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REVISION OF THE SQUIRRELS OF MEXICO
AND CENTRAL AMERICA

BY

E. W. NELSON

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BY E. W. NELSON.

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INTRODUCTION.

THE arboreal squirrels inhabiting the region between the southern border of the United States and the Isthmus of Panama have been studied by several authors, notably J. E. Gray, E. R. Alston and J. A. Allen. The material at the disposal of these revisers was of the most fragmentary character, often without definite localities and in poor condition, hence it is hardly surprising that their conclusions are unsatisfactory.

During the past few years the quantity of material has been greatly increased and its quality much improved. Mr. G. K. Cherrie and Señor Anastacio Alfaro in Costa Rica; Dr. Chas. W. Richmond in Nicaragua; Mr. A. Forrer, the Lumholtz Expedition, and the late Dr. Audley C. Buller in Mexico, and Dr. E. A. Mearns, U. S. A., on the Mexican Boundary, have

¹ Recommended for publication by the Biological Society of Washington, February 25, 1899.

contributed largely to the extent and value of recent collections. The bulk of new material, however, has been gathered by Mr. E. A. Goldman and myself. Since 1891 we have been engaged in making explorations for the United States Biological Survey, under the Department of Agriculture. Western Guatemala has been explored and Mexico has been repeatedly traversed from north to south and from sea to sea. The routes of nearly every naturalist whose work is recorded have been followed, and almost all the known type localities of Mexican mammals have been visited. The series of squirrels thus brought together has given an insight into the relationships of the members of this group, which lack of material had hitherto rendered impossible. Moreover, familiarity with the topography of the country and the geographic distribution of Mexican and Guatemalan species gave me advantages not possessed by any previous worker on Neotropical squirrels.¹

During the preparation of the present revision I have been able to examine representatives—and in most cases types or topotypes—of nearly all the known species and subspecies found in Mexico and Central America. Dr. C. Hart Merriam, who had already done some work on the group, generously placed in my hands his MS notes and the Biological Survey series of more than 600 specimens; Mr. F. W. True, Executive Curator of the U. S. National Museum, gave me the use of the National Museum series, and Dr. J. A. Allen, Curator of Mammals in the American Museum of Natural History, forwarded the Tropical American squirrels, including the types of his species, in that collection. These additions brought the total number of specimens up to 919. But after a little study it became evident that, in order to reach satisfactory conclusions on many questions of synonymy, definite information was necessary concerning the types of species described by Gray and others. Accordingly, a series of specimens from the U. S. National Museum and Biological Survey collections answering as closely as possible to the imperfect published descriptions, was sent to Mr. Oldfield Thomas, Curator of Mammals in the British Museum, for comparison with the types preserved in London. Mr.

¹I am especially indebted to Dr. T. S. Palmer for many valuable suggestions, particularly in connection with the nomenclature and synonymy.

Thomas responded very handsomely, devoting considerable time to the comparison and returning the specimens with annotations which have made it possible to state authoritatively exactly what species were represented.

Within the area covered by the present paper Gray, in 1867, recognized 18 species and varieties, Allen in 1877, 6 species and 3 varieties, and Alston in 1880, only 7 species. As a result of the accumulation of modern material a number of new forms have been described by various authors, and in the present revision 43 species and subspecies are recognized.¹ In order to understand the relationships of these numerous species it is necessary to have a general idea of their surroundings and the topographic features of the region they inhabit.

PHYSIOGRAPHY OF THE REGION.

Mexico and Central America present great contrasts of topographic and climatic conditions, accompanied by wonderful variety of animal and vegetable life. The mountain ranges fronting the two coasts of Mexico, and uniting near the Isthmus of Tehuantepec, are of great magnitude and form the outer border or rim of the broad interior tableland. Southward the continental area is narrow and the elevated interior correspondingly reduced. One of the most characteristic features is the comparatively level lowland skirting both coasts between the sea and the base of the mountains. This coastal plain is sometimes 100 miles wide and often broken by hills or low ranges of mountains which extend out from the main interior ranges as short spurs, or rise island-like in the midst of the plain. The hills reach the sea at many points but usually the country near shore is level. The northern parts of the coastal plains, except a very narrow belt along the east shore of Mexico, lie within the Lower Sonoran zone and in passing southward, gradually merge into the Arid Tropical. On the west side the arid character of the coast belt extends at least to Costa Rica, but on the east coast it gives way in the southern half of Vera Cruz to the Humid Tropical zone which, with the exception of the arid

¹ Several South American species have been reported from the Isthmus of Panama but in the absence of any material have necessarily been omitted.

tropical peninsula of Yucatan, continues on to the Isthmus of Panama. The Arid Tropical areas are characterized by low scrubby forests; the Humid Tropical by greater luxuriance of vegetation. The rainfall on the mountain slopes facing the sea on both coasts is much heavier than on the adjacent lowlands, and is distributed more generally throughout the year, producing a heavier forest growth. In eastern Mexico this causes a northward extension of the Humid Tropical area, in the form of a long narrow tongue along the mountains, which reaches eastern San Luis Potosi. On the west coast the uniformity of the Arid Tropical area is broken by humid tropical islands at intervals along the mountains northward nearly to the border of Guerrero, and by belts of heavy forest along streams flowing through the plains.

Above the Tropical zones in Mexico the higher mountain slopes extend through all the succeeding life zones to extreme timberline, and in Central America to altitudes varying from 6000-14,000 feet. Differences of altitude are always accompanied by climatic changes, but in addition local causes also often exert a marked influence. Thus the proximity of high mountains, or the trend of a range or spur in relation to the course of the prevailing wind, frequently has a direct effect upon the rainfall of the surrounding district. In Vera Cruz the north and northeast slopes of mountains are by far the most humid owing to the fact that during the dry winter months 'northerners' prevail, bringing fogs and rain. A striking example of the climatic differences that may exist within a limited area is afforded by the slopes of Mt. Orizaba, in western Vera Cruz. The top of this mountain rises over 18,000 feet above sea level and is perpetually covered with snow; its southeastern base reaches the hot coast plain, and at an altitude of 800 feet the foothills are covered with a humid tropical forest so dense in places that the dew drops all day from the undergrowth; while on the opposite side, at an altitude of 8000 feet, lie the arid treeless tablelands.

HISTORY AND NOMENCLATURE.

The first tree squirrel of tropical North America to receive a distinctive scientific name was *Sciurus aureogaster*, described

by F. Cuvier in 1829. During the succeeding decade a few species were described, and in 1839 Bachman¹ published several additional species from Mexico. The first general enumeration of Tropical American squirrels appeared in 1842 in Lesson's 'Nouveau Tableau du Règne Animal,' in which seven species were mentioned from the region under consideration. During the next 25 years Wagner, Schinz, Peters, and Gray described a few species, Audubon and Bachman gave accounts of several in their 'Quadrupeds of North America' (1851-54), and Baird in 1857 referred briefly to the Mexican and Central American species in his 'Mammals of North America.'

The year 1867 was marked by the publication of two papers, Fitzinger's 'Natürliche Anordnung der Nagethiere,'² which included 10 species and subspecies of squirrels from Tropical North America; and, a few months later, Gray's 'Synopsis of Species of American Squirrels in the Collection of the British Museum.'³ The latter paper recognized 18 species and varieties north of Panama, several of which were supposed to be new, and was the first formal attempt to revise the Neotropical squirrels. Gray paid little attention to the work of previous authors and consequently renamed a number of species. His descriptions were poor, the synonymy badly involved, and some of the species were given impossible ranges. Dr. J. A. Allen, in revising the group in 1877,⁴ not only had the hopeless task of untangling Gray's results with the scanty material afforded by the museums in the United States, but was further handicapped by the prevailing tendency of the time to lump species, and as a consequence did not clear the ground. In the following year, 1878, Alston published a paper 'On the Squirrels of the Neotropical Region,'⁵ based on an examination of series in the Berlin, Paris, and British museums, with additional specimens sent him by Dr. Allen. Alston states that this material included the types of forty-one nominal species. In this revision 7 species were recognized as living within the limits

¹ Charlesworth's Mag. Nat. Hist., III, p. 334, 1839.

² Sitzungsber. Akad. Wiss. Wien. math.-nat. Cl., lv, pp. 474-480. July, 1867.

³ Ann. and Mag. Nat. Hist., 3d Ser., XX, pp. 415-434. October, 1867.

⁴ Mon. N. Am. Rodentia, 1877.

⁵ Proc. Zool. Soc. London, 1878, pp. 656-670.

of Mexico and Central America, as against 6 species and 3 varieties enumerated by Allen. In the Mammalia of the 'Biologia Centrali-Americana,' published in 1880, Alston again recognized 7 species—no more than those mentioned by Lesson in 1842. This wholesale lumping of widely separated species—sometimes under a name inapplicable to any of the forms placed under it—left the group even more complicated than before.

Dr. Allen followed Alston's paper of 1878 by a 'Synonymatic List of American Sciuri, or Arboreal Squirrels'¹ in which he adopted the latter's conclusions. Trouessart, in his 'Revision du Genre Écureuil'² in 1880, proposed several subgenera and a few months later enumerated the species in his 'Catalogue des Mammifères Vivants et Fossiles' (Rodentia).³

During the last 18 years no extended papers on Neotropical squirrels have appeared, but a number of species have been described from Mexico and Central America by Allen, Thomas, Merriam and myself.

NOTES ON DISTRIBUTION AND VARIATION.

Tree squirrels occur in suitable places throughout Mexico and Central America but the distribution of the various species depends largely upon the character of the forests. Thus *Sciurus negligens* is most abundant in the low, dense forests of ebony, less than twenty-five feet high, on the hot coast plains, while its near relative *S. deppci* loves the shady depths of humid tropical forests on the lower mountain slopes where the damp air produces an exuberant tree growth and an abundance of parasitic plants. The pigmy *Sciurus alfari*, first mistaken by its discoverer for a bird—a Dendrocolaptine creeper—also lives in similar surroundings in the mountains of Costa Rica. The large species exist under even more varied conditions since they occur from the hot coast country to the region of oaks and pines close to timberline, but the ranges of different species or subspecies are never coincident and overlap only in a few instances, as in the case of *S. colliciei nuchalis* and *S. poliopus*

¹ Bull. U. S. Geol. & Geog. Survey Terr., IV, pp. 877-887, 1878.

² Le Naturaliste, II, No. 37, pp. 290-293, Oct., 1880.

³ Bull. Soc. d'Etudes Sci. d'Angers, X, pp. 76-82, 1880.

colimensis on the coast of Colima, and *S. apache* and *S. durangi* in the Sierra Madre. No such antagonism exists between the large species (subgenus *Echinosciurus*) and the smaller ones (subgenera *Guerlinguctus* and *Microsciurus*) which frequently occupy the same ranges.

Many species change their environment by periodical migrations in search of food, moving from one locality to another with the ripening of fruits or seeds upon which they subsist. This is most marked on high mountains where a species may have a vertical range of many thousand feet. Dr. Buller obtained a specimen of *Sciurus poliopus cervicalis* among the pines on the Sierra Nevada de Colima at an altitude of 12,000 feet, but when we visited this mountain at another season, gnawed pine cones were abundant near the summit, but the squirrels had descended to lower levels and were feeding on wild figs and acorns at an altitude of 4000–6000 feet. In eastern Queretaro and northern Hidalgo, *S. aureogaster*, a tropical species which usually ranges below 4000 feet, was found in winter among the oaks and pines above 8000 feet alt. *S. deppsi* likewise at times wanders high above its normal range.

The effect of climate on the character of the pelage is so marked that it is possible to tell with considerable certainty whether a species belongs to the tropics or to the higher mountains. Tropical species have thin pelage, short thin under fur, and coarse, stiff, or almost bristly dorsal hairs; those of the Transition and Boreal zones have thick soft pelage with long dense under fur. These differences are sometimes strikingly shown in subspecies of the same squirrel: thus the tropical *Sciurus aureogaster hypopyrrhus* has thin coarse pelage, while *S. aureogaster frumentor*, which ranges between the altitudes of 6000 and 8000 feet on a cold mountain slope, has dense soft pelage. Species of the hot coasts of Central America are characterized by peculiarly coarse, shining, bristly dorsal hairs. Seasonal differences in pelage are usually slight, since there is no area of heavy snow fall or long continued cold weather except in the Sierra Madre of Durango and Chihuahua. Individual variation, on the other hand, is often excessive and renders some species extremely difficult to describe. The large

number of species and subspecies of these squirrels, together with their great individual variation, have hitherto proved an insuperable stumbling block in their treatment. The large series now available for study shows that the group as a whole is in a state of evolution and has developed groups of closely related species or well marked geographic races, often within very limited areas. For example, in the State of Vera Cruz, the typical form of *Sciurus aureogaster* occurs throughout the northern part, *S. aureogaster frumentor* on the west-central border, and *S. aureogaster hypopyrrhus* in the southern part. Many of the subspecies are so different from others of the same species that without the intermediate series no one would for a moment suspect their specific identity.

The extraordinary amount of geographical variation in tropical North American squirrels is due mainly to an unusual plasticity of organization which allows slight climatic differences to produce a visible effect. The most obvious of these influences are differences in temperature and rainfall, with their distribution through the year, and consequent effect on the vegetation.

The cool forests of the Transition zone in the interior of southern Mexico and Guatemala are characterized by moderate rainfall and have what may be called an inland climate. The forests of the same zone on the mountains bordering the hot coast plains, exposed to the moisture bearing winds from the sea, receive a much greater annual rainfall accompanied by cloudiness and mists, resulting in an exuberance of vegetation not found elsewhere in this zone. The effects of these differences in humidity upon the squirrels are beautifully illustrated by *Sciurus poliopus* and its subspecies. For example, subspecies *hernandezii*, *nemoralis* and *cervicalis*, of the drier interior mountains, are characterized by dull grayish upperparts and white underparts, and the absence of sharply contrasting nape and rump patches. *Sciurus poliopus* and its subspecies *effugius* inhabit mountains near the coast, and the effect of the increased humidity is marked by the striking contrast between their gray backs and bright ferruginous underparts. In addition, *effugius* has an unusually dark nape patch and brilliantly white ear patches.

Increased humidity within the tropics, also, is usually accom-

panied by increased intensity of coloration. This is well shown by the dark, rich colors of *Sciurus aureogaster hypopyrrhus* of the humid tropics compared with the paler colors of the closely related *S. aureogaster*, of the arid tropics a little farther north.

A similar intensification of color is characteristic of the squirrels inhabiting the humid east coast from Vera Cruz to Panama, as contrasted with the paler species of the more arid west coast from Mazatlan to Costa Rica.

SUBGENERA OF NORTH AMERICAN SQUIRRELS.

The tree squirrels of North America may be separated into ten groups, distinguished by cranial, and sometimes by external characters. Six of these groups have been already recognized as of subgeneric rank, and four others are here named.

In discriminating the subgenera of squirrels one of the characters on which much stress has been laid is the presence or absence of the small upper premolar. The discussion of the groups in detail is prefaced, therefore, with a few remarks on this tooth. Trouessart makes the erroneous statement that in the subgenus *Macroxus* the upper molar series is often $\frac{5}{4}$ in the young and $\frac{4}{4}$ in the adult, adding that the rudimentary premolar is more or less speedily shed.¹ Under *Macroxus* he names six Tropical American squirrels, viz., *aureogaster*, *æstuans*, *hoffmanni*, *depppei*, *chrysurus*, and *pusillus*. Of these *æstuans* and *hoffmanni* never have the extra premolar, while all of the others, with the possible exception of *chrysurus*, always have it in the adult skull. The six species named above represent four subgenera, two of which were recognized by Trouessart in the same paper; one has since been separated by Allen; another is described below. In all North American Squirrels having the extra premolar, except the Chickarees or Red Squirrels of the United States and Canada (subgenus *Tamiasciurus*), it is well developed and permanent. Among the Chickarees it is extremely small, variable in size, shape, and position, and frequently absent. Dr. Allen states, in his recent revision, that it is absent

¹ Le Naturaliste, II, No. 37, pp. 292, Oct., 1880.

in thirty percent of the specimens examined. In the skulls of *Tamiasciurus* examined by me the percentage of absences is much smaller than that given by Dr. Allen, but the tooth was frequently so minute that it could be seen only by the aid of a lens. It is smallest, most variable and most frequently absent in the eastern *S. hudsonicus* and its subspecies. In the other groups of North American squirrels, this tooth, when present, is a well-developed peg, reaching nearly or quite as high as the 2d premolar, and often functional, the crown wearing down with the adjacent teeth. Skulls from Mexico show conclusively that in the species of that region, at least, the small premolar is a character of the adult. It is not present with the milk premolar in immature skulls, but appears coincidentally with the permanent premolar and is equally persistent. Since it is persistent in certain groups and always absent in others, it evidently possesses considerable taxonomic value.

The subgenera recognized in the present paper occupy clearly defined geographic areas and, without exception, the ranges of the most closely related groups are separated by a distinct gap. A curious equality is found in the number of subgenera belonging respectively to Tropical and Temperate North America. Five of the ten subgenera belong essentially to Mexico and Central America, only one having a representative within the United States. The remaining five belong to Temperate North America, although four of them have each a single representative in extreme northern Mexico. The distribution of the subgenera may be tabulated roughly as follows:

MEXICO AND CENTRAL AMERICA.

Baiosciurus subgen. nov.
Echinosciurus Trouess.
Aræosciurus subgen. nov.
 Not represented.
 Not represented.
Guerlinguetus Gray.
Microsciurus Allen.

UNITED STATES.

Tamiasciurus Trouess.
Neosciurus Trouess.
Parasciurus Trouess.
Otosciurus subgen. nov.
Hesperosciurus subgen. nov.
 Not represented.
 Not represented.

The extra premolar is present in all of these groups except *Aræosciurus*, *Parasciurus*, and *Guerlinguetus*. *Guerlinguetus*

and *Microsciurus* are South American groups with numerous species, and occur as intrusive elements in Central America, where each is represented by one or two species. *Otosciurus* and *Hesperosciurus* have few species and belong to the western United States, but cross the border into Mexico.

The first name available for a subgenus of American Squirrels is *Guerlinguetus* Gray, 1821, of which *Macroxus* is a synonym. *Macroxus*, the name which has been commonly used, has been curiously diverted from its original application to include nearly all American squirrels. Lesson was the first to misuse the name, after which Gray went to even greater extremes, in which he was, to a certain extent, followed by Trouessart in 1897. In 1880 the last named author established several subgenera of American squirrels, several of which were accepted by Merriam and Allen; yet in 1897 he again lumped several of them in the ancient confusion under *Macroxus*. The most recently described subgenus is *Microsciurus* Allen, 1895.

LIST OF SUBGENERA WITH TYPE SPECIES.

