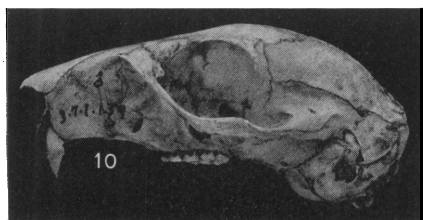
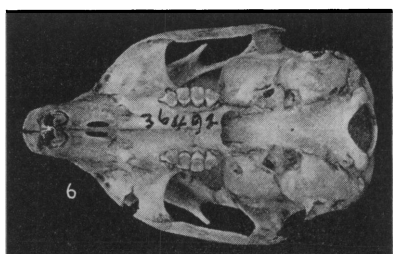
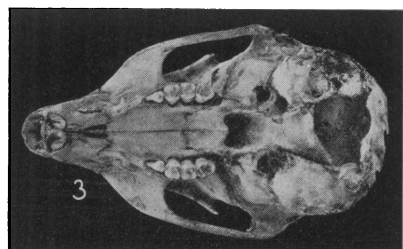
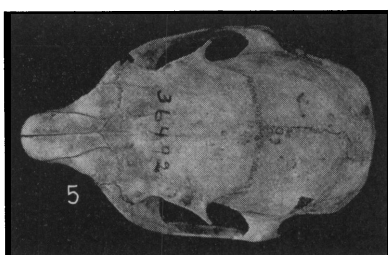
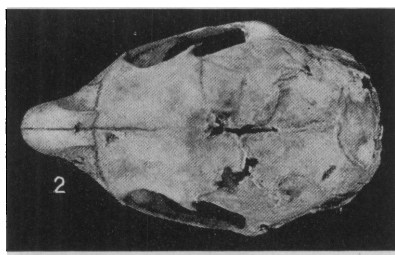
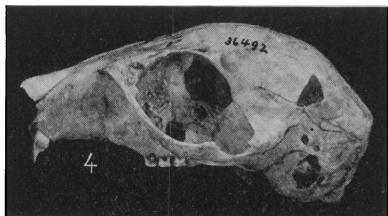
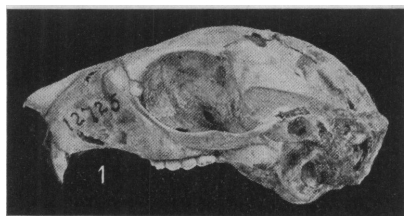


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Figs. 1-3. *Urosciurus pyrrhonotus pyrrhonotus*.
“ 4-6. “ *langsdorffi langsdorffi*.

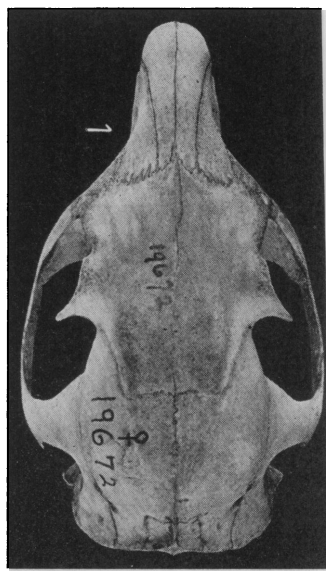
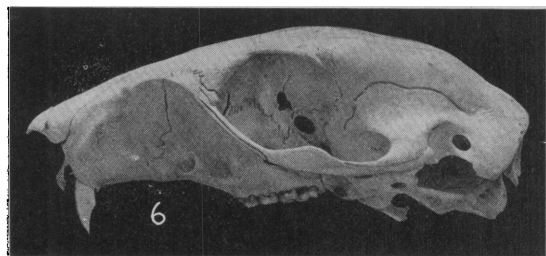
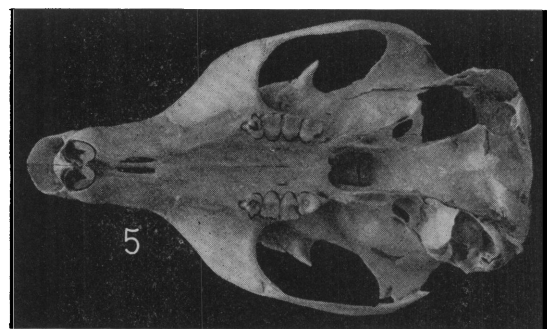
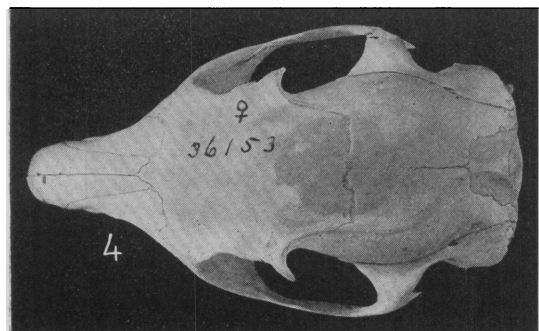
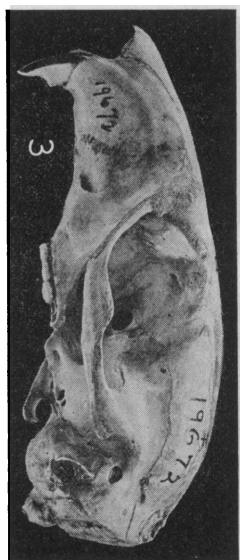
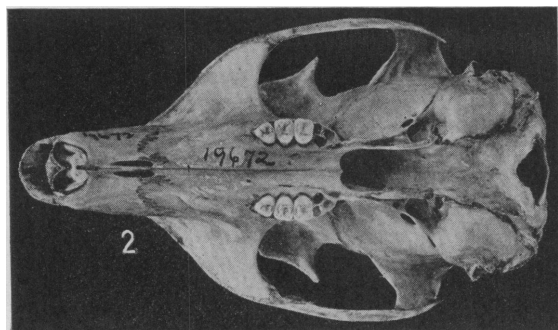


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- Figs. 1-3. *Mesosciurus hoffmanni hoffmanni*. Figs. 7, 8. *Mesosciurus satiensis bondæ*.
 " 4, 5. " *gerrardi gerrardi*. " 9, 10. " *gerrardi milleri*.



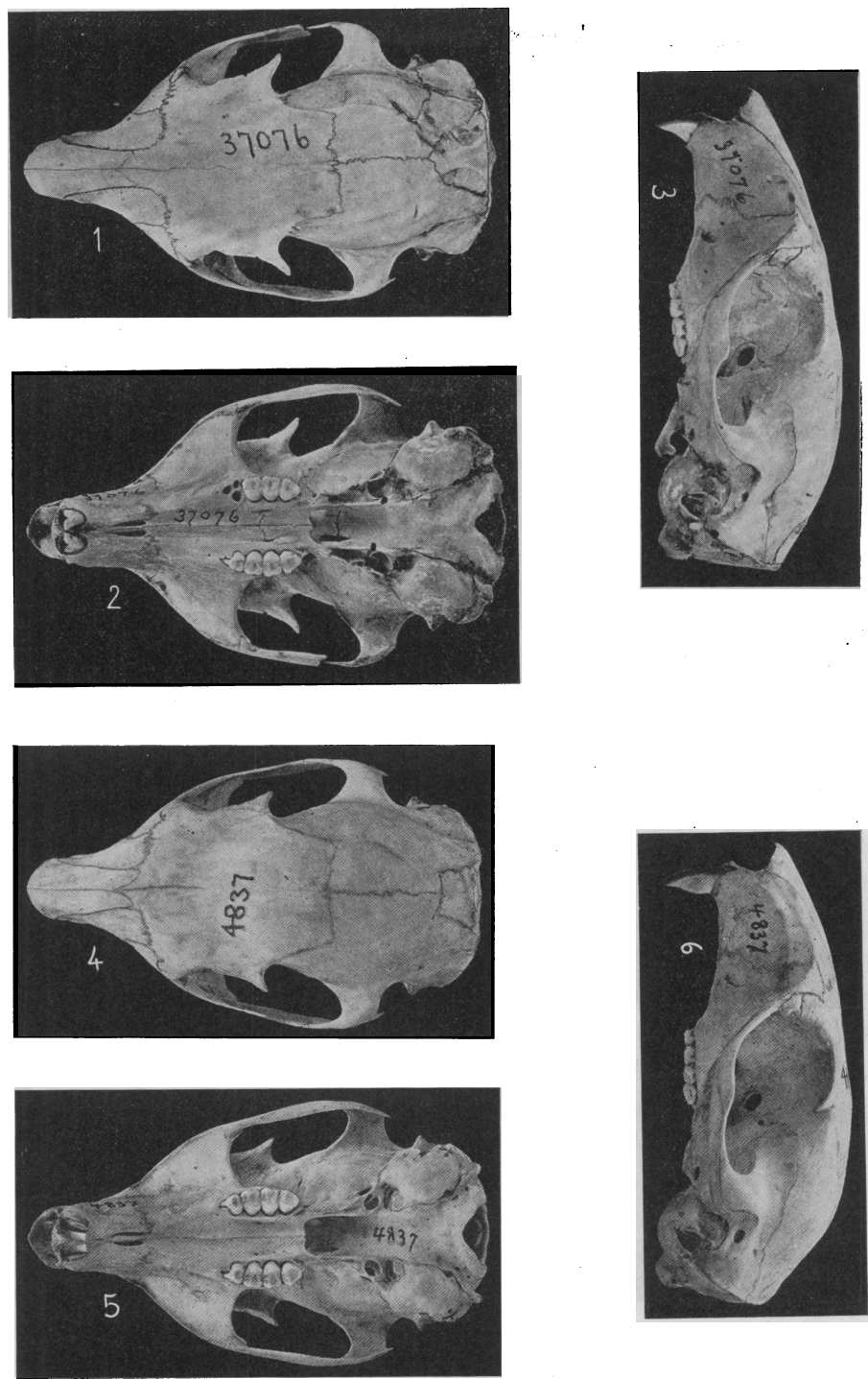
All figures nat. size.
 Figs. 1-3. *Notosciurus rhoadsi*.
 " 4-6. *Guerlinguetus æstuans æstuans*.
 " 8. " *æstuans gilvularis*.
 " 9, 10. " *ingrami*.



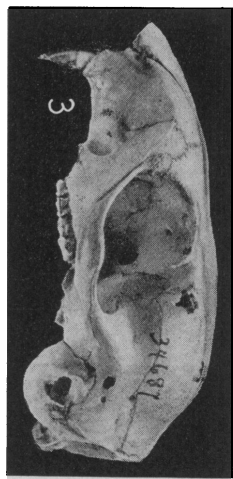
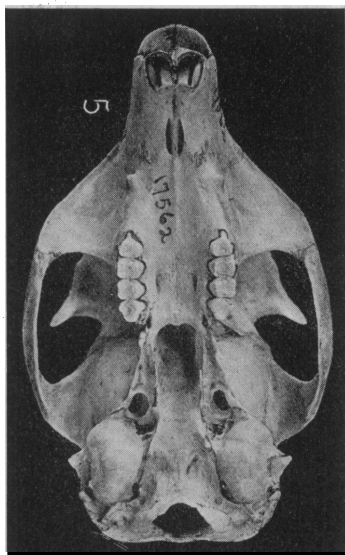
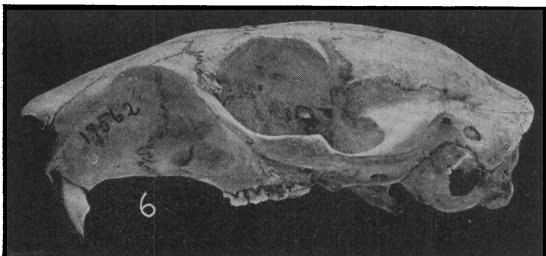
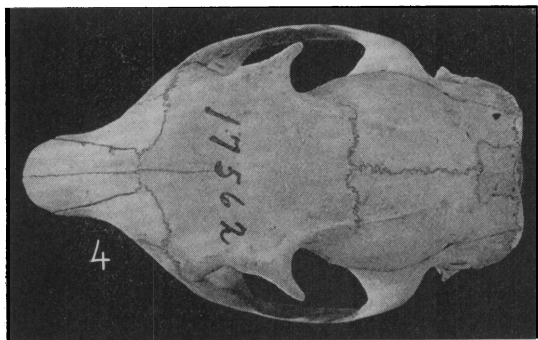
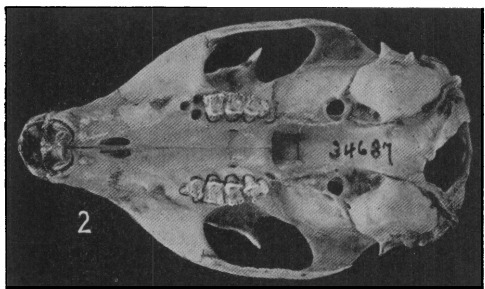
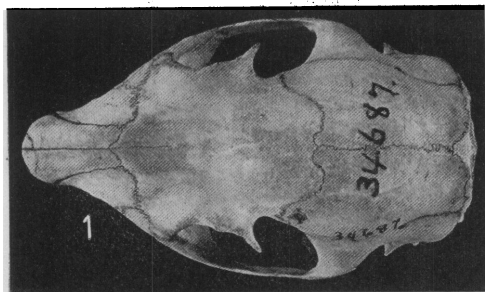
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Figs. 1-3. *Urosciurus tricolor*.