- Echinosciurus*, type *S. hypopyrrhus* Wagler (p. 25, 38).
Hesperosciurus, type *S. griseus* Ord (p. 27, 83).
Neosciurus,¹ type *S. carolinensis* Gmelin (p. 27).
Otosciurus, type *S. aberti* Woodhouse (p. 28, 85).
Tamiasciurus, type *S. hudsonicus* Erxleben (p. 28, 87).
Arcosciurus, type *S. oculus* Peters (p. 29, 88).
Parasciurus, type *S. niger* Linnaeus (p. 30, 97).
Guerlinguetus, type *S. guerlinguetus* Gray (p. 30, 98).
Baioosciurus, type *S. deppci* Peters (p. 31, 101).
Microsciurus, type *S. alfari* Allen (p. 32, 105).

Subgenus ECHINOSCIURUS Trouessart (pl. I, fig. 9).

- Echinosciurus* TROU ESSART, *Le Naturaliste*, II, No. 37, Oct. 1880, p. 292; *Cat. Mamm., Rodentia*, pp. 80-81, 1880 (part).
Macroxus TROU ESSART, *Catalogus Mammalium*, nov. ed., II, pp. 421-429, 1897 (part).
Type *Sciurus hypopyrrhus* WAGLER, from Mexico.

¹*Neosciurus* is included here in order to complete the revision of the subgenera of North American squirrels.

Distribution.—All of Central America and Mexico (except extreme northern part). Ranges from Arid and Humid Tropical zones up to Boreal.

External characters.—Form and color extremely variable: body usually rather slender; tail long, narrow; pelage coarse, stiff, almost bristly, in typical species.

Cranial characters.—Premolars $\frac{2}{1}$. Skull short, broad, depressed; brain case not highly arched but expanded laterally and widening to occiput; interorbital area broad, rostrum short, broad, and heavy; nasals about equal to or shorter than interorbital width.

General notes.—*S. hypopyrrhus* Wagler was named as the type of *Echinosciurus*, but most of the red bellied Central American squirrels were given that name at the time Trouessart wrote, and he no doubt had in mind some bristly haired species from Central America instead of Wagler's animal. However, Wagler's *hypopyrrhus* belongs to the same natural group and must therefore be retained as the type. Most of the large squirrels in tropical North America belong to this group. The skulls are distinguished from those of other large North American species by the combination of two upper premolars with a short broad rostrum and flattened interorbital region. *Echinosciurus* contains *S. aureogaster*, *S. poliopus*, *S. yucatanensis*, *S. colliæi*, *S. truei*, *S. sinaloensis*, *S. nelsoni*, *S. socialis*, *S. griseoflavus*, *S. goldmani*, *S. managuensis*, *S. boothiæ*, *S. adolphei* and *S. thomasi* with their subspecies. These species occupy nearly all of the hot coast region of tropical North America and range thence over the mountains of Central America and southern Mexico. Those of the highlands of Guatemala and southern Mexico are distinguishable from those of the hot coasts and the interior of Central America by their much longer and softer pelage. In the former series are *S. aureogaster*, *S. poliopus*, *S. truei*, *S. sinaloensis* and *S. griseoflavus*, with their subspecies. The species of the hot districts on the coast and southward are remarkable for the stiff, harsh and usually shining long hairs of the back—the character upon which the name of the subgenus must have been based. *S. yucatanensis* with white ear tufts, and *S. poliopus* with a comparatively long, slender rostrum and soft pelage are least typical. *S. aureogaster hypopyrrhus*, the type, is about midway, in the character of its pelage, between the soft haired species of the highlands and the harsh haired species of Central America. The wide geographic range and large number of species of this group are accompanied by a greater amount of specific variation in the skull than is shown in the smaller groups. In the species of Central

America there seems to be a curious correlation between the increased thickness of the rostrum and the increased coarseness of the pelage, the extreme of which is reached in *S. thomasi*.

HESPEROSCIURUS¹ subgen. nov. (pl. I, fig. 5).

Type *Sciurus griseus* Ord, from the Dalles of the Columbia.

Distribution.—Extreme southwestern Washington, western Oregon, and most of California, to northern Lower California, Mexico. Transition zone and border of Upper Sonoran.

External characters.—Size very large—total length about 560 mm.; tail a little shorter than head and body, very broad and bushy.

Cranial characters.—Premolars $\frac{2}{1}$; molar series, including small premolar, unusually heavy; skull large and long, with long and deep rostrum; nasals long, expanded anteriorly and much narrowed posteriorly; brain case depressed and broadened across parietal region; postorbital process of malar strongly developed and usually ending in a point. Skull most like that of *Neosciurus*, especially in proportions of rostrum and interorbital area, but decidedly more depressed and broadened posteriorly; the zygomatic process of squamosal thrown out horizontally, and the zygomatic arch inclined less obliquely upward.

General notes.—*Hesperosciurus* is a small group containing only *S. griseus* Ord and its subspecies *nigripes* Bryant. It is limited to the Transition and upper part of Upper Sonoran zones of the Pacific Coast States and has its nearest relative in the Gray Squirrels (*Neosciurus*) of the eastern United States. Like the latter the color is uniform gray above and white below, the group distinctions resting mainly on cranial characters.

Subgenus NEOSCIURUS Trouessart.

Neosciurus TROUESSART, Le Naturaliste, II, No. 37, Oct. 1880, p. 292; Cat. Mamm., Rodentia, pp. 76–77, 1880 (part); MERRIAM, Proc. Biol. Soc. Washington, VII, p. 27, 1892 (part).

Macroxus TROUESSART, Catalogus Mammalium, nov. ed., II, p. 421, 1897 (part).

Type *Sciurus carolinensis* Gmelin, from Carolina.

Distribution.—Eastern half of United States, not reaching Mexican border. Lower and Upper Austral and Transition zones.

External characters.—Form rather slender; tail bushy; upperparts gray or grayish brown; underparts white. Externally much like certain species of *Aræosciurus* but with different tooth formula.

¹ From ἑσπερος, western; + *Sciurus*.

Cranial characters.—Premolars $\frac{2}{1}$. Skull long and rather narrow; braincase inflated over interparietal region; rostrum long, compressed laterally; nasals much longer than interorbital breadth, much narrowed posteriorly and expanded anteriorly; occiput high and narrow; squamosal process of zygomatic arch turning abruptly down, the arch ascending more obliquely from back to front than in *Hesperosciurus*.

General notes.—This subgenus includes *S. carolinensis* and its subspecies of the eastern United States. It is an Austral and Transition zone group. *Neosciurus* is most closely related to *Hesperosciurus*, from which it is distinguished by the braincase, which is highly arched over the interparietals and narrowed and rounded posteriorly. These two groups balance one another in the eastern and western United States much as do *Parasciurus* and *Arctosciurus*.

OTOSCIURUS¹ subgen. nov. (pl. I, fig. 2).

Type *Sciurus aberti* Woodhouse, from San Francisco Mt., Arizona.

Distribution.—Rocky Mountains and Sierra Madre, from state of Colorado to Durango, Mexico. Transition zone.

External characters.—Ears long and broad, with magnificent tufts in winter; tail short and unusually broad; feet very large. Upperparts mainly gray; underparts white, with lateral line more or less distinctly black.

Cranial characters.—Premolars $\frac{2}{1}$. Skull short and broad; frontal area flattened; braincase depressed, inflated laterally; rostrum compressed laterally, rather light; nasals long (equalling interorbital breadth).

General notes.—*Otosciurus* like *Tamiasciurus* has strong external characters by which it may be at once recognized. The group contains three species, *S. aberti*, *S. concolor*, and *S. durangi*, which range through the yellow pine forests of the Transition zone in the southern Rocky Mountains and northern Sierra Madre.

Subgenus TAMIASCIURUS Trouessart (pl. I, fig. 8).

Tamiasciurus TROU ESSART, Le Naturaliste, II, No. 37, Oct. 1880, p. 292; Cat. Mamm., Rodentia, pp. 81–82, 1880; MERRIAM, Proc. Biol. Soc. Washington, VII, p. 23, 1897; ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., X, pp. 249–298, 1898.

Macroxus TROU ESSART, Catalogus Mammalium, nov. ed., II, pp. 421–429, 1897 (part).

Type '*Sciurus hudsonius* Pall.' (= *S. hudsonicus* Erxl.), from Hudson Bay.

¹ From οὖς, ὠτός, ear; + *Sciurus*.

Distribution.—Most of the wooded parts of the United States and British America; south to northern Lower California, Mexico. Boreal and Transition zones.

External characters.—Size small—under 450 mm.; ears long, well haired, conspicuously tufted in winter; tail short, bushy, flattened; lateral line (present in summer) black.

Cranial characters.—Premolars $\frac{2}{1}$ sometimes $\frac{1}{1}$ (the first very small and irregular in development); skull short, wide and depressed; rostrum short and stout; nasals shorter than interorbital breadth; anterior end of zygomatic arch unusually broad and abruptly spreading; auditory bullæ proportionately large.

General notes.—*Tamiasciurus* was proposed by Trouessart in 1880 and subsequently dropped into synonymy until revived by Dr. Merriam in 1892. Curiously enough Trouessart reduced it again to synonymy in 1897, uniting it with most other North American squirrels under the untenable subgeneric name *Macroxus*. In 1898 Dr. Allen again revived the subgenus, which is unquestionably worthy of recognition as a well marked natural group. *Tamiasciurus* includes all of the Chickarees, *S. hudsonicus*, *S. douglasi* and *S. fremonti* with their subspecies. As already stated by Dr. Merriam, this subgenus is of Boreal origin, but is also common throughout a large part of the Transition zone in the United States.

ARÆOSCIURUS¹ subgen. nov. (pl. I, fig. 3).

Type *Sciurus oculatus* Peters, from eastern Mexico.

Distribution.—Mountains bordering the tableland of Mexico from the volcanoes of Orizaba and Toluca north to central Arizona and west-central New Mexico. Transition zone.

External characters.—Size large; body rather slender; tail usually long, sometimes exceeding length of head and body; upperparts gray or yellowish; underparts white or yellowish.

Cranial characters.—Premolars $\frac{1}{1}$. Skull rather short, depressed; braincase broadened at parietals; occiput low and broad; front of skull depressed at base of rostrum (more arched in *Parasciurus*); rostrum light; nasals narrow, slightly tapering posteriorly; upper end of premaxillæ narrow.

General notes.—The subgenus *Aræosciurus* is characteristic of the Transition zone in the mountains bordering the tableland of Mexico from Mts. Orizaba and Toluca northward. It is intrusive in the United

¹From ἀραιός, slender; + *Sciurus*.

States, where it is represented in Arizona and western New Mexico by a single species, *S. arizonensis*. The group is most nearly related to *Parasciurus* from which the skull characters distinguish it. The following species and subspecies belonging to this subgenus: *S. oculatus*, *S. o. tolucae*, *S. alleni*, *S. nayaritensis*, *S. apache*, *S. arizonensis* and *S. a. huachuca*.

Subgenus PARASCIURUS Trouessart (pl. I, fig. 1).

Parasciurus TROUSSERT, Le Naturaliste, II, No. 37, Oct. 1880, p. 292; Cat. Mamm., Rodentia, pp. 77-78, 1880 (part); MERRIAM, Proc. Biol. Soc. Washington, VII, p. 27, 1892.

Macroxus TROUSSERT, Catalogus Mammalium, nov. ed., II, p. 421, 1897 (part).

Type *Sciurus niger* Linn., from Carolina.

Distribution.—Eastern half of United States, entering Mexico from western Texas. Upper and Lower Austral (Sonoran) zones.

External characters.—Size large; body slender; tail long, rather bushy. Upperparts grizzled blackish or yellowish; underparts blackish or yellowish.

Cranial characters.—Premolars $\frac{1}{1}$. Skull rather long, rostrum long and broad, nasals broad; braincase long, narrow, not inflated over parietals and narrowed at occiput.

General notes.—The subgenus *Parasciurus* is limited to the Fox Squirrels, *S. niger* and *S. ludovicianus* with their subspecies. It is distinguished from *Arcosciurus* mainly by the long narrow braincase and heavier rostrum. The ranges of the two groups do not touch at any point.

Subgenus GUERLINGUETUS Gray (pl. I, fig. 7).

Guerlinguetus GRAY, London Medical Repository, XV, p. 304, April, 1821.

Macroxus F. CUVIER, Dents des Mamm., p. 162, 1823. (Type, le guerlinguet); Dict. Class. d'Hist. Nat. X, p. 16, 1826; LESSON, Nouv. Tabl. Règn. Anim., Mamm., p. 111, 1842 (part); GRAY, Ann. & Mag. Nat. Hist., 3d Ser., XX, pp. 271, 419-434, 1867 (part); TROUSSERT, Le Naturaliste, II, No. 37, 1880, p. 292 (part); Cat. Mamm., Rodentia, pp. 78-80, 1880 (part); Catalogus Mammalium, nov. ed., II, pp. 421-429, 1897 (part).

Type, 'le guerlinguet'—*S. guerlinguetus* Gray (= *Sciurus æstivans* Linn.), from Surinam.

Distribution.—Tropical America from Peru and Brazil to Nicaragua.

External characters.—Size rather small—total length between 300 and 450 mm.; ears long, thinly haired; tail shorter than body, rather

bushy, flattened; color usually some shade of brown on upperparts and buffy or rufous below.

Cranial characters.—Premolars $\frac{1}{4}$. Skull rather broad, flattened interorbitally; rostrum broad and deep at base; nasals long, expanded at outer end; braincase not very highly arched but expanded laterally over parietal region; audital bullæ small; post-palatal notch a little farther behind last molar than in *Microsciurus* (about as in *Baiosciurus*); palatal width between molar series great. The skull resembles in size and general appearance that of *Baiosciurus*, from which it is distinguishable by slender rostrum, proportionately greater interorbital and zygomatic breadth, and by the absence of the small premolar.

General notes.—*Guerlinguetus*, proposed by Gray in 1821, is the first name available for a subgenus of American squirrels. It was subsequently discarded by its author for *Macroxus*, proposed two years later by Cuvier in the 'Dents des Mammifères.' In the 'Nomenclator Zoologicus,' Agassiz cites *Macroxus* from the 'Dictionnaire des Sciences Naturelles, X, 1818,' but a careful search fails to verify the reference. The name does appear in the Dictionnaire Classique d'Histoire Naturelle, Vol. X, 1826, p. 16, which was probably the citation intended by Agassiz. The 'Dents des Mammifères' was completed in 1825, but on page xvi of the introduction Cuvier states that the work appeared in parts, and that the part containing the rodents was issued in 1823; from which therefore must date *Macroxus*. Subsequent writers have followed Gray in ignoring *Guerlinguetus* in favor of *Macroxus*. The latter name was proposed for the group typified by *Sciurus astuans* of South America, yet Lesson in 1842, Gray in 1867, and Trouessart in 1880 and 1897, included under it the most diverse squirrels in America. *Guerlinguetus* should be strictly limited to *S. astuans* with its numerous subspecies and allies, all of which have brownish backs with brown, fulvous, or rufous bellies and a single upper premolar. It is a characteristic group of northern South America, intrusive in Central America where it is represented by *S. a. hoffmanni* of Costa Rica and *S. richmondi* of Nicaragua.

BAIOSCIURUS¹ subgen. nov. (pl. I, fig. 4.)

Type Sciurus deppei Peters, from Papantla, Vera Cruz.

Distribution.—Northeastern Honduras, Guatemala, Chiapas and eastern Mexico to Tamaulipas.

¹From *βαίος*, small; + *Sciurus*.

Proc. Wash. Acad. Sci., May, 1899.

External characters.—Size small—total length between 350 and 400 mm.; ears long, thinly haired; tail slightly shorter than body, narrow and flattened.

Cranial characters.—Premolars $\frac{2}{1}$, well developed; skull rather long and slender; rostrum broad and deep at base; nasals about equal to interorbital breadth; anterior end of zygomatic arch narrow and tapering gradually to junction with premaxilla; braincase rounded and slightly arched on posterior half of frontals; audital bullæ proportionately small, smaller than in *Guerlinguetus* and much smaller than in *Tamiasciurus*.

General notes.—*Baiosciurus* contains but two species, *S. deppei* and *S. negligens*. In size and general style of color these squirrels are very similar to members of the subgenus *Guerlinguetus*, but are distinguished by the presence of an extra premolar and other skull characters. Their size, shape of tail, and form of skull distinguish them from *Microsciurus*; and the slender tail, presence of a well developed small premolar, lack of ear tufts, absence of the black lateral line and shape of skull separates them from *Tamiasciurus*. The group is purely tropical, *S. deppei* belonging to the Humid and *S. negligens* to the Arid Tropical zones.

Subgenus MICROSCIURUS Allen (Pl. I, fig. 6).

Microsciurus ALLEN, Bull. Am. Mus. Nat. Hist., VII, p. 332, 1895;
TROUËSSART, Catalogus Mammalium, nov. ed., II, p. 429, 1897.
Type Sciurus alfari Allen, from Jiménez, Costa Rica.

Distribution—Northern South America north to Costa Rica, Central America.

External characters—Smallest of American squirrels—total length, in nearly or quite all the species, under 300 mm. Ears short, rounded, well haired; tail much shorter than body, slender and rounded.

Cranial characters—Premolars $\frac{1}{1}$. Skull short, broad and highly arched over braincase: rostrum short, broad and deep at base; nasals narrow and shorter than interorbital breadth; upper end of premaxillæ very heavy; malar broad and expanded vertically; postpalatal notch only a trifle posterior to last molar.

General notes.—*Microsciurus* is a tropical American subgenus with numerous species distributed over a large part of northern South America and may be considered intrusive in Central America, *S. alfari* being the only species known north of Panama. *S. pusillus* Desm., *S. kuhli* (Gray), *S. peruanus* Allen, *S. mimulus* Thomas, and other South American species belong here. Until Dr. Allen de-

found this group its members were confused with the species of the subgenus *Guerlinguetus* Gray (*Macroxus* Cuvier) which are characterized by a single upper premolar.

KEY TO SPECIES AND SUBSPECIES.

SIZE LARGE, TOTAL LENGTH OVER 450 MM.

Premolars $\frac{1}{1}$

Belly buffy or yellowish

Back gray

Median area on back black; belly usually deep buff
oculatus p. 88.

Median area on back washed with blackish; belly buffy whitish.....*toluca* p. 89.

Back yellowish gray

Belly rusty yellow; total length over 500 mm.

apache p. 94.

Belly more dingy yellow; total length under 500 mm.....*limitis* p. 97.

Belly white

Back golden buffy or yellowish overlaid with grizzling of black and white.....*nayaritensis* p. 93.

Back gray

Back uniform gray or grayish brown; ears gray; total length under 500 mm.....*alleni* p. 91.

Back gray washed with yellowish on nape and back of shoulders; ears rusty; total length over 500 mm.....*huachuca* p. 96.

Premolars $\frac{2}{2}$

Nape patch strongly marked, rump patch present or absent

Belly gray, white, or buffy

Belly gray, rump patch well marked; back dark gray.....*frumentor* p. 44.