Figs. 4-6. *Urosciurus duidae*.

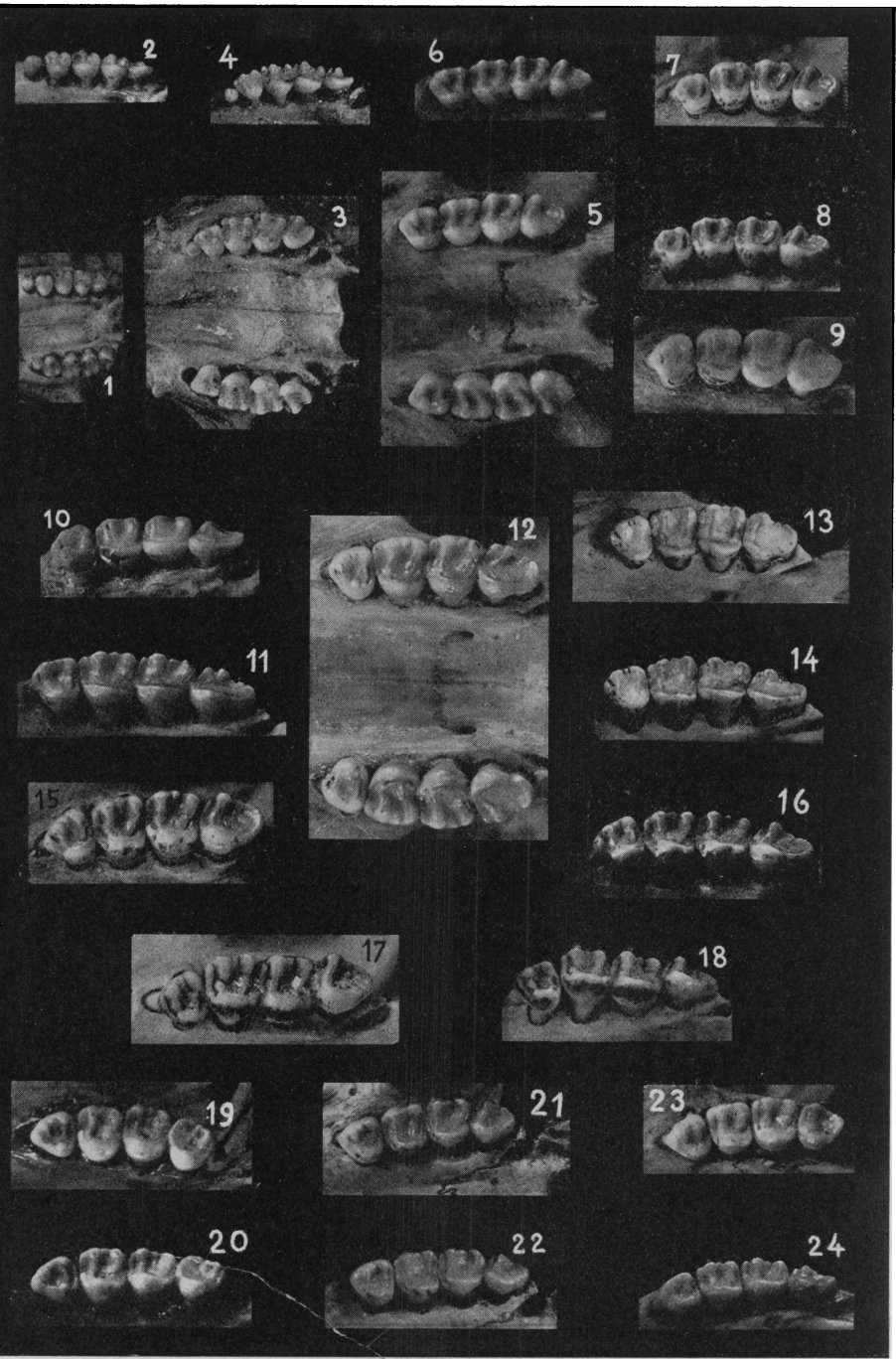


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Figs. 1-3. *Urosciurus pyrrhonotus pyrrhonotus*.
“ 4-6. “ *langsdorffi langsdorffi*.



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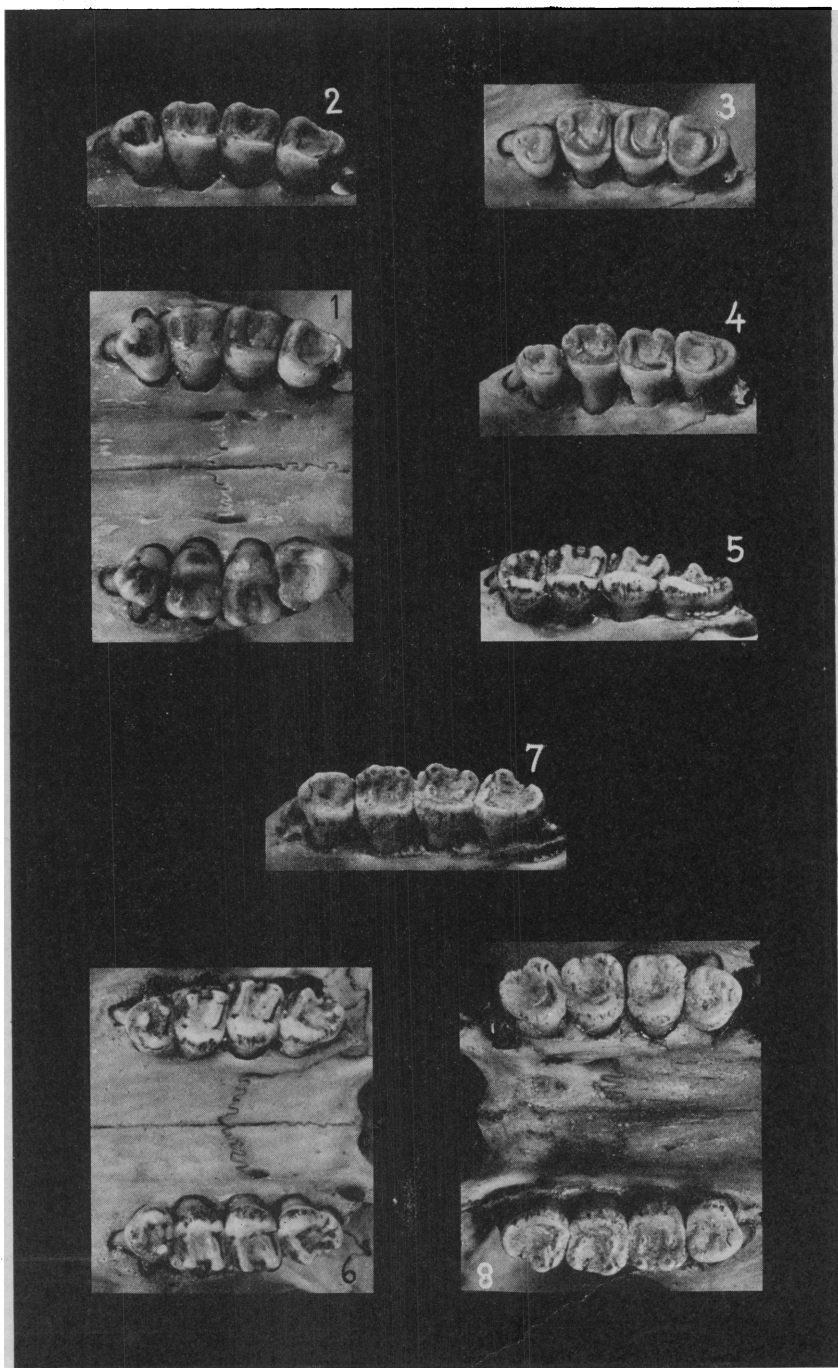
Figs. 1-3. *Simosciurus stramineus stramineus*. Figs. 4-6. *Simosciurus flammifer*.