Belly white or buffy

Rump patch poorly defined or absent

Back dull whitish; belly white or buffy
socialis p. 62.

Back pale gray; belly white or buffy
hernandezii p. 48.

Rump patch well defined

Middle of back gray; feet gray or blackish; belly white.....*colimensis* p. 52.

Middle of back whitish; feet whitish, belly white or buffy.....*cocos* p. 65.

Belly rufous

Feet gray or blackish

Ribs and sometimes shoulders rufous

Back pale gray; top of head iron gray
aureogaster p. 38.

- Back dark gray; top of head iron gray or blackish.....*hypopyrrhus* p. 42.
- Ribs and shoulders not rufous
- Back dingy whitish; nape patch rusty
socialis p. 62.
- Back bluish gray in middle, remainder sooty brownish.....*hirtus* p. 56.
- Feet white
- Back whitish, rump and nape patches very bright.....*cocos* p. 65.
- Back gray
- Nape patch strongly marked, dark rufous
effugius p. 54.
- Nape patch not strongly marked, rusty yellowish.....*poliopus* p. 46.
- Nape and rump patches absent or not well defined**
- Nape and rump patches not well defined
- Back dark gray, sparingly or not at all mixed with yellowish hairs
- Back and under side of tail dark iron gray; feet gray
cervicalis p. 51.
- Back and under side of tail paler gray; feet white
nemoralis p. 50.
- Back pale gray mixed with yellowish hairs; feet white
- Belly white.....*hernandezi* p. 48.
- Belly rufous.....*poliopus* p. 46.
- Nape and rump patches absent
- Back with broad median band of blackish; rest of body whitish
dorsalis p. 74.
- Back without broad median band of blackish
- Belly pale gray; back coarsely grizzled gray or yellowish gray
yucatanensis p. 70.
- Belly not pale gray
- Belly blackish or white**
- Belly blackish; back sooty blackish grizzled with yellowish gray.....*nelsoni* p. 55.
- Belly white
- Ear tufts present, whitish; back gray or yellowish gray
yucatanensis p. 70.
- Ear tufts absent
- Ears bordered with black*
- Back very dark, lateral line reddish; ear patches rusty.....*boothiae* p. 76.
- Back grayer, no lateral line; ear patches very large, white*goldmani* p. 82.
- Ears not bordered with black*
- Back pale gray or yellowish, *finely* grizzled with black
- Back gray
- Size large; total length about 570 mm.; back uniform; no lateral line.....*griseus* p. 83.

Size medium, total length about 485 mm.; median dorsal area rufous; lateral line black
durangi p. 85.

Back yellowish

Ears pale rusty; flanks like back...*truei* p. 61.

Ears dull rusty; flanks washed with whitish

sinaloensis p. 60.

Back yellowish gray, *coarsely* grizzled with black

Ears gray; yellowish of back dull, sometimes very indistinct.....*colliæi* p. 58.

Ears rusty; yellow of back brighter, more buffy.
nuchalis p. 59.

Belly not blackish or white

Belly buffy

Back with median area blackish or dark brown, rest of body buffy.....*dorsalis* p. 74.

Back with median area not blackish

Ears black edged.....*variegatoides* p. 79.

Ears not black edged.....*managuensis* p. 81.

Belly rufous

Top of head paler than back

All of back blackish brown; feet, legs, lower flanks and belly dull chestnut rufous.....*adolphei* p. 73.

Middle of back blackish or dark yellowish brown or grayish yellow; rest of body rufous

dorsalis p. 74.

Top of head not paler than back

Back heavily washed with black

Belly rusty rufous.....*belti* p. 78.

Belly rich dark ferruginous.....*thomasi* p. 71.

Back not washed with black

Back pale gray or sooty blackish

Back pale gray

Feet dark gray or blackish; rufous of belly sometimes extending up on ribs
aureogaster p. 38.

Feet pale gray; rufous of belly not extending up on ribs.....*chiapensis* p. 69.

Back sooty blackish, with thin wash of yellowish gray

Back uniform.....*nelsoni* p. 55.

Back with area of bluish gray across the middle*hirtus* p. 56.

Back not pale gray or sooty blackish

Back yellowish brown sometimes thinly washed with gray.....*griseoflavus* p. 67.

Back blackish, grizzled with gray or yellowish; underparts and costal area rufous

hypopyrrhus p. 42.

- SIZE SMALL, TOTAL LENGTH UNDER 450 MM. ; PREMOLARS $\frac{1}{1}$ OR $\frac{2}{1}$
 Premolars $\frac{1}{1}$; ears medium long, thinly haired (Subgenus *Guerlinguetus*)
 Tail washed with bright ferruginous.....*hoffmanni* p. 98.
 Tail washed with yellowish.....*richmondi* p. 100.
 Premolars $\frac{2}{1}$
 Ears large, tufted (Subgenus *Tamiasciurus*)
 Back gray, belly white, lateral line black.*mearnsi* p. 87.
 Ears small or medium, not tufted
 Ears short, rounded, thickly haired; total length under 300 mm. (Subgenus *Microsciurus*)
 Tail washed with reddish.....*alfari* p. 105.
 Ears medium long, pointed, thinly haired; tail washed with white; total length over 300 mm. (Subgenus *Baiosciurus*)
 Back grayish brown.....*negligens* p. 104.
 Back reddish or yellowish brown.....*deppei* p. 101.

LIST OF SPECIES, TYPE LOCALITIES, AND SPECIMENS EXAMINED.

Name.	Type Locality.	No. of specimens examined.
<i>Sciurus aurogaster</i> F. Cuv.	Eastern Mexico [Typical at Alta Mira, Tamaulipas]	98
<i>hypopyrrhus</i> (Wagl.)	'Mexico' [Typical at Minatitlan, Vera Cruz]	18
<i>frumentor</i> Nelson	Las Vigas, Vera Cruz, Mexico	14
<i>poliopus</i> (Fitzinger)	'Cordillera of Oaxaca' [Typical on Cerro San Felipe] Oaxaca	16
<i>hernandezi</i> Nelson	Mts. w. of Oaxaca City, Oaxaca, Mexico	17
<i>nemoralis</i> Nelson	Patzcuaro, Michoacan, Mexico	32
<i>cervicalis</i> (Allen)	Sierra Nevada de Colima, Jalisco, Mex.	24
<i>colimensis</i> Nelson	Hacienda Magdalena, Colima, Mexico	10
<i>effugius</i> Nelson	Mts. w. of Chilpancingo, Guerrero, Mex.	8
<i>nelsoni</i> Merriam	Huitzilac, Morelos, Mexico	18
<i>hirtus</i> Nelson	Tochimilco, Puebla, Mexico	7
<i>colliæi</i> Richardson	San Blas, Tepic, Mexico	24
<i>nuchalis</i> sub sp. nov.	Manzanillo, Colima, Mexico	17
<i>sinaloensis</i> sp. nov.	Mazatlan, Sinaloa, Mexico	4
<i>truei</i> sp. nov.	Camoa, Rio Mayo, Sonora, Mexico	4
<i>socialis</i> Wagner	Near Tehuantepec City, Oaxaca, Mex.	54
<i>cocos</i> Nelson	Acapulco, Guerrero, Mexico	33
<i>griseoflavus</i> (Gray)	'Guatemala' [Typical near Dueñas]	22
<i>chiapensis</i> subsp. n.	San Cristobal, Chiapas, Mexico	12

LIST OF SPECIES, TYPE LOCALITIES, AND SPECIMENS EXAMINED.

(Continued.)

Name.	Type Locality.	No. of specimens examined.
<i>yucatanensis</i> Allen	Merida, Yucatan, Mexico	5
<i>thomasi</i> sp. nov.	Talamanca, Costa Rica	5
<i>adolphi</i> (Lesson)	Realejo, Nicaragua	1
<i>dorsalis</i> (Gray)	W. coast Central America [Typical at Liberia, Costa Rica]	20
<i>boothiae</i> Gray	'Honduras' [Typical at San Pedro Sula]	8
<i>Sciurus boothiae belti</i> subsp. nov.	Escondido River, Nicaragua	8
<i>variegatoides</i> Ogilby	Salvador, Central America	1
<i>managuensis</i> Nelson	Managua River, Guatemala	3
<i>goldmani</i> Nelson	Huehuetan, Chiapas, Mexico	10
<i>griseus</i> Ord	The Dalles of the Columbia, Oregon	52
<i>durangi</i> (Thomas)	Ciudad Ranch, Durango, Mexico	32
<i>douglasi mearnsi</i> (Town.)	San Pedro Martir Mts., Lower California, Mexico	3
<i>oculatus</i> Peters	Eastern Mexico [Typical at Las Vigas, Vera Cruz]	46
<i>tolucae</i> Nelson	Volcano of Toluca, Mexico	15
<i>alleni</i> Nelson	Monterey, Nuevo Leon, Mexico	22
<i>nayaritensis</i> Allen	Valparaiso Mts., Zacatecas	41
<i>apache</i> Allen	Near Bavispe River, Chihuahua, Mex.	33
<i>arizonensis huachuca</i> Allen	Huachuca Mts., Arizona	26
<i>ludovicianus limitis</i> (Baird)	Devil's River, Texas	14
<i>aetnans hoffmanni</i> Peters	Costa Rica [Typical near San José]	25
<i>richmondi</i> Nelson	Escondido River, Nicaragua	18
<i>deppoi</i> Peters	Papantla, Vera Cruz, Mexico	73
<i>negligens</i> Nelson	Alta Mira, Tamaulipas, Mexico	23
<i>alfari</i> Allen	Jiménez, Costa Rica	3

SYSTEMATIC DESCRIPTIONS OF SPECIES.¹Subgenus **ECHINOSCIURUS** Trouessart. (pl. I, fig. 9.)**SCIURUS AUREOGASTER** F. Cuvier. Red-bellied Squirrel.

- Sciurus niger* ERXLEBEN, Syst. Regni Anim., pp. 417-418, 1777 (part: the melanistic form—*Sciurus mexicanus* or Quatechallotlthlilitic of Hernandez, p. 582. Not *S. niger* Linn., 1758.)
- Sciurus variegatus* DESMAREST, Nouv. Dict. d'Hist. Nat., x, pp. 103-104, 1817 (part); SAUSSURE, Revue et Mag. de Zool., pp. 4, 5, 1861; ALSTON, Proc. Zool. Soc. London, pp. 660-662, 1878 (part); Biol. Cent.-Am., Mamm., pp. 127-128, 1880 (part: specimens from Orizaba, Cordova, Mirador, Santuario and Jalapa, Vera Cruz); SUMICHRAST, La Naturaleza, v, p. 324, 1882 (part: specimens from central Vera Cruz); THOMAS, Proc. Zool. Soc. London, p. 74, 1890. (Not *S. variegatus* ERXLEBEN 1777.)
- Sciurus aureogaster* F. CUVIER, Hist. Nat. Mammifères, vi, livr. LIX, pl. with text, 1829; BACHMAN, Proc. Zool. Soc. London, pp. 88-89, 1838; I. GEOFFROY, Voyage de la Vénus, Zool., Atlas, pl. II, 1846; text, pp. 156-163, 1855 (part: specimens described with rufous lower surface); BAIRD, Mamm. N. Am., p. 282, 1857; ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., III, pp. 181-182, 1890 (part: specimens from Tampico); Ibid., III, p. 222, 1891 (part: specimens from Valles, San Luis Potosi, and Tampico, Tamaulipas).
- Sciurus rufiventris* LICHTENSTEIN, Abhandl. K. Akad. Wiss. Berlin, p. 116 (1827), 1830.
- Sciurus leucogaster* F. CUVIER, Suppl. d'Hist. Nat. Buffon, I, pp. 300-301, 1831.
- Sciurus mustelinus* AUDUBON and BACHMAN, Proc. Acad. Nat. Sci. Phila., pp. 100-101, 1841 (melanistic); Journ. Acad. Nat. Sci. Phila., VIII, pt. 2, p. 312, 1842; Quad. N. Am., III, pp. 258-259, pl. CLII, 1851.
- Sciurus ferrugineiventris* AUDUBON and BACHMAN, Proc. Acad. Nat. Sci. Phila., p. 101, 1841; Journ. Acad. Nat. Sci. Phila., VIII, pt. 2, p. 313, 1842; Quad. N. Am., I, pp. 292-293, pl. xxxviii, 1851.
- Sciurus ferrugineiventris* SCHINZ, Synopsis Mamm., II, p. 14, 1845.
- Sciurus aurogaster* AUDUBON and BACHMAN, Quad. N. Am., III, p. 344, 1851.
- Sciurus hypoxanthus* (LICHTENSTEIN MS) I. GEOFFROY, Voyage de la Vénus, Zool. (text), pp. 158-159, 1855 (on labels of squirrels from Berlin Museum).
- Sciurus chrysogaster* GIEBEL, Säugethiere, p. 650 footnote, 1855.
- Macroxus aureogaster* GRAY, Ann. and Mag. Nat. Hist., 3d ser., xx, 423, 1867 (var. 2 from Mexico).
- Sciurus aureigaster* ALLEN, Mon. N. Am. Rodentia, pp. 750-753, 1877 (part: specimens from Orizaba, Cordova, and Mirador, Vera Cruz); Bull. U. S. Geol. Survey Terr., IV, pp. 882-883, 1878.
- Sciurus hypoxanthus* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., III, pp. 222-223, 1891. (Melanistic specimens from Tampico, Mexico.)
- Sciurus leucops* ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., IX, p. 198, 1897.

Type locality.—'California'—really eastern Mexico. Specimens from Alta Mira, Tamaulipas are typical. Type in Paris Museum?

¹All measurements are in millimeters; specimens measured in the flesh unless otherwise stated. The basal length of the skull is measured from gnathion to basion, the palatal length from Henselion (posterior alveolus of incisor) to palatal notch.

Distribution.—Arid tropical lowlands and adjacent mountains of southern Tamaulipas, northern Vera Cruz, eastern San Luis Potosi, eastern Queretaro and Puebla, northeastern Hidalgo, and thence south to border of Humid Tropical zone in central Vera Cruz, and northern side of Isthmus of Tehuantepec in Oaxaca. (Usually below 4000 ft. alt., but sporadically up to over 8000 ft. in Hidalgo and Queretaro.)

Characters.—Size large; color of back pale grizzled gray with nape patch poorly defined, rusty or yellowish brown; underparts bright ferruginous, this color extending up over fore legs and costal area nearly or quite to top of shoulders. Tail long, flat, and rather slender; hairs on back rather coarse and glossy. Teats: p. $\frac{1}{4}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Color.—Top of nose and fore part of crown iron gray; nape patch often indistinct and varying from dull yellowish brown to dull rusty rufous, generally grizzled with gray or whitish; rest of upperparts including upper cheeks, sides and top of neck (below and behind nape patch) a median line between shoulders, entire lumbar region, rump and outside of thighs varying from dark iron gray to pale whitish gray; fore feet and sometimes outside of fore legs iron gray, usually darker than back; hind feet varying from blackish faintly grizzled with gray to iron gray like back; sides of nose, lower cheeks and chin pale grizzled gray; rest of underparts bright ferruginous, this color usually extending over outside of fore legs and high up over costal area, sometimes even meeting and forming a band across top of shoulders; base of tail all around like back; rest of tail above black washed with white; below, with a broad median band of ferruginous, bordered by a line of black and edged with white; ring around eye dark buff, with an area of dull yellowish brown extending back nearly or quite to base of ear; ears gray like crown, or rusty reddish like nuchal patch; ear patches (usually absent in summer) dingy gray or whitish. Hairs on back black, with broad white tips, often mixed with others having broad median and sometimes basal yellow rings. The winter pelage differs from that of summer mainly in paler upperparts and distinct whitish ear patches.

Variation.—*Sciurus aureogaster* presents a wide range of variation. The underparts range from bright ferruginous to dark rufous, almost like the color of *S. hypopyrrhus*. The back varies from whitish to dark iron gray. The upward extension of ferruginous on the sides varies from a slight wash just back of fore legs to a broad band reaching over costal area and across top of shoulders, covering nearly half of the body.

A specimen from Orizaba in the U. S. National Museum has the

rufous reaching up all along the flanks, covering the outside of thighs and back, and confining the gray dorsal area to a median band on lumbar region and rump; the top of head and nape black, thinly grizzled with gray, and the tail black thinly washed with gray above, and with ferruginous along middle of under side. A specimen from Pinal de Amoles, Queretaro, has the upperparts, including outside of legs, sides of body and upper surface of tail, nearly uniform pale grizzled gray; the underparts dingy rusty. A specimen from Catemaco, Vera Cruz (approaching *hypopyrrhus* in intensity) has the same pattern as the one last described, but the breast and inguinal region are grizzled with gray. The width of the red median band on the under side of tail varies and is sometimes nearly or quite replaced by the widening of the black border. This is a common phase in individuals grading toward *hypopyrrhus*. Specimens from northern Vera Cruz, Queretaro, San Luis Potosi, and Tamaulipas are paler or grayer than those from farther south in central Vera Cruz.

On the east slope of the Cofre de Perote near Jico and Jalapa, Vera Cruz, most of the squirrels are intergrades between *aureogaster* proper and *frumentor*. They are even richer ferruginous below than true *aureogaster*, but have the distinct nape and rump patches and tendency to obsolescence of rufous median band on lower side of tail of *frumentor*. On account of the rufous underparts these specimens are referred to *aureogaster* rather than to *frumentor*; they combine the characters of the two forms in about equal proportion but differ slightly from either. Squirrels from Lake Catemaco, Vera Cruz, and about Guichicovi, Serabia, and Santo Domingo, Oaxaca, on the Isthmus of Tehuantepec, show intergradation between true *aureogaster* and *hypopyrrhus*, and it is frequently puzzling to decide on which side of the line to class them.

Melanism is common in this species; it is particularly prevalent in some localities and at times entirely replaces the normal phase. A melanistic specimen from Alta Mira, Tamaulipas, has the top of the head and rest of upperparts dark rusty brown, thinly washed with black, darkest over the shoulders; tail black slightly washed with gray; entire underparts, including nose and sides of head to eyes, fore feet and legs and hind feet black, and a thin collar of grizzled rusty brown across the under side of neck. A specimen from Forlon in the same state is similar but has a very much heavier wash of black on the back. Very young squirrels show the characteristic color markings.

Measurements.—Average of 5 adults from Alta Mira: total length 509; tail 260; hind foot 66.6.

Cranial characters.—Premolars $\frac{2}{1}$. The skull (pl. I, fig. 9) of this species is typical of a large group of squirrels in Mexico and Central America. It is rather short and robust, with heavy rostrum; the braincase is inflated over the interparietal region; the peg-like 1st premolar is set barely inside and close to the anterior angle of the 2d premolar. Five adult skulls from Alta Mira average: basal length 49.8; palatal length 26.5; interorbital breadth 19.1; zygomatic breadth 34.5; length of upper molar series 11.3.

General notes.—This strikingly colored species was the first tree squirrel of Mexico and Central America to receive a distinctive scientific name, and has figured most prominently in scientific literature. Cuvier published an excellent figure of it with the original description, showing the characteristic bright rufous underparts. The figure represents the less common phase of pelage with but slight extension of rufous on the costal area and a poorly defined nuchal patch. By some curious oversight Cuvier, two years later, renamed the species *S. leucogaster*. He gave California as the habitat of this squirrel but mentioned specimens from eastern Mexico; modern explorations have proved conclusively that it occurs only in eastern Mexico. Later authors have placed it under various names, among which *Sciurus variegatus* Erxleben has been frequently used, but as I have recently shown (Science, NS., VIII, No. 208, pp. 897-8, Dec. 23, 1898), the latter name belongs to a ground squirrel—the so called *Spermophilus macrourus* of Bennett and other authors. The *Sciurus ferruginiventris* of Audubon and Bachman is unmistakably the same as Cuvier's *aureogaster*, and like it was said to come from California; and there is little doubt that *S. mustelinus* of the same authors was based on a melanistic specimen of the same animal.

Sciurus aureogaster is separable into three well marked geographic races, of which the one most closely agreeing with Cuvier's figure and description inhabits northern Vera Cruz and southern Tamaulipas. Hence specimens from Alta Mira in southern Tamaulipas are here described as typical.

Habits.—This squirrel has a wide distribution in the forests of eastern Mexico, ranging from the coastal plains to the slopes of the Cordillera. On the northern side of the Isthmus of Tehuantepec, Oaxaca, as well as near Orizaba and Jalapa, Vera Cruz, and farther north it commonly ranges up to an altitude of 4000 feet.

Still farther north it extends back along the deep river valleys far into the interior of Hidalgo and Queretaro; and on the humid, densely forested slopes of the mountains at Pinal de Amoles, Quere-

taro, and near Encarnacion, Hidalgo, Mr. Goldman took specimens at an altitude of over 8000 feet. The northern part of its range is an arid tropical region where it occurs mainly in heavy woods along streams and canyons. Farther south, on the borders of the humid tropical region, it finds suitable forests more generally distributed; and on the mountain slopes it is usually found in areas of heavy tree growth.

Throughout their range these squirrels do considerable damage to cornfields, and while corn is in the ear it is an easy matter to find them about the edges of fields cleared in the forest. At other times they are dispersed, seeking food wherever wild fruits or nuts may be in season. Their occurrence at an altitude of 8000 feet in Hidalgo and Queretaro is probably due to a migration in search of food, for this is far above their usual range.

Specimens examined.—Ninety-eight, from the following localities: Victoria, Forlon and Alta Mira, Tamaulipas; Valles, San Luis Potosi; Pinal de Amoles, Queretaro (8000 feet); Metlaltoyuca, Puebla; Sierra Encarnacion, Hidalgo (8000 feet); Papantla, Chichicaxtle, Jalapa, Jico, Mirador, Orizaba, Motzorongo, Otatitlan, Tuxtla, and Catemaco, Vera Cruz; Serabia, Guichicovi, and mountains near Santo Domingo, Oaxaca.

SCIURUS AUREOGASTER HYPOPYRRHUS (Wagler).

Fire-bellied Squirrel.

Sciurus hypopyrrhus WAGLER, Oken's Isis, pp. 510-511, 1831; WAGNER, Schreber's Säugth., II, Suppl. pl. CCXIII C, 1837; Ibid., Suppl., III, pp. 167-168, 1843; SAUSSURE, Revue et Mag. de Zool., p. 5, 1861; ALLEN, Mon. N. Am. Rodentia, pp. 746-750, 1877 (part); ALSTON, Proc. Zool. Soc. London, pp. 662-664, 1878 (part); Biol. Cent.-Am. Mammalia, pp. 128-131, 1880 (part: specimens from Coatzacoalcos, Vera Cruz).

Sciurus hypopyrrhus GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 424, 1867.

Macroxus morio GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 424, 1867.

Macroxus maurus GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 425, 1867.

Sciurus variegatus SUMICHRAST, La Naturaleza, v, p. 324, 1882 (part: specimens from southern Vera Cruz, Mexico).

Sciurus rufiventris? ROVIROSA, La Naturaleza, VII, p. 360 (1885-86) 1887 (Tabasco, Mexico).

Sciurus aureogaster ALLEN, Bull. Am. Mus. Nat. Hist., III, pp. 181-182, 1890 (part: specimens from Serabia, Oaxaca).

Type locality.—'Mexico.' Specimens from Minatitlan, Vera Cruz, are typical. Location of type specimen unknown—but probably in Berlin Museum.

Distribution.—Humid tropical forests of southern Vera Cruz, ad

jacent parts of extreme southeastern Oaxaca, Tabasco, eastern Chiapas, and perhaps extreme northwestern Guatemala (below 4000 feet).

Characters.—This form is much darker than true *S. aureogaster*; the intense, almost chestnut rufous of underparts usually extends as a broad band over the costal area and top of shoulders; the pelage is thinner, with much stiffer and more shining dorsal hairs, and the tail slenderer with black predominating. Teats: p. $\frac{1}{4}$ a. $\frac{2}{5}$ i. $\frac{1}{4}$.

Color.—Top of nose and fore part of crown dark iron gray; lumbar region, rump, outside of thighs and base of tail finely grizzled with black, grayish white, and dull rusty or yellowish brown; nape patch indistinct, dull yellowish brown or dingy rufous, often grizzled with black and gray; ears like nape, grizzled gray or reddish brown, sometimes bordered with black; a thin basal patch of dingy grayish white in winter; ring around eyes reddish or dark buffy brown, confluent with area of same color extending back on sides of head below ears; sides of nose, chin, and most of cheeks dingy gray; rest of underparts deep, almost chestnut ferruginous, the same color usually covering all of fore legs and extending up as a broad band over costal area and shoulders; fore and hind feet black, sometimes minutely grizzled with gray; tail above, black thinly washed with white; below, usually with a narrow median line of rich ferruginous, heavily bordered with black and thinly edged with white, the median rufous line frequently absent and replaced by black. Hairs on back (except rufous area) black, with fine tips of white or sometimes narrow subterminal rings of yellowish brown.

Variation.—Black squirrels of this form are very common at Minatitlan and in Tabasco. A curious specimen from Minatitlan is uniformly black except on sides of nose, cheeks and chin which are dark gray; flanks and hips thinly grizzled with yellowish gray; upper surface of tail thinly grizzled with gray; underparts, including inside of legs, dark reddish brown. The nuchal patch is sometimes confluent with the rufous area on shoulders, though usually lighter. An immature specimen from the vicinity of Santo Domingo, Oaxaca, is dingy reddish brown above, grizzled with black and gray. The area covered by rufous on sides and across shoulders varies, and the color also varies in intensity. The forelegs are sometimes grizzled iron gray with or without mixture of reddish.

Measurements.—Average of 5 adults from Minatitlan: total length, 522.8; tail vertebræ, 266.8; hind foot, 67.3.

Cranial characters.—Premolars $\frac{2}{4}$. Skull similar to that of typical *aureogaster* but larger and proportionately narrower, with audital

bullæ larger and slightly constricted just in front of middle. Five adult skulls from Minatitlan average: basal length, 52.6; palatal length, 27.1; interorbital breadth 18.4; zygomatic breadth, 34.8; length of upper molar series 11.4.

General notes.—Although Wagler merely gave 'Mexico' as the type locality for *S. hypopyrrhus*, his description applies so well to the dark colored race of *S. aureogaster* of southern Vera Cruz that it seems advisable to adopt his name for this form. Specimens from Minatitlan, Vera Cruz, are typical.

An adult from Minatitlan (No. 78082 ♀ ad., U. S. Nat. Mus.) is even darker and more generally ferruginous than the Santo Domingo specimen, and has a blackish area on fore shoulders and blackish rump finely grizzled with dingy yellowish. After comparing this specimen with the type of *Macroxus maurus* Gray, Mr. Thomas writes that it is exactly like one of the two co-types. He also states that the British Museum has a specimen from Teapa, Tabasco, similar to the type of *Macroxus morio* Gray, but a little less melanistic, and that this specimen is the same as our No. 78082 except for a little dash of melanism across the shoulders, thus proving the identity of *maurus* and *morio*.

The name *hypopyrrhus* Wagler has been used indiscriminately by various authors for the rufous bellied squirrels of Mexico, Central America and even northern South America.

Habits.—The Fire-bellied Squirrels live in the humid tropical forest where they range from sea level up to an altitude of about 4000 feet. They levy a heavy toll upon cornfields planted in clearings in the forest, and are also fond of cacao beans, gathering about the plantations in large numbers, and are especially destructive in Tabasco and eastern Chiapas. In order to gather a cacao crop the planters are obliged to employ men with guns to patrol the plantations daily, but in some districts, despite such efforts, the squirrels are a serious pest and do great damage.

Specimens examined.—Eighteen: from Minatitlan and Catemaco, Vera Cruz; mountains near Santo Domingo and Guichicovi, Oaxaca; Uspanapa River, Tabasco; Tumbala, Chiapas.

SCIURUS AUREOGASTER FRUMENTOR Nelson.

Perote Squirrel.

Sciurus aureogaster frumentor NELSON, Proc. Biol. Soc. Washington, XII, pp. 154-155, June 3, 1898.

Type locality.—Las Vigas, Vera Cruz, Mexico. Type no. 54259 U. S. National Museum, Biological Survey Collection.

Distribution.—Mixed pine and oak forests of Upper Austral zone on east and north base of the Cofre de Perote and adjacent eastern slope of the Cordillera near Las Vigas, Vera Cruz (alt. 6000–8000 ft.).

Characters.—Differs strikingly from typical *aureogaster* in having well marked nuchal and rump patches of yellowish brown or rufous brown; the underparts gray or gray washed with rufous; tail heavier and more bushy; pelage softer. Teats: p. $\frac{1}{4}$ a. $\frac{2}{2}$ i. $\frac{1}{1}$.

Color.—Nuchal and rump patches strongly marked, varying from dark yellowish brown to dark rusty red, washed with black, extending forward as a paler area along sides of head to enclose ears and eyes; rest of upperparts including nose and fore crown, fore feet, outside of legs and sides of body, dark grizzled iron gray, usually with rusty or pale rufous subterminal rings on hairs of back and sides; hind feet varying from black, slightly grizzled with gray, to dark iron gray; chin, throat and cheeks dingy gray; rest of underparts varying from pale gray to gray washed with rusty red; tail at base like back, rest of tail above black thinly washed with white; below, with a median band varying from pale rusty yellowish to dark ferruginous, bordered with a black band and edged with white; ears usually like nuchal patch but sometimes grayish and sometimes with a black border; basal patch dingy white, present in winter, usually absent in summer. Hairs on back black, with conspicuous white tips often mixed with others having pale rufous subterminal rings.

Variation.—The series of this form and of *aureogaster* show perfect intergradation although the two extremes are strikingly different. Some specimens taken below Las Vigas have the ferruginous of the underparts somewhat grizzled with gray and more dingy than in *aureogaster*. The black on the lower surface of the tail varies from a narrow border to a broad band which reduces the median area to a narrow line. Some specimens show 3 or 4 distinct black and rusty, or reddish, annulations on lower surface of tail, giving a grizzled appearance which does not occur in either *aureogaster* proper or *hypopyrrhus*. No melanistic specimens seen.

Measurements.—Average of 5 adults from type locality: total length 504.6; tail vertebrae 249.2; hind foot 68.8.

Cranial characters.—Premolars $\frac{2}{1}$. Skull indistinguishable from that of typical *aureogaster*. Four adult skulls from the type locality average: basal length 52.5; palatal length 26.1; interorbital breadth 19.7; zygomatic breadth 34.4; length of upper molar series 11.2.

General notes.—In several characters this subspecies agrees with the description of *S. nigrescens* Bennett, but after comparing a speci-

men of *frumentor* with Bennett's type, Mr. Thomas writes that they are not the same.

Habits.—This form, like true *aureogaster*, gathers about corn fields to feast upon the ripening ears. At other seasons it feeds mainly upon acorns and pine nuts, moving from one locality to another with the variation in food supply.

Specimens examined.—Fourteen: from near Las Vigas and above Jico, Vera Cruz, Mexico.

SCIURUS POLIOPUS (Fitzinger). Oaxaca Squirrel.

Sciurus albipes WAGNER, Abhandl. math.-phys. Cl. K. bayerisch. Akad. Wiss. München, II, pp. 501-504, 506-507, 1837; Suppl. pl. CCXIII D, Schreber's Säugthiere, 1837 (not *S. albipes* Kerr, 1792).

Sciurus varius WAGNER, Supplement Schreber's Säugthiere, III, pp. 168-170, 1843 (see Suppl. pl. CCXIII D, 1837). Not *S. varius* Pallas, 1831.

Sciurus variegatus poliopus FITZINGER, Sitzungsber. K. K. Akad. Wiss. Wien. math.-naturw. Cl., LV, I. Abth., p. 478, March, 1867. (Based on *S. varius* var. β Wagner, l.c. III, p. 168, 1843.)

Sciurus variegatus rufipes FITZINGER, Sitzungsber. K. K. Akad. Wiss., Wien. math.-naturw. Cl., LV, I. Abth., p. 478, March, 1867. (Based on *S. varius* var. γ Wagner, l.c. III, p. 168, 1843.)

Macroxus leucops GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, pp. 427-428, Dec., 1867.

Sciurus variegatus ALSTON, Proc. Zool. Soc. London, 1878, pp. 660-662; Biol. Cent.-Am., Mamm., pp. 127-128, 1880 (part: Oaxaca and La Parada, Oaxaca).

Sciurus wagneri ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, pp. 453-454, Nov., 1898.

Type locality.—Cerro San Felipe, Oaxaca, Mexico. Type in Berlin Museum.

Distribution.—Pine and oak forests of Transition and Boreal zones on mountains north, east, and south of Valley of Oaxaca, Mexico (alt. 7500-11,000 feet).

Characters.—Size large; back grizzled gray; underparts bright ferruginous; feet white. Pelage thick and soft; tail large and bushy. Teats: p. $\frac{1}{4}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Color.—Top of nose and fore crown iron gray; nape patch rather indistinct, yellowish brown washed with black; rump patch, when present (usually absent), of same color; rest of back and outside of fore and hind legs gray, more or less plentifully intermixed with hairs having yellowish or rusty brown subterminal rings; feet usually pure white; ears gray or mixed gray and brown, with well marked white basal patches: sides of head gray, or grayish white, paler than back; ring around eyes whitish; chin and throat white or grayish white; rest of underparts rich ferruginous red; tail at base all round like

back; tail above black, washed with white; below, with well defined broad median area varying from grizzled yellowish or rusty brown to clear ferruginous, narrowly bordered with black and edged with white. Hairs of back black with white tips and basal, median or subterminal rings of rufous.

Variation.—Most of the series from Cerro San Felipe, Reyes, and Mt. Zempoaltepec agree in having the feet white. When the nape patch is well defined the area between the eye and base of ear is usually yellowish brown.

A Zempoaltepec specimen is brighter rufous below, and the reddish buffy rings of the dorsal hairs are brighter and more conspicuous than usual. The three specimens from the vicinity of Ozolotepec, at the southeast end of the Valley of Oaxaca, are in winter pelage and differ from summer specimens from the Cerro San Felipe in having the sides of the head and ring around eye shaded with dark buffy, and the feet grizzled gray. The squirrels from near Ozolotepec live in an isolated group of mountains, though not distant from the range of which the Cerro San Felipe forms a part, and probably represent a local form not sufficiently differentiated to warrant subspecific recognition. A single specimen from Cerro San Felipe, with feet grizzled gray, represents Wagner's var. β (= *S. variegatus polioopus* Fitzinger); and another with feet white suffused with rufous represents Wagner's var. γ (= *S. variegatus rufipes* Fitzinger) showing that these forms were based upon individual variation. Apparently there is no striking difference between summer and winter pelages. No melanistic specimens seen.

Measurements.—Average of five adults from type locality: total length 527.6; tail vertebræ 257.6; hind foot 70.2.

Cranial characters.—Premolars $\frac{2}{1}$. Skull (pl. II., fig. 3) more slender and rostrum longer than in typical *S. aureogaster*. Five adult skulls from the type locality average: basal length 52.2; palatal length 27.3; interorbital breadth 18.6; zygomatic breadth 34.5; length of upper molar series 10.7.

General notes.—In 1837 Wagner named this squirrel *Sciurus albipes*, and in 1843 replaced this name by *S. varius*, mentioning two varieties, var. β ("pedibus nigro-cinereis") and var. γ ("pedibus ferrugineis"). In March, 1867, Fitzinger named these varieties respectively *Sciurus variegatus polioopus* and *Sciurus variegatus rufipes*, and in the following December Gray named the species *Macroxus leucops*. Recently Dr. J. A. Allen has shown that both of Wagner's

names were preoccupied and, overlooking Fitzinger's names, renamed the species *S. wagneri*.¹

A typical specimen of *S. poliopus* (No. 68183 U. S. Nat. Museum) from Cerro San Felipe, was sent to the British Museum for comparison with the type of Gray's *Macroxus leucops*, and Mr. Thomas informs me that it is exactly like one of the two cotypes (B. M. 58. 10. 22.4.); the other cotype differs only in being rather less rufous and not so gray.

Wagner's specimens were obtained by Karwinski, a botanical collector who did much work on the Cerro San Felipe (a few miles north of the city of Oaxaca) and as the original descriptions apply perfectly to the squirrels of this part of the Cordillera of Oaxaca it is unquestionably the type locality.

Specimens examined.—Sixteen: from Cerro San Felipe, Reyes, Mt. Zempoaltepec, mountains near Ozolotepec, and Pluma, Oaxaca.

SCIURUS POLIOPUS HERNANDEZI Nelson.

Oak Woods Squirrel.

Sciurus albipes quercinus NELSON, Proc. Biol. Soc. Washington, XII, pp. 150-151, June, 3, 1898 (not *S. quercinus* Erxl., 1777).

Sciurus wagneri quercinus ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, p. 453, Nov., 1898.

Sciurus albipes hernandezii NELSON, Science, NS., VIII, p. 783, Dec. 2, 1898.

Type locality.—Mountains 15 miles west of City of Oaxaca, Oaxaca, Mexico. Type no. 68202, U. S. National Museum, Biological Survey Collection.

Distribution.—Pine and oak forests of Transition and Boreal zones on mountains west of the Valley of Oaxaca and thence to Lower Sonoran zone in southern Puebla and southeastern Guerrero, Mexico.