All figures $\frac{3}{4}$.

- Figs. 1, 2. *Nannosciurus whiteheadi*.
 " 3, 4. *Microsciurus similis similis*.
 " 5, 6. *Leptosciurus p. pucheranii*.
 " 7, 8. " *ignitus irroratus*.
 " 9, 10. " *leucogaster*.
 " 11, 12. *Mesosciurus hoff. hoffmanni*.

- Figs. 13, 14. *Mesosciurus ger. gerrardi*.
 " 15, 16. " *saltuensis bondæ*.
 " 17, 18. " *gerrardi milleri*.
 " 19, 20. *Guerlinguetus æst. æstuans*.
 " 21, 22. " *gilvicularis*.
 " 23, 24. " *ingrami*.



All figures $\frac{3}{1}$.

- Figs. 1, 2. *Urosciurus duidae*.
 " 3, 4. " *igniventris igniventris*.
 " 5, 6. *Simosciurus stramineus stramineus*.
 " 7, 8. *Hadrosociurus flammifer*.

GEOGRAPHIC DISTRIBUTION AND INTERRELATIONSHIPS OF SOUTH AMERICAN SQUIRRELS.

As shown in the foregoing pages, the squirrel fauna of South America, embracing some 75 species and subspecies, is separable into 9 natural and well circumscribed superspecific groups, here allotted the value of genera; some of them include two or more well marked sections. The geographic distribution of these groups is correlated with areas markedly different in physiographic features. While such correlation is to be expected, it seems worth while to point out in some detail the nature and extent of these agreements.

The striking topographic features of South America are the highlands of the coast borders and the vast extent of the interior lowlands, creating conditions of environment that result in strong biologic reactions, as most of the land area is intertropical. The geologically oldest parts of the continent are well known to be the Guianian and Brazilian highlands of the Atlantic border, the Andean ranges of the Pacific border having come into existence much later, and the interior of the continent remaining an inland sea till long after the Caribbean, Pacific, and Atlantic borders had become dry land. The present topographic conditions, however, have long prevailed, and it is these only that we have here especially to consider.

So far as climatic conditions are concerned, the whole continent of South America should be the home of some species of squirrel, the southern extremity of the continent being well within the climatic range of squirrels in other lands. But in South America they are of by no means universal distribution, as forests are necessary for the existence of tree squirrels, the only members of the family Sciuridæ which have found their way to any part of tropical or even subtropical America. Vast areas of South America are forestless. More than half of Venezuela consists of treeless plains or llanos; large portions of Brazil are open grassy or scrubby campos, while much the greater part of the southern third of the continent consists of pampas, nearly treeless steppes, or open chaco country. These immense open spaces are nearly as effective barriers to tree squirrels as would be great inland seas. They afford them not only no congenial living conditions but interpose barriers to their dispersion.

In general terms, squirrels are restricted in South America to a narrow belt near the Caribbean coast, from the Island of Trinidad (geographically and faunally a detached fragment of the continent) and the Paria Peninsula west to where the Sierra de Mar merges into the Sierra de Merida, and thence over the great Andean system of the western border of the continent.

Throughout this system squirrels are found in considerable variety as far south as about to the northern border of Chile, beyond which they appear to have failed to penetrate, their most southern point in the western half of the continent being southern Bolivia.

On the eastern side of the continent, south of the Venezuelan llanos, they occupy the Guiana Highlands and the forested parts of the Brazilian Highlands south to southern Brazil, and extend thence westward in the wooded parts of the drainage areas of the Orinoco and Amazon to the eastern base of the Andes. But these several widely different physiographic areas are each occupied by special types of squirrel, none of the groups recognized as generic being common to any portion of both the eastern and

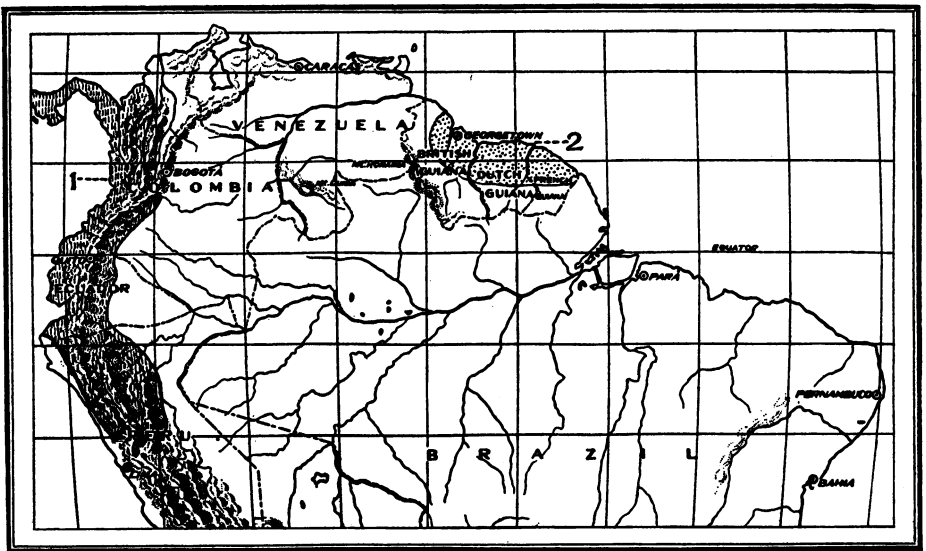


Fig. 22. 1, *Microsciurus*; 2, *Sciurillus*.¹

western divisions of the continent. The distribution of the genera and species may be briefly stated as follows, premising that the Caribbean border of the continent is to be regarded as part of the western division.