Characters.—Back grayer than in *S. poliopus*, and intermixed with yellow instead of rufous; underparts white or buffy; median band on lower surface of tail usually grizzled yellowish gray. Pelage thick and soft; tail large and bushy. Teats: p. $\frac{1}{4}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Color.—Top of nose and fore part of crown grizzled gray washed with blackish; nape usually faintly yellowish, grizzled with black; rump patch rarely present; rest of upperparts, including outside of legs, pale gray mixed with pale yellowish; feet white; ears gray or mixed gray and yellowish brown with well marked white basal patch; sides of head dingy grayish, sometimes shaded with brown between eye and ear; ring around eye whitish; tail all around at base like

¹ Bull. Am. Mus. Nat. Hist., N. Y., X., pp. 453-4, Nov. 10, 1898.

back; tail above black, heavily washed with white; below, with broad median band varying from dingy grizzled yellowish gray to pale rusty, a poorly defined black border and broader edging (and sometimes wash over entire lower surface) white; chin and throat white; rest of underparts usually white, sometimes varying to pale buffy or rusty buff. Hairs on back black with white tips and yellowish basal rings, mixed with others having subterminal and basal rings of dull yellowish, and still others with black subterminal, and yellowish median rings.

Variation.—The yellowish ringed hairs on the back vary somewhat in number but are not sufficiently numerous to appreciably effect the general color. A faint yellowish indication of the rump patch is sometimes present, but always indistinct. No melanistic specimens seen. Specimens from the arid Lower Sonoran and upper edge of the Arid Tropical zones in northwestern Oaxaca, southwestern Puebla, and adjacent part of Guerrero are closely related to *hernandezi*, but are slenderer with backs whiter, nape and rump patches more distinctly yellowish brown; underparts usually buffy but sometimes white, and median area on under side of tail bright rusty ferruginous. The characters presented by these squirrels are almost worthy of subspecific recognition, but the material at hand is too limited to satisfactorily determine their value.

Measurements.—Average of five adults from type locality: total length 539.6; tail vertebræ 268.8; hind foot 68.8.

Cranial characters.—Premolars $\frac{2}{1}$. Skulls average a little smaller (with longer upper molar series) but are not otherwise distinguishable from those of *S. poliopus*. Five from type locality average: basal length 51.5; palatal length 26.5; interorbital breadth 19.5; zygomatic breadth 34.6; length of molar series 11.

General notes.—The name first proposed for this squirrel being preoccupied, the subspecies was renamed in honor of Francisco Hernandez, the author of the *Historiæ Animalium Novæ Hispaniæ*.

Habits.—These squirrels feed upon acorns and pine nuts, and at the time of our visit to the type locality, in September, were found in the huge oak trees growing along certain slopes and ridges in the pine forest at an altitude of 8000–9000 feet. They were shy, and instead of concealing themselves at our approach, usually made off through the tree tops.

Specimens examined.—Twenty-one: from mountains west of Valley of Oaxaca, southwestern Puebla and southeastern Guerrero.

SCIURUS POLIOPUS NEMORALIS Nelson.

Michoacan Squirrel.

Sciurus albipes nemoralis NELSON, Proc. Biol. Soc. Washington, XII, p. 151, June 3, 1898.

Sciurus wagneri nemoralis ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, p. 454, Nov., 1898.

Type locality.—Patzcuaro, Michoacan, Mexico. Type no. $\frac{35358}{47523}$, U. S. National Museum, Biological Survey Collection.

Distribution.—Pine and oak forests of Transition and Boreal zones, from the Volcano of Toluca, State of Mexico, to Nahuatzin, Michoacan, Mexico (alt. 7000–12,000 feet).

Characters.—Similar to *S. hernandezi* in having feet and underparts white, but back, including nape and rump patches, decidedly darker. Pelage full and soft; tail large and bushy. Teats: p. $\frac{1}{4}$ a. $\frac{2}{2}$ i. $\frac{1}{1}$.

Color.—Top of nose and fore crown dark iron gray washed with shining black; nape patch usually varying from dingy yellowish brown to dark rusty, almost chestnut brown, washed and grizzled with black; rump patch usually paler; rest of upperparts, including outside of legs, iron gray with slight intermixture of rusty; feet usually white; ears dark gray or grizzled gray and yellowish brown, with distinct white basal patches; sides of head whitish gray; ring around eye whitish; sides of head from nape patch to eyes sometimes yellowish brown; underparts usually white, rarely buffy yellow; tail above black, with heavy wash of white; below, with broad median area grizzled gray, yellowish gray or yellowish brown, with poorly defined black border and white edge, the white sometimes extending as a wash over entire lower surface. Hairs of back black, with subterminal and sub-basal rings of dark buffy or yellowish, or with white tips and basal, or sub-terminal, buffy rings.

Variation.—The nape and rump patches vary from dingy yellowish to dark buffy or dingy chestnut, washed more or less heavily with black; nape usually darker than rump. A melanistic phase occurs at Patzcuaro and becomes more common to the southeast until on the Volcano of Toluca it entirely replaces the gray phase. Only two out of nine melanistic specimens from Toluca are grizzled with dingy yellowish gray, the others being uniformly black. Some of the six melanistic specimens from Patzcuaro are sparsely and others abundantly grizzled with gray or dingy fulvous, and the tail is strongly edged with white. In the latter specimens the under surface is usually smoky black, and one has albinistic patches in the axillæ and on the

belly. An immature female from Patzcuaro has the feet gray, but this is rare. Only three of the large series in the gray phase from Patzcuaro have buff underparts. The amount of intermixed rusty on the back varies but is never strong enough to affect the general color.

Measurements.—Average of five adult specimens from type locality: total length 537; tail vertebræ 272; hind foot 68.8.

Cranial characters.—Premolars $\frac{2}{1}$. Skulls not distinguishable from those of *S. poliopus*. Three adult skulls from the type locality average: basal length 51; palatal length 26.8; interorbital breadth 18.6; zygomatic breadth 34.3; length of upper molar series 11.

Habits.—These squirrels feed upon acorns and pine seeds according to the season, and are not so shy as some of their relatives. They were common near Patzcuaro and on the Volcano of Toluca.

Specimens examined.—Thirty-two: from Patzcuaro and Nahuatzin, Michoacan, and north slope Volcano of Toluca, Mexico.

SCIURUS POLIOPUS CERVICALIS (Allen).

Colima Mountain Squirrel.

Sciurus leucops ALLEN, Mon. N. Am. Rodentia, pp. 753-756, 1877 (part: specimens from Sierra Madre of Colima—not *S. leucops* Gray, 1867).

Sciurus variegatus ALSTON, Biol. Cent.-Am., Mammalia, pp. 127-128, 1880 (part: specimens from "Durango, Xantus, U. S. Nat. Mus.," really from the Sierra Madre of Colima. Not *S. variegatus* Erxl., 1777).

Sciurus aureogaster leucops ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., 11, pp. 166-167, Oct., 1889.

Sciurus cervicalis ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., 111, pp. 183-185, Dec., 1890.

Sciurus wagneri cervicalis ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, p. 454, Nov., 1898.

Type locality.—Hacienda San Marcos, Tonila, Jalisco, Mexico (at east base of Sierra Nevada de Colima). Type no. 1991, American Museum of Natural History, New York.

Distribution.—Pine and oak forests of Upper Austral and Boreal zones of the Sierra Nevada de Colima, Jalisco, Mexico, and thence north along high mountains to Ameca, Jalisco, and east into western Michoacan (alt. 6000-12,000 feet; sporadically down to 4000 ft.).

Characters.—Readily distinguished from the other forms of *S. poliopus* by the dark iron gray upperparts, blackish head, dark nape and rump patches, and dark iron gray under surface of tail. Pelage thick and soft; tail large and full. Teats: p. $\frac{1}{4}$ a. $\frac{2}{2}$ i. $\frac{1}{1}$.

Color.—Top of nose and fore crown shiny black with grizzling of grayish white; nape and rump patches usually distinct, dark fulvous or rusty brown heavily washed and grizzled with black; rest of upper-

parts, including outside of legs, dark iron gray (rarely intermixed with yellowish ringed hairs); feet similar but paler; ears dark grayish or yellowish brown with distinct white basal patch; sides of head dingy grayish; ring around eye whitish; area between eye and ear often suffused with brownish; underparts white, sometimes slightly grizzled with black; tail at base like rump; rest of tail, above black heavily washed with white; below, a broad median line of grizzled dark iron gray bordered with black and edged with white, the white often forming a thin wash over under surface. Hairs of back usually black with white tips, but occasionally intermixed with others having a median ring of buffy.

Variation.—Specimens from the type locality show comparatively little variation. The upperparts are sometimes paler or darker than in typical specimens and the wash of black on crown and rump is sometimes heavy enough to obscure the yellow patches. The feet vary from iron gray to whitish gray but are never white. Black always predominates on lower side of tail but the amount of gray varies. Compared with typical specimens those from Ameca are paler on the back and lower surface of tail, and the nape and rump patches are more obsolescent.

Measurements.—Average of five adults from type locality: total length 536; tail vertebræ 267.2; hind foot 66.4.

Cranial characters.—Premolars $\frac{2}{1}$. Skull indistinguishable from that of *S. poliopus*. Five adult skulls from near type locality average: basal length 51.2; palatal length 27.6; interorbital breadth 19.8; zygomatic breadth 34.9; length of upper molar series 11.7.

Habits.—These handsome squirrels have a wide vertical range. In April they were found at an altitude of 4000 feet feeding on wild figs in the canyon near Plantinar, at the east base of the Sierra Nevada de Colima. On the north slope of the same mountain they were common and feeding on acorns among scrubby oaks at 6000 feet, and we saw many gnawed pine cones at 12,000 feet. Dr. Buller who collected the type took a specimen at the latter altitude on this mountain.

Specimens examined.—Twenty-four: from Plantinar, Hacienda San Marcos and elsewhere on slopes of Sierra Nevada de Colima, and at Ameca, State of Jalisco.

SCIURUS POLIOPUS COLIMENSIS Nelson. Colima Squirrel.

Sciurus leucops ALLEN, Mon. N. Am. Rodentia, pp. 753-754, 1877 (part: specimens from Río Coahuylana, Colima, Mexico).

Sciurus albipes colimensis NELSON, Proc. Biol. Soc. Washington, XII, p. 152, June 3, 1898.

Sciurus wagneri colimensis ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, p. 454, Nov., 1898

Type locality.—Hacienda Magdalena, Colima, Mexico, Type no. $\frac{33197}{45202}$. U. S. National Museum, Biological Survey Collection.

Distribution.—Arid tropical coast region in State of Colima, western Mexico (below 2000 ft.).

Characters.—Pelage thinner and tail more slender than in other subspecies of *S. poliopus*; nape and rump patches well marked, rusty or yellowish brown; back gray mixed with considerable rusty; feet dark iron gray or blackish. Teats: p. $\frac{1}{4}$ a. $\frac{2}{2}$ i. $\frac{1}{4}$.

Color.—Nape and rump patches distinct, varying from yellowish brown to dark rusty shaded with black; nose and forecrown grizzled iron gray, sometimes suffused with yellowish brown extending forward from nape patch; rest of back rather pale grizzled gray, abundantly intermixed with rusty ringed hairs; outside of legs iron gray; fore feet dark iron gray; hind feet darker iron gray varying to black and thinly grizzled with gray; sides of head dingy grizzled gray, sometimes suffused with yellowish brown; ring around eye dingy white or dull buff; ears like nape, with small basal patch of dull whitish or dingy rusty; underparts white; tail at base like back; rest of tail above black thinly washed with white; below, with broad median area dark grizzled iron gray (sometimes faintly washed with yellowish) bordered by black and thinly edged with white. Hairs of back black with white tips and basal, sub-basal or subterminal rings of buffy or rusty.

Variation.—The upperparts vary from pale gray to iron gray; the feet are usually darker than the back, but sometimes paler. An immature specimen from the type locality is pale gray with the rusty rump patch nearly obsolete. A female taken in February at Armeria has the inside of fore limbs, thighs, and sides of belly washed with buffy, and median area on under side of tail dark grizzled fulvous. The black border on lower surface of tail varies from a narrow line to a band half an inch wide.

Measurements.—Average of five adults from type locality: total length 526; tail vertebræ 267; hind foot 67.6.

Cranial characters.—Premolars $\frac{2}{1}$. Skull somewhat smaller but not otherwise separable from that of typical *S. poliopus*. Five adult skulls from near type locality average: basal length 502; palatal length 26.7; interorbital breadth 19.1; zygomatic breadth 33.8; length of molar series 11.2.

General notes.—*Sciurus p. colimensis* is most closely related to *S. p. cervicalis*, but typical specimens are readily distinguished by paler backs and strongly marked reddish or fulvous nape and rump patches. The feet are darker than in any of the other subspecies of

poliopus and, with the exception of *S. p. effugius*, the nape and rump patches are more strongly contrasted with the rest of the back.

Specimens examined.—Ten: from Hacienda Magdalena, Armeria, and Rio Coahuayana, Colima.

SCIURUS POLIOPUS EFFUGIUS Nelson. Guerrero Squirrel.

Sciurus albipes effugius NELSON, Proc. Biol. Soc. Washington, XII, pp. 152-153, June 3, 1898.

Sciurus wagneri effugius ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, p. 454, Nov. 10, 1898.

Type locality.—High mountains west of Chilpancingo, Guerrero, Mexico. Type no. 70288 U. S. National Museum, Biological Survey Collection.

Distribution.—Pine and oak forests of Transition and Boreal zones along summit of Cordillera in southwestern Guerrero (alt. 7500-9500 ft.).

Characters.—Back grizzled gray; nape patch conspicuous, dark rufous; ear patches large, white and more conspicuous than in any other form of the species; underparts darker rufous than in *poliopus*; median area on under side of tail deeper, richer rufous. Pelage thick and soft; tail large and bushy. Teats: p. $\frac{1}{4}$ a. $\frac{2}{5}$ i. $\frac{1}{4}$.

Color.—Winter pelage: Nape patch rusty rufous, becoming almost rusty chestnut in some specimens; top of nose iron gray intermixed with yellow ringed hairs; rest of dorsal surface finely grizzled iron gray intermixed with rusty ringed hairs; indications of a rump patch similar in color to nape sometimes present but heavily overlaid with grizzling of white and black; extension of nape patch over sides of head, including bases of ears and eyes, slightly paler than main area; ring around eye buffy or whitish; ears reddish brown like crown, but sometimes grizzled with grayish; basal ear patches very large and brilliantly white; outside of legs gray, usually with less mixture of rusty than on back; feet white, often washed with pale rufous; tail at base like rump; rest of tail above black, heavily washed with white (with rufous under color showing through); below, with broad median area nearly pure rich dark rufous, narrow black border, and thin white edge; chin and throat white; rest of underparts rich dark rufous. Hairs on back black, with short white tips and either basal, sub-basal, or median rings of rufous.

Variation.—One topotype has the nape patch extending over shoulders and costal region, rest of back strongly suffused with rusty, and a wash of same color on outside of fore legs and feet; another,

probably representing a much worn phase of the summer pelage, has very distinct well defined nape and rump patches of rusty brown; top of nose and back, including outside of legs and feet, pale iron gray with very indistinct rusty rings on intermixed hairs; chin and throat white; underparts pale dull rusty washed with dingy white.

Measurements.—Average of five adults from type locality: total length 496.8; tail vertebræ 249; hind foot 68.

Cranial characters.—Premolars $\frac{2}{1}$. Skulls average a little smaller but are otherwise like those of *S. poliopus*. Four adults skulls from the type locality average: basal length 50.9; palatal length 26.9; interorbital breadth 19.1; zygomatic breadth 34.5; length of upper molar series 11.

Habits.—In December we found these squirrels feeding on acorns of the large oaks among the pines on top of the Cordillera, but the abundance of gnawed cones scattered on the ground showed that at other seasons pines furnish their chief food supply. They were extraordinarily shy and cunning, and it was very difficult to secure specimens.

Specimens examined.—Eight: all from the type locality.

SCIURUS NELSONI Merriam. Nelson's Squirrel.

Sciurus nelsoni Merriam, Proc. Biol. Soc. Washington, VIII, p. 144, Dec. 1893.

Type locality.—Huitzilac, Morelos, Mexico. Type no. 51157 U. S. National Museum, Biological Survey Collection.

Distribution.—Oak and pine forests of Transition and Boreal zones in mountains on south and west sides of Valley of Mexico, and south side of Valley of Toluca, in the Federal District and States of Mexico and Morelos (alt. 8000–12,000 ft.).

Characters.—Body large and heavy; back grizzled, sooty blackish brown; feet black; underparts grizzled blackish, sometimes washed lightly with dingy yellowish brown or rusty rufous. Pelage very thick and soft; under fur long; tail extremely broad and bushy. Teats: p. $\frac{1}{1}$ a. $\frac{2}{2}$ i. $\frac{1}{1}$.

Color.—Upperparts sooty blackish usually washed or grizzled with dull yellowish brown; head usually darker than back and sometimes entirely black, shading gradually into color of back on nape; ears, feet, and sometimes outside of fore legs and lower thighs black; sides of head (when not black) grizzled blackish gray varying to dark yellowish brown; lower cheeks and chin grayer; underparts grizzled and varying from dingy blackish brown, thinly washed with dull yellowish, to dark brown washed with dull rusty; tail at base all around like rump, rest of tail above black, washed with grayish white; below

nearly uniform blackish with yellowish gray or brown showing through and thin edging of dingy white, but sometimes with median area very dark grizzled yellowish gray or yellowish brown, washed with black and narrowly edged with dingy white. Hairs on entire back black with narrow subterminal and broader basal or sub-basal rings of smoky buff or brown.

Variation.—No melanistic specimens have been seen from the type locality, but two individuals from Tenango del Valle in the Bangs collection are nearly uniform black, having only a thin grizzling of dingy gray along the sides, and one has a pale wash of reddish brown on breast and belly. Another specimen in the same collection from Tenango differs in having a nuchal patch of dark grizzled reddish brown, contrasting with rest of back; feet pale buffy brown, toes dingy whitish; rest of back normal, but entire underparts dull rufous, becoming darker posteriorly. One specimen from Ajusco also has the underparts similarly colored.

Measurements.—Average of five adults from type locality: total length, 521.6; tail vertebræ, 262.6; hind foot, 67.6.

Cranial characters.—Premolars $\frac{2}{1}$. Skull like that of *S. aureogaster*. Five adult skulls from the type locality measure: basal length 50.7; palatal length 26.7; interorbital breadth 19.4; zygomatic breadth 34.9; length of upper molar series 11.9.

General notes.—*Sciurus nelsoni* is one of the most distinct of the Mexican squirrels and has a very limited distribution. It has a single subspecies which lives on the slopes of Mts. Popocatepetl and Iztacihuatl, and serves as a good illustration of the remarkable readiness with which the squirrels of tropical North America vary with climatic conditions. The area inhabited by *S. nelsoni* and *S. nelsoni hirtus* are in the same life zone and not more than 75 miles apart. *S. nelsoni* is much the darker of the two and its coloration is correlated with the somewhat greater rainfall of the area it inhabits.

Specimens examined.—Eighteen: from Huitzilac, Morelos; Salazar and Ajusco, Federal District; and Tenango del Valle, State of Mexico, Mexico.

SCIURUS NELSONI HIRTUS Nelson.

Mount Popocatepetl Squirrel.

Sciurus nelsoni hirtus NELSON, Proc. Biol. Soc. Washington, XII, pp. 153-154, June 3, 1898.

Type locality.—Tochimilco, Puebla, Mexico. Type no. 55325 U. S. National Museum, Biological Survey Collection.

Distribution.—Oak and pine forests of Transition and Boreal zones on Mts. Popocatepetl and Iztaccihuatl, in States of Mexico, Puebla, and Morelos (alt. 8000 to 12,000 ft.).

Characters.—Similar to *S. nelsoni* but differs in having a dark iron gray area on middle of back, grizzled gray feet, and dingy ferruginous underparts. Pelage thick and soft; under fur long; tail extremely broad and bushy. Teats: p. $\frac{1}{4}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Color.—Crown, nape, and rump dingy grizzled yellowish or grayish brown; top of nose, middle of back (often reaching down on outside of legs) finely grizzled bluish gray; feet gray, toes paler; ears similar to crown, with conspicuous white basal patches; chin and lower cheeks dull gray; underparts dingy ferruginous; tail above, black heavily washed with white; below, median area grizzled yellowish or rusty brown, with black border and thin white edge. Hairs on gray area of back black, with short white tips, scantily mixed with similar hairs having narrow median or subterminal rings of dull buffy.

Variation.—The gray area is sometimes an enclosed spot on middle of back and sometimes covers most of the upper surface; the general color is lighter and less sooty than in *nelsoni*, and the wash on tail is white. The ferruginous of underparts varies from light rusty to dark dull rufous. One specimen from Tochimilco has black ears and feet and a small patch of gray on middle of back, but can be recognized at once by the other characters. Two winter specimens from Mt. Popocatepetl can be distinguished from summer specimens from Tochimilco by the general grayness of the upperparts.

Measurements.—Average of five adults from type locality: total length 514.2; tail vertebrae 256.8; hind foot 68.

Cranial characters.—Premolars $\frac{2}{4}$. Skull like that of *S. aureogaster*. Five adult skulls from type locality average: basal length 50.2; palatal length 26.5; interorbital breadth 19.4; zygomatic breadth 35.1; length of upper molar series 11.8.

General notes.—This subspecies seems to be peculiar to the Volcano of Popocatepetl, and probably Iztaccihuatl immediately adjacent. One specimen came from near timberline on the north slope of Popocatepetl, the others from Tochimilco on the southeast slope, and Tetela del Volcan on the south slope.

Specimens examined.—Seven: from Tochimilco, Puebla; Mt. Popocatepetl, Mexico; and Tetela del Volcan, Morelos.

SCIURUS COLLÆI Richardson. Collie's Squirrel.

Sciurus colliei BACHMAN, Proc. Zool. Soc. London, p. 95, 1838 (nomen nudum); RICHARDSON, Voy. of H. M. S. Blossom, Zool., pp. 8-9, pl. 1, 1839; BACHMAN, Charlesworth's Mag. Nat. Hist., III, p. 334, July, 1839; AUD. & BACH., Quad. N. Am., III, pp. 21-23, pl. CIV, 1851; ALLEN, Mon. N. Am. Rodentia, pp. 738-740, 1877 (part: specimens from San Blas, Mexico).

Macroxus colliei GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, pp. 421-422, 1867 (part: var. 3, Mexico).

Sciurus hypopyrrhus ALSTON, Proc. Zool. Soc. London, 1878, pp. 662-664 (part); ALLEN, Bull. U. S. Geol. Survey Terr., IV, pp. 881-882, 1878 (part).

Type locality.—San Blas, Tepic, Mexico. Type in British Museum.

Distribution.—Arid tropical lowlands and lower slopes of adjacent mountains from northern border of Tepic south to Bay of Banderas (below 2500 feet).

Characters.—Body large and slender; upperparts dull yellowish gray or dark grayish; legs and feet grayer; underparts white. Pelage rather thin; hair on back harsh; under fur long and thin; tail long and rather full. Teats: p. $\frac{1}{4}$ a. $\frac{2}{2}$ i. $\frac{1}{4}$.

Color.—Top of nose iron gray; rest of upperparts and base of tail all around nearly uniform dull yellowish gray or brownish gray shaded with black, darkest on crown; lower border of flanks and sides of shoulders rather grayer than back; outside of legs distinctly grayer than back; feet usually paler or more whitish than legs; side of head dull grayish; ring around eye paler or more whitish; ears usually somewhat yellower or browner than crown, with basal patch of dingy whitish or yellowish white; underparts white, sometimes pure and sometimes darkened by the plumbeous under fur showing through; tail above black, washed with white; below, with broad median area dark grizzled black and yellowish gray, or black, dull gray and yellowish brown, with narrow indistinct border of black, edged with white. Hairs of back black, with rather narrow subterminal or median ring varying from pale buffy to brownish gray.

Variation.—The variation in the San Blas series is small and confined mainly to the intensity of the yellowish or buffy of the back; some specimens have the feet and toes whiter than others and are grayer on the flanks. Some spring and summer specimens have a curious scorched, rusty brown color on the back, as if burned by the sun.

Measurements.—Average of five adults from type locality: total length 506.4; tail vertebræ 264.6; hind foot 65.

Cranial characters.—Premolars $\frac{2}{1}$. Skull similar to that of *S. aureogaster*, but averaging smaller; jugal slenderer; upper molar series a little narrower and lighter. Four adult skulls from the type locality average: basal length 49; palatal length 25.6; interorbital breadth 18.4; zygomatic breadth 32.6; length of upper molar series 11.

General notes.—Specimens from Ixtapa and Las Palmas near the Bay of Banderas are intermediate between the San Blas Squirrel and *S. c. nuchalis*. Specimens from Acaponeta near the northern border of Tepic are yellower than those from San Blas, thus inclining toward the yellow backed *S. sinaloensis* of Mazatlan. The latter may prove a subspecies of *colliæi* notwithstanding its striking difference in general appearance.

This species was named in honor of Dr. C. Collie, Surgeon of H.M.S. 'Blossom,' who collected the type during the ship's visit to San Blas in the winter of 1828.

Specimens examined.—Twenty-four: from San Blas, Santiago, and Acaponeta, Tepic.

SCIURUS COLLÆI NUCHALIS subsp. nov.

Manzanillo Squirrel.

Type from Manzanillo, Colima, Mexico. Type no. $\frac{32657}{44580}$ ♂ ad., U. S. Nat. Museum, Biological Survey Collection. Collected Feb. 2, 1892, by E. W. Nelson.

Distribution.—Arid tropical lowlands from the border of Michoacan north along the coast to the Bay of Banderas, Jalisco, and inland to the more heavily wooded mountains near San Sebastian, Jalisco (below 3000 feet).

Characters.—Differs from true *colliæi* in its rusty rufous ears, buffy yellow suffusion on nape and shoulders and heavy wash of black on lumbar area and rump. Pelage rather thin; hairs of back coarse, stiff and shining: Teats: p. $\frac{1}{4}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Description of type.—Winter pelage: Upperparts, including crown and base of tail, buffy yellowish or yellowish gray, grizzled with black on crown and nape and heavily washed over lumbar region and rump with shining black; the yellow more rusty on nape and more buffy posteriorly; flanks paler than back; ears rusty rufous, with small basal patches of rusty or rusty whitish; sides of nose and cheeks dingy yellowish brown; ring around eye paler yellowish; feet and outside of legs iron gray, with wash of gray on fore shoulders; underparts white, tail, above black rather thinly washed with white;

below at base, grizzled brownish gray, rest of lower surface with a broad median band of grizzled rusty yellowish, broadly bordered with black and narrowly edged with white. Hair on back black with broad median ring of rusty or buffy yellowish.

Variation.—Two of the Manzanillo specimens resemble the type and are very different from typical *colliæi*. Three others are grayer than the type, or less strongly shaded with yellowish on back, but may be distinguished from *colliæi* by the rusty ears, more yellowish suffusion on nuchal area, and heavier wash of black on rump. On three of the specimens the median line on lower side of tail is grizzled yellowish rusty; on two others it is grizzled gray with a yellowish suffusion. Specimens from Ixtapa, Las Palmas, Mascota, and San Sebastian are intermediate but are more like *nuchalis* than like true *colliæi*. Compared with typical *colliæi* all of the twelve specimens from these localities have the ears more yellowish or rusty; the nuchal area yellower than rest of back; the crown, lumbar region and rump more heavily washed with black; the median line on lower surface of tail grizzled rusty rufous on two specimens, and suffused with a paler shade of same on a number of others; pelage coarser and harsher, with grizzling on back consequently coarser.

Measurements.—Average of five adults from type locality: total length 530; tail vertebrae 274.8; hind foot 68.4.

Cranial characters.—Premolars $\frac{2}{1}$. Skull similar to that of typical *colliæi* but larger, with proportionately larger audital bullae and rather broader, heavier jugals. Five adult skulls from the type locality average: basal length 52.3; palatal length 27.6; interorbital breadth 20.6; zygomatic breadth 35.9; length of upper molar series 11.4.

General notes.—This form is characterized mainly by the increased rustiness on the head, body, and under side of tail. There is a progressive increase in the amount of this color southward from San Blas to Manzanillo.

Specimens examined.—Seventeen: 5 from Manzanillo, Colima; 12 (all intermediate) from San Sebastian, Mascota, Las Palmas and Ixtapa, Jalisco.

SCIURUS SINALOENSIS sp. nov. Sinaloa Squirrel.

Type from Mazatlan, Sinaloa, Mexico, no. 13753, ♂ ad., American Museum of Natural History, N. Y. Collected Jan. 27, 1897, by P. O. Simons.

Distribution.—Arid tropical parts of southern and central Sinaloa (below 2500 feet).

Characters.—Crown, nape, and middle of back pale rusty yellowish; flanks, legs, and feet whitish. Tail long, bushy; ears thinly haired; pelage rather full and soft; under fur long. Teats: p. $\frac{1}{4}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Color.—Winter pelage: Top of nose gray, shading on fore crown into grizzled yellowish gray, rest of crown, nape, middle of shoulders and rump pale rusty yellow slightly grizzled with black; sides of neck, shoulders, costal area, lower flanks, legs and feet grayish white, palest on feet; sides of nose and ring around eye dingy gray; cheeks pale yellowish brown; ears dull rusty yellow with small basal patch of same; underparts white; tail above brownish yellow, lightly grizzled with black and heavily washed with white; below, a broad median area brownish yellow (thinly grizzled with black and lightly washed with white) narrowly bordered with black and edged with white. Hairs on back black with sub-basal and subterminal rings of rusty.

Variation.—Specimens of this squirrel from extreme southern Sinaloa are a little darker than the type.

Measurements of type.—Total length 524; tail vertebræ 255; hind foot 62.

Cranial characters.—Premolars $\frac{2}{1}$. Skull larger and more massive than in true *colliæi*; rostrum decidedly heavier than in *colliæi* or *truei*, and heavier even than in *aureogaster*; nasals broader and more expanded anteriorly. The skull of the type measures: basal length 53; palatal length 26.3; interorbital breadth 20; zygomatic breadth 34; length of upper molar series 11.

General notes.—This fine species belongs to the group of which *S. colliæi*, *S. c. nuchalis*, and *S. truei* are the other members. It is the most divergent of all and its rusty yellow back and hoary white sides and tail render it easily recognizable. Specimens from near Rosario, in extreme southern Sinaloa, are darker than those from Mazatlan, and it is possible, notwithstanding its wide difference, that *sinaloensis* may eventually prove to be a subspecies of *colliæi*.

Specimens examined.—Four: from Mazatlan, Tatamales, and Plomosas, Sinaloa.

SCIURUS TRUEI sp. nov. Sonora Squirrel.

Type from Camoa, Rio Mayo, Sonora, Mexico. No. 96229 ♂ ad. U. S. Nat. Museum, Biological Survey Collection. Collected January 20, 1899, by E. A. Goldman.

Distribution.—Scrubby forests of Arid Lower Sonoran zone in southwestern Sonora and northern Sinaloa, Mexico.

Characters.—Upperparts of head and body dark yellowish; outside of legs and feet dark gray, in strong contrast to back; ears behind, rusty; underparts white; tail slender; ears thickly haired and sparsely tufted; pelage thick and soft; under fur long. Teats: p. $\frac{1}{4}$ a. $\frac{2}{2}$ i. $\frac{1}{4}$.

Color.—Winter pelage: Top of nose gray, rest of upperparts, including sides of neck and flanks, nearly uniform dark yellowish, grizzled with black; outside of legs and feet dark gray, slightly paler on toes; ring around eye whitish; sides of head dingy yellowish gray; ears bordered anteriorly with grayish; behind, including small basal patch, rusty; underparts white; tail at base like back but washed with grayish white below; rest of tail above, grizzled black and dark yellowish, thinly washed with white; below, mainly dark yellowish, grizzled with black, an indistinct narrow black border and thin white edge. Hairs on back black, with sub-basal and subterminal rings of dark yellowish.

Variation.—The principal variation in the specimens examined is a difference of intensity in the rusty of the ears.

Measurements.—Average of four adults from type locality: total length 487.5; tail vertebræ 247.5; hind foot 66.7.

Cranial characters.—Premolars $\frac{2}{1}$. Skull markedly different from that of typical *colliæi*. It is proportionately broader with brain case more flattened, interorbital area broader; rostrum shorter and heavier; nasals shorter and much more deeply emarginate posteriorly; jugal much broader (exceptionally broad) and expanded vertically; audital bullæ larger and scarcely depressed on inner anterior border. Four adult skulls from type locality average: basal length 47.7; palatal length 24.3; interorbital breadth 18.3; zygomatic breadth 33.2; length of upper molar series 11.

General notes.—*Sciurus truei* is most nearly related to *S. colliæi* from which it may be distinguished by its uniformly dark yellowish back, slenderer tail, and marked skull characters. Mr. Goldman found it inhabiting the fringe of trees along the Rio Mayo and adjacent foothills, and heard of it in the foothills near Alamos, Sonora, close to the border of Sinaloa, so there is no doubt of its occurrence also in the northern part of this State. It is named in honor of Mr. F. W. True, Executive Curator, U. S. National Museum.

Specimens examined.—Four: all from type locality.

SCIURUS SOCIALIS Wagner. Tehuantepec Squirrel.

Sciurus socialis WAGNER, Abhandl. math.-phys. Cl. K. bayerisch. Akad. Wiss. München, II, pp. 501, 504–507, pl. v, 1837; Supplement Schreber's Säugthiere, III, pp. 170–171, 1843; GRAY, Ann. & Mag. Nat. Hist., 3d ser., XX, p. 428, 1867.

- Sciurus variegatus* ALSTON, Proc. Zool. Soc. London, 1878, pp. 660-662 (part); Biol. Cent.-Am., Mamm., pp. 127-128, 1880 (part: specimens from Tehuantepec); SUMICHRAST, La Naturaleza, v, p. 324, 1882 (part: specimens from southern part of Isthmus of Tehuantepec and Chiapas—not *S. variegatus* Erxl., 1777).
- Sciurus aureigaster* ALLEN, Mon. N. Am. Rodentia, pp. 750-753, 1877 (part: specimens from Tehuantepec and Santa Efigenia, Oaxaca).
- Sciurus leucops* ALLEN, Mon. N. Am. Rodentia, pp. 753-756 (part: specimens from Tehuantepec).

Type locality.—Vicinity of Tehuantepec City, Oaxaca, Mexico. Type in Berlin Museum.

Distribution.—Arid tropical lowland forests along the Pacific coast from Puerto Angel, Oaxaca, south to Tonalá and Tuxtla, Chiapas, Mexico, and up the river valley to Nenton, Guatemala (below 3000 feet).

Characters.—Nape patch usually well defined, rusty rufous; back dingy whitish gray overlying yellowish or rusty; underparts varying from white or buffy to bright ferruginous. Pelage thin, hairs of back coarse and stiff; under fur short; tail long and narrow. Teats: p. $\frac{1}{1}$ a. $\frac{2}{2}$ i. $\frac{1}{1}$.

Color.—Nose and fore part of crown grizzled iron gray; nape patch rusty rufous slightly washed with black; rest of upperparts whitish, rather coarsely grizzled with black, and shaded with underlying yellowish or rusty rufous; rump patch usually obsolete but sometimes more distinctly rusty rufous than surrounding area; feet like back; ears grizzled gray and rufous, with basal patch white; extension of nape patch around bases of ears, and over cheeks, including eyes, paler and more yellowish brown than main area; ring around eye dingy fulvous; sides of nose and cheeks below eyes dingy grayish white; underparts varying from pure white to pale buffy and bright rufous. Tail all around at base like rump; rest of tail, above black heavily washed with white; below, median area varying from pale fulvous gray (in worn fur) to rich orange—or dark rufous (in good fur), bordered by narrow band of black and edged with white. Hairs on back black, narrowly tipped with white and mixed with others having broad sub-terminal rings of rusty rufous; or in some specimens with white tips and broader sub-basal rufous rings.

Variation.—*Sciurus socialis* is a variable species, characterized by general hoariness of back with pale rusty under color showing through, and rusty nuchal patch. The color of upperparts varies according to the proportionate amount of grayish white and yellowish rufous; sometimes the back is hoary whitish and sometimes the white is restricted and the underlying reddish or rusty becomes prominent. In

some specimens the nape patch is only slightly marked or entirely replaced by the general whitish color; it is absent in a few specimens from near Tehuantepec, and becomes more and more obsolete to the south. Our large series, representing both summer and winter specimens, shows great variation in color of underparts. Midsummer specimens with few exceptions vary from pale to deep reddish buff; the under side of tail along median line is usually paler (buffy gray, or yellowish rufous), and the ear patches are absent or very small. Specimens taken in winter, and up to close of dry season in May or June (with half a dozen exceptions), are rich rufous below.

A young female from Huilotepec (May 8) is dingy gray below with the buff restricted to axillary and inguinal regions, the middle of the back rather darker and more rusty and the sides grayer, in greater contrast with the back than usual.

An adult female from Tonalá in summer pelage differs from all the others in having the entire back strongly suffused with light rusty red, thinly grizzled with grayish white; underparts dingy yellowish white faintly and minutely grizzled with black; lower surface of tail grizzled dull orange buffy and black, edged with white. Specimens on which rufous ringed hairs predominate on the back are suffused with rufous. In the series from Puerto Ángel north of Tehuantepec City the back is much paler or more grayish white, the nuchal patches darker, and underparts deeper rufous than in typical *socialis*, but in one case the back is uniform grayish white with no sign of a nuchal patch. In the series from the vicinity of Tonalá south of Tehuantepec the nuchal patch is less strongly marked and usually absent; the subterminal rufous on the back is much more conspicuous, often showing through as a strong yellowish rusty suffusion grizzled with white and black; and the underparts vary from pale buffy whitish to dull ferruginous.