Two very obvious characteristics of the sciurids of South America, the number of premolars and the number of mammæ, as noted in the early part of this paper (pp. 158, 159), present great constancy throughout vast geographic areas. All the groups with 6 mammæ are restricted (with the one

¹ The accompanying distribution maps (Figs. 22-25) are of course to be taken as only approximate, and largely hypothetical so far as the exact boundaries of the areas are concerned, being diagrammatic expressions of our present knowledge of the subject.

exception of the genus *Sciurillus*, to be further noticed later) to the Caribbean border and the Andean region. They include the genera *Microsciurus*, *Mesosciurus*, *Notosciurus*, and *Leptosciurus*. The squirrels with 8 mammae occupy exclusively all the rest of the squirrel-inhabited parts of the continent, from the eastern slope of the Andes to the Atlantic coast. They include the genera *Guerlinguetus*, *Hadrosciurus*, *Urosciurus*, and *Simosciurus*, in other words, the guerlinguets and the 'giant' squirrels. *Simosciurus*, a member of the latter, however, presents a partial exception, having penetrated to the Pacific slope along the Ecuador-Peru boundary.

All South American squirrels have the premolar formula $\frac{1}{1}$, except the genera *Microsciurus* and *Sciurillus*, which have the premolar formula $\frac{2}{1}$.

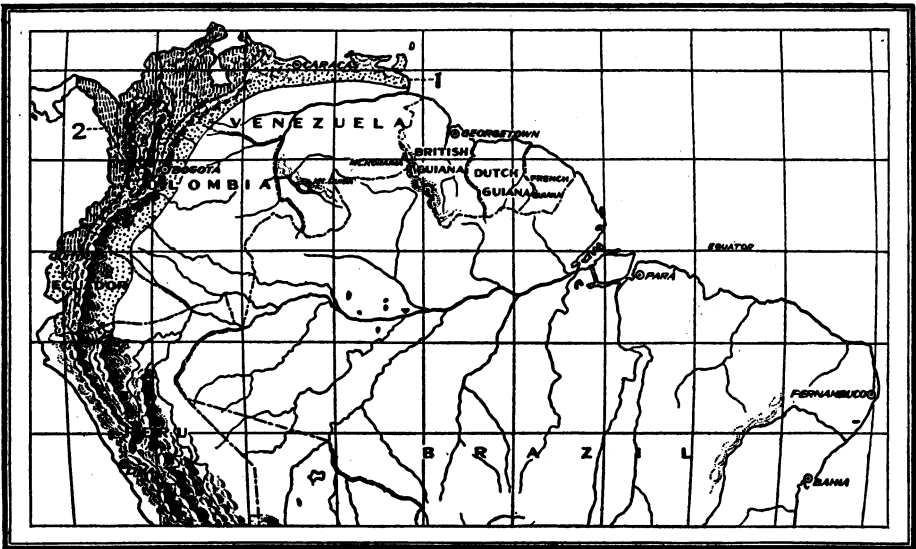


Fig. 23. *Mesosciurus*. 1, Subgenus *Mesosciurus*; 2, subgenus *Histriosciurus*.

Microsciurus ranges from Costa Rica to southern Peru, but is confined in South America to the Andean or Cordillera region, and in Colombia to the western part of this area, it not extending to the Eastern Andes, and being absent from the Bogotá region and the Merida and Maritime ranges of Venezuela. Its altitudinal range in western Colombia is from sea level to paramo. *Sciurillus*, on the other hand, is known only from the Guianas, and from only a few specimens, and is hence unrepresented in nearly all museums. It is a very ancient type, has no close relationship with any other American genus, and is among the smallest of known squirrels. Its affinities are with the *Nannosciurinae*, to which it has been referred by Thomas

(see *antea*, p. 190). The only other known representatives of this sub-family occur in the Malay Archipelago and in West Africa. Its presence on the east coast of South America therefore may be taken as possibly another indication of former land connection between South America and Africa.

The genera will now be briefly reviewed with reference to their constituent groups and their distribution and interrelationships.

Microsciurus is represented by nearly 20 rather closely allied forms, most of them rated as species. They are all very small, the difference in size between the largest and smallest being but little greater than the range

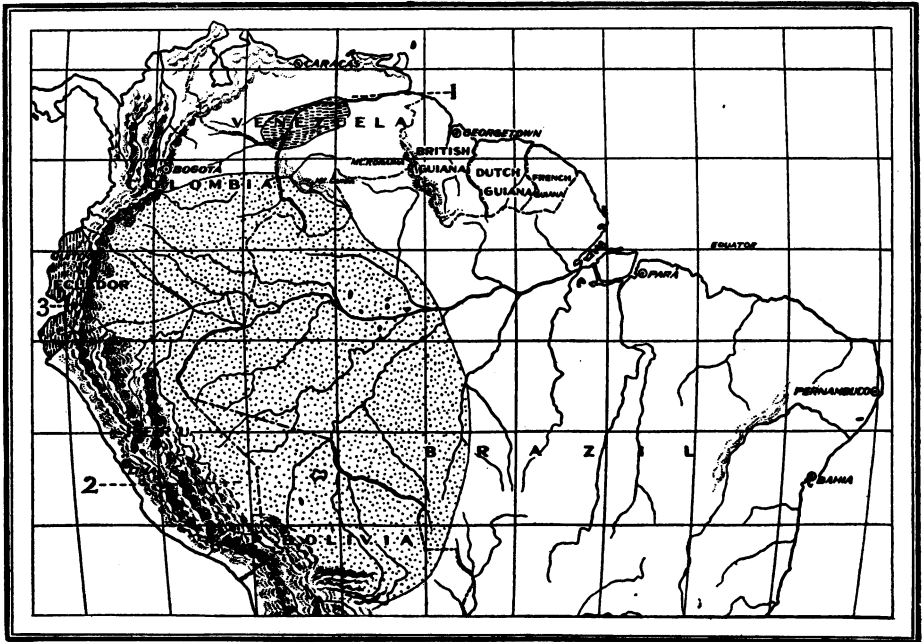


Fig. 24. 1, *Hadrosociurus*; 2, *Urosociurus*; 3, *Simosociurus*.

of individual variation in a good series of almost any of the species. In coloration and in the character of the pelage there is little diversity, and in the case of the latter the difference is correlated with sea level and high altitude environment. It differs widely from all other generic groups of American squirrels, and is the only South American genus (*Sciurillus* excepted) with two upper premolars. Its peculiar geographic distribution has already been stated. It may be considered as an old generalized type.