Measurements.—Average of five adults from type locality: total length 524.4; tail vertebræ 271.4; hind foot 66.6.

Cranial characters.—Premolars $\frac{2}{1}$. Skull very similar to that of *S. aureogaster*. Five adult specimens from the type locality average: basal length 51.8; palatal length 26.9; interorbital breadth 18.1; zygomatic breadth 33.9; length of upper molar series 11.3.

General notes.—This species was described from an immature specimen taken by the botanical collector Karwinski, who reported that it frequented the forest on the southern coast of the Isthmus of Tehuantepec in droves. The idea of its gregarious habits, suggesting Wagner's name, must have come from seeing it during the mating season, when a number are often found together, as in the case of other

squirrels. It frequents low scrubby forests and raids cornfields when the ears are maturing.

Specimens examined.—Fifty-four: from Huilotepec (near Tehuantepec City), Tequisistlan, Colotepec, Puerto Angel, Santa Efigenia, Oaxaca; Calera, Tonalá, Tuxtla, Chiapas; Nenton, Guatemala.

SCIURUS SOCIALIS COCOS Nelson. Acapulco Squirrel.

Sciurus aureogaster I. GEOFFROY, Voy. de la Vénus, Zoology, Atlas, pl. 10, 1846; text, pp. 156-163, 1855 (specimen with white under surface figured in pl. 10 of Atlas). Not *S. aureogaster* F. Cuvier, 1829.

Sciurus socialis cocos NELSON, Proc. Biol. Soc. Washington, XII, pp. 155-156, June 3, 1898.

Type locality.—Acapulco, Guerrero, Mexico. Type no. 70644 U. S. National Museum, Biological Survey Collection.

Distribution.—Arid tropical lowlands of the Pacific coast from Acapulco, Guerrero, south to Jamiltepec, Oaxaca (below 1500 ft.).

Characters.—Nape and rump patches distinct, dark rufous brown; back and feet grayish white; underparts white, buffy, or ferruginous. Pelage thin; hairs on back coarse and stiff; under fur thin and short. Tail long, narrow, and heavily washed with white. Teats $\frac{1}{4}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Color.—Nape and rump patches varying from rusty rufous to deep chestnut rufous lightly washed with black; anterior extension of nape patch along sides of head enclosing bases of ears and eyes, usually rather paler or yellowish; ears like nape; top of nose and fore crown pale iron gray; rest of upperparts, including outside of legs and feet, grayish white—latter sometimes creamy white; underparts varying from pure white to pale creamy buff, rufous buffy or rich dark ferruginous; tail above black, heavily washed with white, with rufous basal color sometimes showing through; tail below, with median area varying from rufous buffy to rich dark ferruginous, bordered with black and edged with white, the white extending also over all of under surface as an overlying wash. Hairs of back black, with long white tips, usually intermixed with others having broad rusty sub-basal rings.

Variation.—In the series of 33 specimens, all but seven fall within the limits of variation already given. The exceptions are described below. An adult female from Acapulco (Jan. 10) has the usual dark rufous nape and rump patches, the former extending over ears and down to eyes; top of nose and front part of crown clear iron gray; rest of upperparts, including feet and legs white, with a reddish suffusion along back; underparts pale creamy buff; tail above black heavily washed with white; underside of tail obscurely black and rufous heav-

ily overlaid with white. A male taken at same place (Jan. 19) is similar but the white on upper surface is duller and the underparts rich buff.

Another male taken at Acapulco (Jan. 10) has the nape patch even richer or darker rufous than usual; top of nose and fore part of crown clear iron gray; rest of upperparts dingy rusty red, grizzled with grayish white; feet and outside of thighs whiter; underparts bright ferruginous, palest on throat and breast; tail as usual heavily washed with white.

Two males from Acapulco (Jan. 11) are in a curious melanistic condition: One has the nose and fore part of crown black, sparsely grizzled with white, the nape and rump patches very rich dark rufous washed with black, and the intermediate area along the back black, finely grizzled with dark rusty; sides of head, neck and body black, overlaid with fine grizzling of dark fulvous and dingy rufous; feet glossy black; tail black, thinly washed with white above and below, with dark rusty rings near bases of hairs; underparts smoky black washed with fulvous brown and dull rusty. The other melanistic specimen has the top of head as in the last; the nape and rump patches black, the rest of upper parts dull rusty brown grizzled with black and more sparsely with white; chin dark gray; throat grizzled rufous; rest of underparts dark reddish brown becoming darker posteriorly; tail above black heavily overlaid with white; below black, heavily bordered with white.

A female taken at Llano Grande, Oaxaca (Feb. 18) has the nose and fore part of crown black, grizzled with gray; nape and rump patches dingy rusty, heavily washed with black; rest of back grizzled reddish brown and black, shading into dark yellowish brown on sides; feet grizzled black and grayish brown; toes black; underparts dark dingy buff; tail above black, washed with white; below, median band buffy yellow with broad border of black, edged with white.

Measurements.—Average of 5 adults from type locality: total length 518.2; tail vertebræ 268; hind foot 66.

Cranial characters.—Premolars $\frac{2}{1}$. Skull very similar to that of *S. socialis* but somewhat shorter; broader interorbitally; upper molar series slightly shorter. Five adult skulls from the type locality average: basal length 50.8; palatal length 26.5; interorbital breadth 19.3; zygomatic breadth 33.7; length of upper molar series 10.6.

General notes.—In the Zoology of the Voyage of the Venus, under the name *S. aureogaster*, is a good figure of a white bellied specimen of this species, which probably came from Acapulco. On

the way south from that port we took the last typical specimen of *S. s. cocos* at Jamiltepec, Oaxaca; the series taken beyond, at Puerto Angel, is intermediate between true *socialis* and *cocos*. We found these squirrels frequenting cocoanut groves near Acapulco and feeding upon the nuts. It is the only squirrel we saw doing this although cocoanut trees are common in the ranges of various other species. The name of the subspecies was suggested by this peculiar habit.

Specimens examined.—Thirty-three: from Acapulco, Aguacatillo, San Marcos, and Ometepec, Guerrero; Pinotepa, Llano Grande and Jamiltepec, Oaxaca.

SCIURUS GRISEOFLAVUS (Gray) Guatemala Squirrel.

Sciurus ludovicianus TOMES, Proc. Zool. Soc. London, p. 281, 1861 (from Dueñas, Guatemala. Not *S. ludovicianus* Custis, 1806).

Macroxus griseoflavus GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 427, 1867.

Sciurus aureigaster ALLEN, Mon. N. Am. Rodentia, pp. 750-753, 1877 (part: No. 1156 from Guatemala).

Sciurus griseoflavus ALSTON, Proc. Zool. Soc. London, p. 660, 1878; Biol. Cent.-Am., Mamm., pp. 126-127, 1880; ALLEN, Bull. U. S. Geol. Survey Terr., iv, pp. 880-881, 1878.

Sciurus affinis (REINHARDT, MS. in) ALSTON, Proc. Zool. Soc. London, p. 660, 1878 (nomen nudum).

Type locality.—'Guatemala.' (Specimens from near Dueñas are typical).

Distribution.—Oak and pine forests of the Transition and Boreal zones in central and northwestern Guatemala and adjacent high mountains in southeastern Chiapas, Mexico.

Characters.—Size large and heavy. Color of upper parts grizzled yellowish brown, thinly washed with gray (especially in winter); belly fulvous brown or rusty rufous. Pelage full and soft; under fur long; tail broad and flat. Teats: p. $\frac{1}{1}$ a. $\frac{2}{2}$ i. $\frac{1}{1}$.

Color.—Upperparts, including crown and base of tail, grizzled yellowish brown, sometimes thinly washed with grayish white; outside of legs like flanks; feet usually grayer, but sometimes grizzled yellow and brown, and sometimes dark yellowish brown; top of nose, sides of head, and ears, grayer than crown; an indistinct dingy grayish ear patch sometimes present; chin and throat pale grayish fulvous; rest of underparts varying from dark dull rufous to dingy grayish washed with reddish fulvous; tail above black washed with white, with underlying yellowish brown showing through; below, with broad median area grizzled yellowish or rufous brown, bordered

by a narrow black line, and thinly edged with white. Some hairs on back entirely black, others black with white tip and either a sub-basal ring or basal and median rings of brownish yellow.

Variation.—The gray wash on the back varies greatly, sometimes being entirely absent, especially in specimens from the humid forests fronting the Pacific Ocean; in others it is general over the dorsal surface, and in others still is confined to a band across the back, leaving poorly marked rusty or yellowish brown nuchal and rump patches of varying size. In one specimen the nape patch is chestnut brown, the middle of back washed with light gray and the rump yellowish brown. In winter, the white wash on the back is most conspicuous, and the underparts are duller and less strongly ferruginous. (They may be dark ferruginous, or dark grizzled grayish washed with fulvous, or pale ferruginous). The absence of white tips produces the yellowish brown nape and rump areas, or wholly yellowish brown backs of specimens from the humid forest fronting the Pacific. Such specimens have many hairs with subterminal rings of rusty yellow.

Measurements.—Average of two adults from central Guatemala, from dried skins: total length 547.5; tail vertebrae 270; hind foot 68.

Cranial characters.—Premolars $\frac{2}{1}$. Skull a little longer than that of *S. aureogaster* but otherwise very similar. Four adult skulls from southwestern Guatemala average: basal length 51.8; palatal length 27.2; interorbital breadth 19; zygomatic breadth 34.4; length of upper molar series 11.4.

General notes.—A specimen from central Guatemala (No. 61226 U. S. Nat. Museum) sent to London for comparison with Gray's type, was pronounced by Mr. Thomas to closely resemble the two cotypes on the dorsal surface but is richer rufous below with less white on the tail. These differences fall within the minor individual variations.

Gray gave 'Guatemala' as the type locality for this species, and specimens from near Dueñas are typical. Specimens from the dense humid forests near Guatemala City and thence along the slopes of the mountains fronting the Pacific to Pinabete, Chiapas, are darker or browner than those from the higher mountains of the interior. Those from Calel are a little paler than typical specimens, and those from the forest at the Hacienda Chancol are still grayer or nearer the form from the mountains of central Chiapas.

Habits.—We found these squirrels rather common in the dense oak forests at about 7000 feet above sea level on the volcano of Santa Maria, near Quezaltenango, but owing to the tangled undergrowth and

the abundance of parasitic plants on the trees it was difficult to secure specimens. Near Calel, and at Hacienda Chancol, they were less common among other species of oaks in the more open forest at an altitude of 9000 to 10,000 feet, but were very shy, and it required cautious and long continued hunting to secure a few specimens.

Specimens examined.—Twenty-two: from vicinity of Guatemala City, Volcano Santa Maria, Calel, Hacienda Chancol, Guatemala; and Pinabete, Chiapas.

SCIURUS GRISEOFLAVUS CHIAPENSIS subsp. nov.

Chiapas Squirrel.

Type from San Cristobal, Chiapas, Mexico. No. 75957, ♂ ad., U. S. Nat. Mus., Biological Survey Collection. Collected Sept. 22, 1895, by E. W. Nelson and E. A. Goldman.

Distribution.—Pine and oak forests of Transition and Boreal zones in mountains of central Chiapas (alt. 7500–9500 feet).

Characters.—Similar to true *S. griseoflavus* but differing in the decidedly grayer upperparts; paler, often nearly white, feet, and usually more vivid ferruginous underparts. Pelage full and rather soft; under fur long and dense; tail broad and full. Teats: p. $\frac{1}{4}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Color.—Winter pelage: Upperparts, including outside of legs, top of nose, and base of tail, dark grizzled gray (rather darker on top of head), interspersed with many scattered hairs having median rings of reddish buffy; ears dingy whitish gray with small whitish basal patches; feet grayish white, the toes often nearly white; narrow ring around eyes pale fulvous, confluent with a darker area of fulvous brown extending back along sides of head to base of ears; sides of nose, lower cheeks, chin and throat, pale grayish; underparts usually rusty rufous, brighter than in true *griseoflavus*; tail at base all around like back; above, black heavily washed with white; below, usually with broad median area of yellowish, yellowish brown or rusty rufous, black border and well marked white edge. Hairs on back black, tipped rather broadly with white and often with broad median rings of reddish buff (most numerous and conspicuous along flanks).

Variation.—The series at hand shows but little variation in the upperparts. In some specimens the crown is darker, and the brown area behind the eyes more distinctly marked; the feet vary from grizzled gray to almost white. The greatest variation is in the underparts and tail. Eight of the twelve specimens are bright ferruginous below, one is dull buffy yellow, one dark grizzled gray heavily washed with

rusty rufous, while the two others are washed with rufous except a grizzled gray band about 4 inches broad across the belly. The median area on the lower surface of tail is sometimes broad, sometimes merely a narrow line (the black border increasing in width as the other decreases) and varies from rusty ferruginous to yellowish brown.

Measurements.—Average of five adults from type locality: total length 506.2; tail vertebræ 256; hind foot 68.2

Cranial characters.—Premolars $\frac{2}{1}$. Skull a little shorter than that of *griseoflavus* but scarcely distinguishable from the latter or from that of *S. aureogaster*. Five adult skulls from the type locality average: basal length 50.9; palatal length, 26.6; interorbital breadth 19.1; zygomatic breadth 34.3; length of upper molar series 11.4.

General notes.—The squirrels taken in the oak forest between 9000 and 10,000 feet altitude on the mountains at Todos Santos, Guatemala, are intermediate between *chiapensis* and true *griseoflavus*. Those taken at Calel, Guatemala, are more yellowish brown and much closer to *griseoflavus*. A specimen from the arid subtropical canyon at Nenton, Guatemala (below 3000 feet), and two others from similar localities near Tuxtla, Chiapas, seem to indicate a direct gradation, in this intermediate region, between *S. griseoflavus chiapensis* and *S. socialis*. Unfortunately our series from intermediate points is too limited to satisfactorily decide this point. Surprising as it may appear, the differences between *griseoflavus chiapensis* and *socialis* are not greater than those between the latter and *S. socialis cocos*.

Habits.—The Chiapas squirrel feeds upon both acorns and pine seeds, moving from one part of the forest to another with the season.

Specimens examined.—Twelve: all from the type locality.

SCIURUS YUCATANENSIS Allen. Yucatan Squirrel.

Sciurus carolinensis var. *yucatanensis* ALLEN, Mon. N. Am. Rodentia, pp. 705-706, Aug., 1877; Bull. U. S. Geol. Survey Terr., IV, p. 879, 1878.
Sciurus carolinensis ALSTON, Proc. Zool. Soc. London, 1878, pp. 658-659; Biol. Cent.-Am., Mamm., pp. 124-125, June, 1880 (part: specimens from Yucatan).

Sciurus yucatanensis ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., IX, pp. 5-7, 1897.

Type locality.—Merida, Yucatan, Mexico. Cotypes nos. 8502-8503. U. S. National Museum.

Distribution.—Arid tropical forests of peninsula of Yucatan.

Characters.—Back dingy, coarsely grizzled gray; belly white; pelage coarse and harsh but not bristly; thin ear tufts sometimes present, yellowish white; tail rather full.

Color.—Upperparts, including feet, rather coarsely grizzled black and gray (sometimes suffused with yellowish), more yellowish along middle of back and paler gray on sides of nose, body, and feet; ring around eye dingy whitish; ears sometimes dark gray and sometimes with distinct dingy white basal patch and small dull yellowish white tuft at tip 8 or 9 mm. long; underparts varying from white to pale grizzled gray. Tail at base similar to back; rest of tail above black, heavily washed with white; below, with median area coarsely grizzled black and gray, or dull, pale fulvous, bordered by black and edged with white. Hairs on back black, with broad median ring of white or yellowish.

Variation.—The small series examined does not show much seasonal difference, but the presence of ear patches and small tufts in two specimens (♂ and ♀) and their absence in three others indicate the probable existence of certain marked differences of this kind. One specimen taken at Chichenitza (Mar. 7) is mainly iron gray with slight trace of yellow on the back; the underparts are whitish finely grizzled with black. Another specimen taken at the same locality (Mar. 18) has a strong yellowish shade on the upperparts, and the chin, neck, breast, and middle of belly are nearly pure white, the underparts being grizzled with black only along border of flanks.

Measurements.—Average of two adults from Chichen-Itza: total length 451; tail vertebrae 222; hind foot 55.

Cranial characters.—Premolars $\frac{2}{1}$. Skull very similar in general outline to that of typical *S. aureogaster* but much smaller, with proportionately longer nasals and larger audital bullae; nasals rounded in front as in *aureogaster*. The single skull at hand shows no approach to the massive rostrum and broad flattened nasals of the *thomasi* group. It measures: basal length 45; palatal length 23; interorbital breadth 16.2; zygomatic breadth 19; length of upper molar series 9.5.

General notes.—*Sciurus yucatanensis* is at once separable from *S. carolinensis* and its races, and from *S. alleni*, by the much coarser grizzling on the back, and the stiffer, harsher pelage in addition to the cranial characters. It is a strongly marked species, the presence of whitish ear tufts in certain pelages separating it from the other Mexican and Central American squirrels of the subgenus *Echinosciurus*.

Specimens examined.—Five: from Merida and Chichen-Itza, Yucatan.

SCIURUS THOMASI sp. nov. Costa Rica Squirrel.

Sciurus boothia ALLEN, Mon. N. Am. Rodentia, pp. 741-746, 1877 (part: specimens from eastern Costa Rica.—Not *S. boothia* Gray, 1842).

Sciurus hypopyrrhus ALSTON, Proc. Zool. Soc. London, pp. 662-664, 1878 (part); ALLEN, Bull. U. S. Geol. Survey Terr., IV, pp. 881-882, 1878; (part); ALSTON, Biol. Cent.-Am., Mamm., pp. 123-131, 1880 (part: specimens from interior of Costa Rica); ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., III, p. 206, 1891; Bull. Am. Mus. Nat. Hist., N. Y., IX, p. 35, 1897; ALFARO, Mamíferos de Costa Rica, pp. 30-31, 1897 (part: specimens from eastern Costa Rica),

Type from Talamanca, Costa Rica. No. $\frac{12044}{3307}$ U. S. National Museum. Collected by Wm. Gabb.

Distribution.—Humid tropical forests of eastern Costa Rica.

Characters.—Entire upperparts black with underlying dark yellowish or ferruginous brown shining through; underparts rich deep ferruginous; pelage thin; hair on back coarse, stiff, and glossy; under fur short and thin; tail long and narrow.