Mesosociurus has the widest distribution of any of the South American genera, it having representatives in Central America as far north as Costa

Rica, and an outlying form (*Mesosciurus richardsoni*) in Nicaragua. It occupies all of the Andean region south to Peru, and extends east in the Caribbean coast region to Trinidad. It comprises three quite distinct groups, as (1) the *hoffmanni* group, (2) the *gerrardi* group, and (3) the *saltuensis* group, no one of which overlaps the range of either of the others,



Fig. 25. 1, *Notosciurus*; 2, *Leptosciurus pucheranii* group; 3, *L. ignitis* group; 4, *L. leucogaster*; 5, *Guerlinguetus aestuans-alphonsei* group; 6, *G. ingrami*.

so far as is now known. The *hoffmanni* group (subgenus *Mesosciurus*) consists of a large number of forms (species and subspecies) all below medium size, and practically all of the same size, of the same general character of pelage, and of the same general style of coloration. The wide range

of individual differentiation in size and coloration renders difficult the satisfactory discrimination of local forms. True *hoffmanni* is found in the mountainous parts of central Costa Rica, and has a barely recognizable lowland form in Costa Rica and Chiriqui. South of Chiriqui there is a hiatus in its range, it next appearing in the Western Andes of Colombia, and it occurs thence throughout all the western and central Andean range to southern Ecuador, with a lowland form along the coast of Ecuador. The mountain form of the Western Andes is not satisfactorily distinguishable from specimens from the Irazú region of Costa Rica. In the northern part of the Central and in the Eastern Andes in Colombia, true *hoffmanni* breaks up into several distinguishable local forms, some of which approach, and may intergrade with, *griseogena* of the Sierra de Merida and Sierra de Mer of Venezuela, which in turn is not greatly different from *chapmani* of the Paria Peninsula and the Island of Trinidad. There is a slightly differentiated form of *chapmani* in Tobago Island, and another strongly specialized form in Margarita Island. This latter differs so widely in coloration from any of the mainland forms as to indicate its long isolation.

The *hoffmanni* group is thus a group of wide dispersion and of very numerous forms, and perhaps may be regarded as one of the oldest groups of South American squirrels. Within its range are included the range of the genus *Microsciurus* and part of the range of the genus *Leptosciurus*.

The *gerrardi* group of the genus *Mesosciurus* (subgenus *Histriosciurus*) consists of a large number of forms of much larger size than the squirrels of the *hoffmanni* group, and of much more restricted distribution. They differ from the latter not only in conspicuously larger size, but in markedly different coloration and pelage. They are as remarkable for inconstancy of characters, particularly in coloration, as are the members of the *hoffmanni* group for constancy to a general type. The range of the *gerrardi* group is the western slope and adjoining lowlands of the Western Andes, from sea level to about 5000 feet, from northeastern Ecuador to Panama and the lowlands of the Caribbean drainage of Colombia, east to a little beyond the Venezuelan border. Not only do the extreme phases of the *gerrardi* group differ widely, especially in coloration, but specimens, with the exception of two Panama forms, of the same form from the same locality vary so much that hardly two can be found that are closely similar. It is obviously a highly plastic group, of probably comparatively recent evolution, and confined mainly to the humid tropical zone. So far as known, no two forms of, respectively, the *hoffmanni* and the *gerrardi* groups occupy the same areas, although the boundaries of the ranges of the two groups must practically adjoin each other along the western slope of the Andes for nearly a thousand miles. The only other group of squirrels that shares the habitat of the *gerrardi* group is the genus *Microsciurus*.

The third or *saltuensis* group of *Mesosciurus* was formerly known only from the small physiographically isolated area of the Santa Marta district of northeastern Colombia, where it ranges from sea level to about 9000 feet, with a lowland and a highland subspecies. The American Museum expeditions have now shown that a form of this group occurs on the lower Rio Cesar, the principal river draining the Sierra de Santa Marta region. Another widely isolated species occurs in central Peru, which so closely resembles the Santa Marta forms that, if their ranges were contiguous, it might perhaps be regarded as merely a subspecies of the Santa Marta group. The members of the *saltuensis* group agree in size with the forms of the *gerrardi* group, but differ widely from them in color and in the character of the pelage, which is long, soft, and full in the *saltuensis* group and thin, short, and hispid in the *gerrardi* group, in accordance with the contrasted environment of the two groups — temperate and humid tropical, respectively. The contrast in color in the two groups is striking, the ventral surface being deep red in all the forms of the *gerrardi* group and white in the *saltuensis* group, except that in the Peruvian form (*Sciurus pyrrhinus* Thomas) it may be either white or red or mixed white and red. The coloration of the upperparts in the two groups is equally distinctive, yet they are so closely related in all essential characters that the two groups must have had a common origin or have been derived the one from the other, with probably the *saltuensis* group as the older of the two. Both groups belong to the subgenus *Histriosciurus*.

The genus *Leptosciurus* is a small group of squirrels but little exceeding in size the larger forms of the genus *Microsciurus*, two of the three known species greatly resembling the *Microsciuri* in external features, but differing from them and from the *Mesosciuri* in the shape of the skull and in tooth structure. The range of *Leptosciurus* is discontinuous, occupying two, and perhaps three, separate areas; one in Colombia and one in the Andes of southern Peru and Bolivia. The northern area comprises nearly all of the Colombian Andes, where it is represented by four known forms, three of them closely related, the other possibly specifically separable. The genus is not known from Ecuador, and has not been met with in northern Peru, its known range in the south being an area in the high Andes of southern Peru and the adjoining Andean portion of Bolivia, trending northwest-southeast, about 500 miles long and approximately half as wide. Here it is represented by a single species, quite distinctly related to the forms of the Colombian Andes.

Another area in eastern Bolivia is occupied by a species here referred to *Leptosciurus* (the *Macroxus leucogaster* Gray), found at much lower altitudes in the Santa Cruz de la Sierra region, from which only it is thus

far known. It is an aberrant member of the genus, exceeding the others in size, with a harsher pelage and quite different coloration. In cranial and other essential characters, as the shape of the skull, the structure of the teeth, and the presence of only 6 mammæ, it agrees with the other members of the genus. It is further peculiar in that it is the only known species with 6 mammæ that has invaded the great Amazonian area otherwise occupied exclusively by squirrels with 8 mammæ. It possibly may be looked upon as a comparatively recent intrusion from the west of an otherwise strictly Andean genus.

Still another Andean genus of the group of squirrels with 6 mammæ is the recently discovered *Notosciurus* (see *antéa*, pp. 209-211), thus far known only from a single specimen from northern Ecuador. It is similar in general appearance to the *hoffmanni* forms of *Mesosciurus*, with which it agrees in general coloration and tooth structure, but differs in the form of the skull and in the character of the feet.

The squirrels with 8 mammæ comprise two very distinct groups, the small guerlinguets and the large so-called 'giant' squirrels. The first consists of the single genus *Guerlinguetus*, while the other comprises three groups of generic or subgeneric value, according to the viewpoint of valuation. They are here recognized as generic, though they are all much more closely related *inter se* than they are to any other group.

Guerlinguetus has a wide range, occurring in the lowlands bordering the Guiana Highlands, south along the Atlantic coast to at least Pernambuco, and in the lowlands of the Orinoco and the Lower Amazon. How far westward it ranges in the drainage of these two rivers is unknown. It has been recorded from the Upper Orinoco as far as the Rio Cunucunumá (near Mt. Duida), from the lower Rio Negro, the Rio Branco, the Rio Tocantins, the lower Rio Madeira, and the Lower Amazon. In the Brazilian Highlands, south to São Paulo and Paraná, *Guerlinguetus* is represented by a highly aberrant form (*Sciurus ingrami* Thomas), perhaps subgenerically separable from the numerous forms of the Amazonian and Orinoco lowlands. As most of this vast, more or less elevated region is open country, the single species of squirrel known to inhabit it is locally distributed, occurring only where forested areas offer a congenial habitat. It has a fuller and softer pelage than the forms of the other group, somewhat larger size and a somewhat differently proportioned skull, differences for the most part plainly correlated with the very diverse conditions of environment of the two groups.

The giant squirrels differ from the guerlinguets not only in size, in coloration, in the character of the pelage, especially in the possession of a very bushy tail, but in the shape of the skull and the character of the dentition. The distribution of the group as a whole is also very different, it being almost

confined to the drainage of the Amazon and its tributaries and the middle and upper parts of the Orinoco drainage. So much of this region is still unexplored that the continuity of the range is at present largely unknown. I have seen no specimens from, nor have I found a record of any taken in, the delta region of the Lower Amazon, or even below the mouths of the Rio Madeira and Rio Negro. Thence northward and westward there is reason to suppose that the distribution of the group embraces practically the whole of the vast woodlands of the Amazonian drainage, even to the sources of its tributaries in the eastern base of the Andes, from southeastern Colombia to Bolivia, and also across the low divide to the upper sources of the Rio Paraná.

Most of the forms of the giant squirrel group belong to the genus *Urosciurus*, with three outlying groups, each consisting of a single species. These are *Hadros-ciurus*, comprising the isolated *Sciurus flammifer* Thomas along the Middle Orinoco; *Simosciurus* (*Sciurus stramineus* Eydoux and Souleyet, and its subspecies), occupying a small area on the western slope of the Andes in southern Ecuador and northern Peru; and the *Sciurus langsdorffii* group of the Paraná-Tapajos divide and the sources of the Rio Marmore in Bolivia. The latter is much less aberrant from typical *Urosciuri* than either *Hadros-ciurus* or *Simosciurus*. It is evident that the latter long ago found its way to the western slope from the Amazonian basin to the area bordering the Gulf of Guayaquil, and has since become strongly specialized through isolation and marked change in environment, shown in the form of the skull and the character of the teeth as well as in pelage and coloration.

PHYLOGENETIC CONSIDERATIONS.

It is perhaps futile to attempt to formulate the phylogeny of the South American squirrels *inter se*. It is, however, pretty clearly evident that the Sciuridæ, including the tree squirrels, reached North America from Asia. The marmots have penetrated southward in North America to a much less extent than the spermophiles and ground squirrels, which, so far as known, have never passed beyond the Mexican plateau. The tree squirrels occupy all of North America from the northern limit of tree growth to Panama, and extend thence southward through the tree-covered parts of South America to 32° south on the Atlantic border, but only to about 15° south on the Andean side. Two genera, *Microsciurus* and *Mesos-ciurus*, are apparently intrusive into Central America, as there is no North American type to which they are closely related, or from which their immediate origin can be suggested. As already said, *Microsciurus* is *sui generis*; *Mesos-ciurus*

is the only genus south of the Mexican plateau with the premolar formula $\frac{1}{1}$; and the only other genera of Central America, or of North America, with 6 instead of 8 mammæ are *Microsciurus*, *Syntheosciurus* (the latter known only from the mountains of Chiriqui), and *Baioosciurus* of Nicaragua and eastern Mexico, north to Tamaulipas. *Syntheosciurus*, with its grooved upper incisors, two upper premolars and rather peculiar skull, is not closely related to *Mesosciurus*. The only point of close agreement between *Baioosciurus* and *Mesosciurus* is in the number of mammæ, which is insufficient to outweigh the other differences between them. *Baioosciurus* superficially recalls *Leptosciurus*, but in essential characters they are widely dissimilar. Finally then we may conclude that the South American genera at present resident along the direct highway of migration between North and South America were disintegrated from the primitive stock and received their present impress long ages ago.

Guerlinguetus, aside from the difference in the mammæ formula, is not so very unlike the *hoffmanni* section of *Mesosciurus*, these two types being quite similar in tooth characters and in the general form of the skull. *Guerlinguetus* has developed a relatively much longer tail, and a quite different pelage in the typical forms, the latter readily explainable on the basis of the very different environment of the two groups. These two genera could have originated, at no very remote date, from a common ancestral type.

The giant squirrels of the Amazonian lowlands may well be supposed, on geological and geographical grounds, to be of more recent origin than the forms of the older land surfaces of South America; yet the element of migration is a possible source of grave uncertainty. From the viewpoint of present evidence, the large squirrels of the Amazonian woodlands may be said to resemble, superficially at least, the fox squirrels (genus *Parasciurus*) of middle North America (mainly southern United States and Mexican tableland), as in size, proportions, the heavy bushy tail, the possession of only one upper premolar and 8 mammæ, and still further in the elongate, low-crowned skull. On the other hand, they differ quite strongly in tooth structure, the teeth being heavy and strong, with well-developed cusplets on the outer border of the upper molars in *Parasciurus*, with all these conditions reversed in *Urosciurus* and its near affines in South America. On the other hand, the differences are far greater between *Urosciurus* and the various types of North American and Central American squirrels with the premolar formula $\frac{2}{2}$ than between *Urosciurus* and *Parasciurus*. We are left then to the supposition of an early extended migration of an original stock from North America to Brazil, with subsequent essential modification, or the supposition of an evolution from some early type or types from which the other existing South American genera of squirrels have been derived — with always the exception of *Sciurillus*!

In brief, the most that can be assumed with any degree of certainty is that the present highly varied South American sciurid fauna (with one exception) reached its present dispersion through the early migration from North America of some ancestral type. The case of *Sciurillus*, so different from all other American forms, and so similar to East Indian and West African types, can hardly be accounted for on any theory of parallel development, its differences from any other American type being so varied and profound, and so fully in agreement with a possible African ancestor.

ADDENDA.

Since the foregoing pages were made ready for the press an important collection of mammals and birds has been received from the Antioquia district of western Colombia, a region previously unrepresented in the mammal and bird collections of the American Museum. This collection was made by Leo E. Miller and Howarth S. Boyle, in continuation of the Museum's explorations in western Colombia, November to March (both months inclusive), 1914-1915. Among the 200 or more mammals obtained are 46 squirrels, collected at the following localities; Santa Elena, Barro Blanco, and La Frijolera, in the Central Andes, in the vicinity of Medellin, at altitudes of 5000 to 9000 feet; Puerto Valdivia (altitude 360 feet), on the lower Rio Cauca; Malena (altitude 1000 feet), near Puerto Berrio, on the Rio Magdalena; Alto Bonito (altitude 1500 feet) and Dabeiba (altitude 2000 feet), on the headwaters of the Rio Sucio, on the Pacific slope. This collection affords such important information on the squirrels of the Antioquia district that it seems desirable to summarize it in the present connection.

Page 192. *Microsciurus otinus* (Thomas). Type locality, "Medellin." Six specimens: Puerto Valdivia (alt. 360 ft.), 3; Alto Bonito (alt. 1500 ft.), upper Rio Sucio, 4. These specimens are the first of this species to reach the American Museum.

Page 201. *Leptosciurus pucheranii medellinensis* (Gray). Seven specimens: Barro Blanco (alt. 7200 ft., just above Medellin), 4; Santa Elena (alt. 9000 ft., also near Medellin) 3. These specimens are practically topotypes of *medellinensis*, not previously represented in the American Museum collection.

Page 203. *Leptosciurus pucheranii salentensis* (Allen). Eight specimens, all from La Frijolera (alt. 5000 ft., just above Puerto Valdivia).

These specimens are provisionally referred to *salentensis*, but they all have the black dorsal band more strongly developed than the type series of that form. In other features of coloration they are closely similar to typical *salentensis*.

Page 222. *Mesosciurus hoffmanni quindianus* (Allen). Six specimens: Barro Blanco, 3; Santa Elena, 2; Malena, 1.

These specimens extend the range of *quindianus* in the Central Andes considerably to the north of previous records.

Pages 236-240. The receipt of 6 specimens of *Mesosciurus hoffmanni quindianus* from the immediate vicinity of Medellin, and of no specimens of the *Mesosciurus gerrardi* group from the Medellin region, renders it quite certain that the type locality of *Sciurus gerrardi* Gray, from "New Grenada," was *not* the vicinity of Medellin as assumed by me as probable on p. 236 of this paper. Furthermore, the present Antioquia collection contains 12 specimens of the *gerrardi* group from the immediate vicinity of Puerto Valdivia, on the lower Rio Cauca, which are not the form described and figured by Gray as *S. gerrardi*. On the other hand (see below), the series of the *gerrardi* group collected on the upper Rio Sucio (Pacific slope), at and near Dabeiba, is referable to my *M. gerrardi salaquensis*, which has no black tail-tip, and the limbs, shoulders and sides of the body are not red as represented in the description and colored figure of *gerrardi*, which represent a form more closely resembling *M. gerrardi zuliae* (Osgood) than any other member of the group at present known to me. I now believe that the type locality of *gerrardi* is somewhere between the ranges of the *zuliae-cucuta* group of this paper and the form described below as *baudensis*, in northern Colombia, and that it is a direct connectant between them. A single specimen from Rio San Jorge (No. 32701), with the tip of the tail lost, but which apparently must have been black, conforms in nearly all particulars, even to a nearly white belly, with the requirements of true *gerrardi*, and also geographically with the type region now suggested.

The specimens referred above (p. 239) to *gerrardi* I now find represent **two quite distinct forms of the *gerrardi* group, both quite different from true *gerrardi*, as follows:**

***Mesosciurus gerrardi baudensis* subsp. nov.**

Mesosciurus gerrardi gerrardi ALLEN, *antea*, p. 236, part.

Type, No. 33180, ♂ ad., Baudo (alt. 3500 ft.), coast region of western Colombia, July 16, 1912; Mrs. E. L. Kerr.

Back, from the shoulders to the base of the tail, with a broad area of intense glossy black, which extends also over the basal third of the upper surface of the tail; rest of the tail above deep red, without a black tip; fore limbs, shoulders and sides of the body deep red, which color extends along the lower edge of the flanks to the front of the thighs and hind limbs; the intermediate region between the black dorsal area and the red of the lower border of the flanks is grizzled ochraceous and black; whole ventral surface dark red; lower surface of tail black for the basal third, grizzled more or less with orange, the rest dark red, the hairs broadly banded mesially with black, the black usually showing more or less at the surface.

Represented by two specimens from Baudo, 1 from Bagado, 1 from Juntas de Tamaná (the latter not typical).

Intergrades with *M. g. choco* to the northward along the coast, with *salaquensis* in the interior, and with *milleri* to the southward.

Mesosciurus gerrardi valdiviæ subsp. nov.

Mesosciurus gerrardi gerrardi ALLEN, *antea*, p. 236, part (only the Valdivia specimens).

Type, No. 37674, ♀, ad., Puerto Valdivia (alt. 360 ft.), lower Rio Caura, Dec. 23, 1914; Leo E. Miller.

Similar in general coloration to *M. g. choco*, but without a black tail-tip. Upperparts finely grizzled black and ochraceous, giving the general effect of blackish finely punctated with yellowish; whole of the mid-dorsal region much darker than the flanks, ochraceous prevailing on the sides; ventral surface, including inside of limbs, reddish orange; fore limbs and feet externally reddish orange, usually extending upward over the shoulders; hind limbs externally like the flanks; tail above blackish for the basal fourth, the rest red at the surface, including the tip; under surface of tail centrally grizzled black and ochraceous, broadly fringed with red, and with a broad submarginal band of black. Type (collector's measurements), total length, 468 mm.; head and body, 250; tail vertebræ, 218; hind foot, 59.

Puerto Valdivia, 6 specimens; Frijolera (near Puerto Valdivia, alt. 5000 ft.), 6 specimens.

Strongly resembles dark specimens of *M. g. choco* of the Panama region and adjoining west coast district of northern Colombia, but is darker, with the ochraceous tipping of the hairs of the upperparts much shorter, and the tail without the broad black tip characteristic of *choco*. The series of 12 specimens is very uniform in coloration and other features.

Page 245. **Mesosciurus gerrardi salaquensis** (Allen). Seven specimens: Alto Bonito (headwaters of Rio Sucio, alt. 1500 ft.), 3; Dabeiba (alt. 2000 ft., near Alto Bonito), 4.

These specimens agree well with the type series of *salaquensis*, and extend the known range of *salaquensis* southeastward to Dabeiba.