Color.—Upperparts, including crown, base of tail, sides of neck, and outside of legs, nearly uniform glossy black with yellowish or ferruginous brown of underlying color shining through; top of nose, chin, and sides of head dingy grayish brown; ears blackish with thin tufts of black hairs at tips and conspicuous basal patches of ferruginous; feet varying from black to grizzled ferruginous brown, latter color sometimes extending as a wash over outside of legs; entire underparts rich ferruginous, sometimes varied with irregular white areas; tail above black, thinly washed with white; below with median area black grizzled with ferruginous or yellowish brown, narrowly bordered with black and thinly edged with white. Hairs on back shining black with broad median ring of rusty buffy or rufous brown.

Variation.—The underlying color of the back and the ear patches vary from yellowish brown to rich ferruginous. The darkest, most intensely colored specimen is from Santa Clara and has the median rings on hairs of back nearly as deep ferruginous as the underparts.

Measurements.—Average of four adults from eastern Costa Rica (from dry skins): total length 517.5; tail vertebræ 246.5; hind foot 62.2.

Cranial characters.—Premolars $\frac{2}{1}$. Skull (pl. II, fig. 6) even broader and stouter than that of *S. boothiæ belti*; rostrum much broader and heavier; interorbital breadth much greater; occiput broader. The type skull measures: basal length 50; palatal length 26.2; interorbital breadth 22; zygomatic breadth 35.5; length of upper molar series 11.5.

General notes.—This species seems to occupy the more humid area of eastern Costa Rica, ranging inland to the border of the more arid western slope where it meets *S. adolphei dorsalis*. It may be

readily distinguished from the latter by the ferruginous ear patches and blackish dorsal surface, the top of head not being paler than back. Although specimens of both *S. thomasi* and *S. dorsalis* are before me from the same locality, La Carpintera, where their ranges meet, there are no intergrades. I take great pleasure in naming this handsome species in honor of Mr. Oldfield Thomas, Curator of Mammals in the British Museum.

Specimens examined.—Five: from Talamanca, La Carpintera and Santa Clara, Costa Rica.

SCIURUS ADOLPHEI (Lesson). Nicaragua Squirrel.

Macroxus adolphei LESSON, Rev. Zool., v, p. 130, 1842 (nomen nudum); Nouv. Tabl. Règne Animal, Mamm., pp. 112-113, 1842; GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 433, 1867.

Sciurus boothia ALLEN, Mon. N. Am. Rodentia, pp. 741-746, 1877 (part: Nicaragua).

Sciurus hypopyrrhus ALSTON, Proc. Zool. Soc. London, 1878, pp. 662-664; ALLEN, Bull. U. S. Geol. Survey Terr., iv, pp. 881-882, 1878 (part); ALSTON, Biol. Cent.-Am., Mamm., pp. 128-131, 1880 (part).

Type locality.—Realejo, Nicaragua. Type in Paris Museum.

Distribution.—Tropical lowlands on west coast of Nicaragua.

Characters.—Top of head and nape iron gray, paler than back; rest of upperparts and base of tail dark grayish brown; underparts and outside of fore and hind legs reddish chestnut brown, sometimes with patches of white. Pelage thin; hairs of back coarse, stiff, and shining; under fur short.

Color.—Top of nose and crown dull iron gray; nape grayish brown; rest of back and upper part of thighs darker brown, with a shade of grayish, slightly paler on flanks; sides of nose, cheeks and sides of neck grayish brown; ears like crown and with well marked white basal patches; feet dark chestnut grizzled with blackish; fore-legs all around (except axillar area), adjacent part of shoulders, lower border of costal area and outer border and inside of thighs (except inguinal area) dark reddish chestnut; underparts (except white chin, throat, axillar and inguinal region), of same reddish chestnut as legs; tail at base dark grizzled brown; tail above black heavily washed with white; below, with broad median area of rusty brown, a narrow black border and white edge. Hairs on back black, with broad median ring of dull yellowish or slightly reddish brown.

Measurements.—Adult, No. 8495 U. S. Nat. Museum (from dry skin): total length 440; tail vertebræ 199 (tail imperfect); hind foot 65. In the flesh the total length of this species must exceed 500 mm.

General notes.—The type specimen of *S. adolphei* was collected during the voyage of the French ship 'La Pylade' by the ship's surgeon, Adolphe Lesson, in whose honor the species was named. The specimen described above differs from the description of the type only in being a little less intensely colored on the back and in having less white on the underparts. Lesson mentions another specimen from the same locality which had a black dorsal line, grayish sides and flanks, with grizzled gray and white on outside of legs. This squirrel appears to differ from *S. a. dorsalis* mainly in its darker colors.

Specimens examined.—One: from west coast of Nicaragua.

SCIURUS ADOLPHEI DORSALIS (Gray).

Banded-backed Squirrel.

Sciurus dorsalis GRAY, Proc. Zool. Soc. London, p. 138, 1848; SCLATER, *Ibid.*, 1870, pp. 670-671.

Sciurus rigidus PETERS, Monatsber. K. Pr. Akad. Wiss., Berlin, 1863, pp. 652-653.

Sciurus intermedius GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 421, 1867.

Macroxus dorsalis GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, pp. 422-423, 1867 (part).

Macroxus nicoyana GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 423, 1867.

Macroxus melania GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 425, 1867.¹

?*Sciurus boothiæ* ALLEN, Mon. N. Am. Rodentia, pp. 741-746, 1877 (part: specimens from Costa Rica).

Sciurus hypopyrrhus ALLEN, Mon. N. Am. Rodentia, pp. 746-750, 1877 (part: No. 8628 from Costa Rica); ALSTON, Proc. Zool. Soc. London, 1878, pp. 662-664 (part); ALLEN, Bull. U. S. Geol. Survey Terr., iv, pp. 881-882, 1878 (part); ALSTON, Biol. Cent.-Am., Mamm., pp. 128-131, 1880 (part); ALFARO, Mamíferos de Costa Rica, pp. 30-31, 1897 (part: west coast of Costa Rica).

Type locality.—Erroneously given as Caracas, Venezuela. (Specimens from Liberia, Costa Rica, are typical.) Type in British Museum.

Distribution.—Comparatively arid parts of tropical western Costa Rica from near Alajuela (or perhaps even farther south) north to district about Liberia, the peninsula of Nicoya, and perhaps adjacent part of Nicaragua.

Characters.—Colors brighter than in *S. adolphei*; top and sides of head decidedly paler and grayer than back; broad area along middle of back from nape to base of tail blackish brown or grizzled yellowish brown enclosed by band of lighter or paler grayish along sides; underparts white, buffy yellowish or bright rufous. Tail long and narrow;

¹ This may be a valid species or subspecies but the type was evidently a melanistic specimen and in the absence of material I refer it here. The type came from extreme southern Costa Rica (Point Burica).

pelage thin; hair on dorsal surface coarse and stiff; under fur thin.

Teats: p. $\frac{1}{4}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Color.—This subspecies has several color phases of which the two most characteristic are described below. *Blackish-backed phase:* Top and sides of head grizzled gray, paler than back; back with broad band (widening on lumbar region and narrowing thence to tail) blackish, blackish brown, or dark yellowish brown, bordered by band (half an inch to an inch wide) of whitish or gray, paler than dorsal area and separating it from color of underparts; lower flanks, all of legs, feet, and underparts nearly uniform white, buffy, or rufous; cheeks, chin and sides of neck grizzled gray or grayish brown; ears grizzled gray or grayish brown, sometimes bordered with black; ear patches white; tail above black, heavily washed with white, below, a broad median area varying from dark rufous to rusty orange or grayish white, bordered by a black line and edged with white.

Grizzled-backed phase: Top and sides of head pale gray or grayish brown, paler than back; rest of back grizzled grayish brown, yellowish brown or blackish brown, darkest on upper half and paler or grayer along sides and on legs; sides usually more or less strongly mixed with color of underparts; fore feet like underparts or heavily washed with same color; hind feet similarly washed but more nearly like outside of hind legs; underparts rusty, bright ferruginous, or buffy, sometimes with irregular white patches; ears like top of head; ear patches large, white; sides of head and chin dull grayish or grayish brown; tail above at base like back, rest of upper surface black, washed with white; below with median band of rusty, rufous, or yellowish brown bordered by black and edged with white.

Hairs on middle of back of blackish backed specimens, brownish black with scattered white tips; hairs on flanks of these specimens blackish broadly tipped with white or rufous. Hairs on specimens with grizzled backs, black with median or subterminal ring of rusty buffy, brownish yellow or grayish brown; on flanks similar but usually paler and sometimes with whitish tips.

Variations.—This is an extraordinarily variable squirrel. The top of head and upper part of flanks are usually paler than the median dark dorsal area; the underparts, lower flanks and outside of legs and feet may be white, some shade of buff, or bright rufous; or the back may be grizzled brown, with the same color extending over flanks to outside of legs and mixing with the color of the feet. In some cases where the last described phase is most marked the head is but little paler than back, especially in specimens from vicinity of San José and La

Carpintera. At the latter place the range of this subspecies appears to join that of *S. thomasi*, but no intergrades have been seen.

Measurements.—Average of four adults from northwestern Costa Rica (from dry skins): total length, 510; tail vertebræ 248.5; hind foot 63.2.

Cranial characters.—Premolars $\frac{2}{1}$. Skull like that of *S. b. belti*, and similar to that of *S. thomasi* but rather larger with slender rostrum. Two adult skulls from northwestern Costa Rica average: Basal length 51.7; palatal length 27.7; interorbital breadth 21.8; zygomatic breadth 35.2; length of upper molar series 11.7.

General notes.—In the original description of *Sciurus dorsalis* Gray gave Caracas, Venezuela, as the type locality. Dr. Sclater has since stated¹ that the type came from Nicaragua, but Mr. Thomas writes that he does not know on what authority. Citations of this squirrel from Nicaragua are probably referable to true *adolphei*. A number of specimens examined by me from northwestern Costa Rica, especially from near Liberia, agree exactly with Gray's description, and one (No. 15759 U. S. Nat. Museum, from Liberia, Costa Rica) sent Mr. Thomas for comparison was pronounced by him to be absolutely like the type.

The type locality of Gray's *Macroxus nicoyana*, based on a rufous color-phase of *S. a. dorsalis*, was given as Nicoya, a town on the peninsula of Nicoya, in northwestern Costa Rica. *S. rigidus* of Peters and *S. intermedius* of Gray are based upon a phase of *dorsalis* in which the head and upper part of flanks are nearly as dark as the middle of the back, but the underparts, lower flanks, and outside of legs and feet are nearly uniform bright rufous. Mr. Thomas has compared a specimen from Alajuela, Costa Rica (No. 15757 U. S. Nat. Museum) with Gray's type of *intermedius* in the British Museum and pronounces it identical, differing only in slightly duller colors. The type of *S. rigidus* came from San José, Costa Rica. The type locality of *intermedius* was given as Guatemala—evidently an error, as no squirrel of this style is found in Guatemala, while it is common in western Costa Rica.

Specimens examined.—Twenty: from San José, La Carpintera, Alajuela, Bebedero, San Mateo, Liberia and Nicoya, Costa Rica.

SCIURUS BOOTHIÆ Gray. Honduras Squirrel.

Sciurus richardsoni GRAY, Ann. & Mag. Nat. Hist., x, p. 264, 1842 (not *S. richardsoni* Bachman, 1838).

¹Proc. Zool. Soc., London, 1870, pp. 670-671.

Sciurus boothia GRAY, List. Spec. Mamm. Brit. Mus., p. 139, 1843; Voy.

H. M. S. 'Sulphur,' Zool., p. 34, pl. 13, fig 1, 1863.

Sciurus fuscovariegatus SCHINZ, Synopsis Mamm., 11, pp. 15-16, 1845.

Macroxus boothia GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 424, 1867.

Sciurus hypopyrrhus ALSTON, Proc. Zool. Soc. London, pp. 662-664, 1878 (part); ALLEN, Bull. U. S. Geol. Survey Terr., iv, pp. 881-882, 1878 (part); ALSTON, Biol. Cent.-Am., Mamm., pp. 128-131, 1880 (part: specimens from Honduras).

Type locality.—'Honduras' (specimens from San Pedro Sula are typical). Type in British Museum.

Distribution.—Humid tropical coast forests of northern Honduras and border of Guatemala.

Characters.—Back dark grayish brown, washed with shining black; belly white; feet blackish; ears black edged, with basal patches dark rusty; upper- and underparts separated by a narrow line of dull reddish brown along flanks. Pelage thin; hairs on back coarse, stiff, and shining; under fur short; tail long and narrow. Teats: p. $\frac{1}{1}$ a. $\frac{2}{2}$ i. $\frac{1}{1}$.

Color.—Upperparts, including top of nose and base of tail, uniform coarsely grizzled dark grayish brown, sometimes faintly suffused with reddish; outside of legs and feet similar, but darker and sometimes almost shining black; ears bordered with black; basal patch on back of ears dingy rusty; chin and sides of head dull grayish brown; entire underparts white; tail at base all around like back; rest of tail above black thinly washed with white; below, median area grizzled dark brownish suffused with yellowish or faint rufous, bordered with black, and thinly edged with white. Hairs on back black, with broad median ring of grayish or buffy brown.

Variation.—Three specimens from San Pedro Sula and one from Truxillo, Honduras (July), vary but little, the upperparts being washed with black over brownish, the feet black or blackish, grizzled with grayish brown or dull reddish brown, the underparts uniformly white.

A half grown specimen in the National Museum labeled 'Guatemala' differs from typical specimens in having the outside of the feet and legs black; sides of head and chin finely grizzled dark gray; underparts finely grizzled grayish brown, and lower surface of tail black, grizzled with gray near base.

Measurements.—Average of three adults from San Pedro Sula (from dry skins): total length 524; tail vertebræ 255; hind foot 63.3.

Cranial characters.—Premolars $\frac{2}{1}$. The only skull of this species at hand from San Pedro Sula is immature, but its proportions appear to be the same as those of subspecies *belti*.

General notes.—Gray first called this species *S. richardsoni* in 1842, but finding this name preoccupied by *S. richardsoni* of Bachman, 1838, he renamed it *S. boothiæ* in 1843. Overlooking Gray's change, Schinz renamed the species *S. fuscovariegatus* in 1845. Most recent authors have lumped this squirrel with numerous others under the name *hypopyrrhus*.

Mr. Oldfield Thomas, to whom a specimen from San Pedro Sula, Honduras (No. 19549 ♀ ad., U. S. National Museum) was sent for comparison with Gray's type, writes that they agree absolutely in color. Gray gives no definite type locality for this species, but specimens from San Pedro Sula are absolutely typical. Mr. Thomas writes that the type is less than half grown and that in redescribing this species in 1867 (Ann. and Mag. Nat. Hist., 3d. ser., xx, p. 424) Gray mentions, not the type, but specimens received by the British Museum from Honduras in 1845 which have gray instead of white bellies. *S. boothiæ* grades into *S. b. belti* to the south, and it is very probable that another subspecies exists in the mountains of interior Honduras. I have been unable to learn for whom Gray named this species.

Specimens examined.—Eight: from San Pedro Sula, Truxillo, and Segovia River, Honduras; Guatemala (1 specimen without definite locality).

SCIURUS BOOTHIÆ BELTI subsp. nov.

Escondido River Squirrel.

Type from Escondido River, 50 miles from Bluefields, Nicaragua. No. $\frac{36477}{48847}$ ♀ ad., U. S. Nat. Museum, Biological Survey Collection. Collected Nov. 22, 1892, by Chas. W. Richmond.

Distribution.—Humid tropical forests of eastern coast region of Nicaragua and north to Segovia River, Honduras.

Characters.—Differs from *S. boothiæ* mainly in having the underparts uniformly rusty rufous, and feet grizzled with rusty yellowish. Pelage thin; hair on back coarse, stiff and shiny; under fur short and thin; tail flat and slender. Teats: p. $\frac{1}{1}$ a. $\frac{2}{2}$ i. $\frac{1}{1}$.

Color.—Upperparts including top of nose and base of tail all around grizzled grayish brown, more or less heavily washed with black; ears bordered with black, posterior surface and basal patches dull rusty; sides of head and chin varying from yellowish brown to brownish gray; feet black, grizzled with rusty yellowish; outside of fore and hind legs like flanks but appreciably suffused with rusty yellow; tail above black, thinly washed with white; below, median area varying from grizzled yellowish brown to rusty, with narrow black

border and still narrower white edge. Hairs on back, black with a broad dull buffy or yellowish gray median ring.

Variation.—The ground color of the back varies from grayish brown with a light suffusion of reddish, to clayey brown with an overlying wash of shiny black. The rusty suffusion on outside of legs is strong in some and light in others. An August specimen is practically the same as others taken in November, thus indicating little or no seasonal change. One from the Segovia River, Honduras, is like those from the type locality, except that the underparts are deeper rufous. Another from the same locality has a brownish shade in the rufous of underparts, and large irregular pectoral and abdominal white areas connected by a narrow white median line. A third has the underparts grizzled rusty brown with a large, irregular median white line. These specimens (June and July) have the back heavily washed with black and in some respects are intermediate between typical *boothiae* and *belli*. A single melanistic specimen from Nicaragua is the only one seen.

Measurements.—Average of five adults from type locality: total length 512; tail vertebræ 261.6; hind foot 61.7.

Cranial characters.—Premolars $\frac{2}{1}$. Skull (pl. II, figs. 1 and 5) generally similar to that of *S. aureogaster*, but rostrum broader and heavier, anterior end of nasals broader and more flattened, interorbital width greater, occiput usually broader; the small premolar heavier, thus resembling *S. thomasi*. Four adult skulls from the type locality average: Basal length 48.8; palatal length 25.5; interorbital breadth 19.6; zygomatic breadth 33.7; length of upper molar series 11.4.

General notes.—This subspecies is named in honor of Thomas Belt, the well known author of 'A Naturalist in Nicaragua.'

Habits.—Dr. Richmond found these squirrels living in the forests along the borders of clearings or other openings.

Specimens examined.—Eight: from Escondido River, Nicaragua; and Segovia River, Honduras.

SCIURUS VARIEGATOIDES Ogilby. Variegated Squirrel.

Sciurus variegatoides OGILBY, Proc. Zool. Soc. London, 1839, p. 117; Ann. & Mag. Nat. Hist., v, pp. 62-63, 1840; WAGNER, Supplement. Schreber's Säugthiere, III, pp. 185-186, 1843.

Macroxus pyladei LESSON, Rev. Zool., Paris, v, p. 130, April, 1842 (nomen nudum); Nouv. Tabl. Règne Anim., Mamm., p. 112, 1842.

Sciurus griseocaudatus GRAY, Voyage of 'Sulphur,' Mammalia, II, p. 34, pl. 13, fig. 2, pl. 18, figs. 7-12, 1843.

Sciurus pyladii BAIRD, Mamm. N. Am., p. 282, 1857.

Proc. Wash. Acad. Sci., May, 1899.

- Macroxus colliæi* GRAY, Ann. & Mag. Nat. Hist., 3d ser., XX, pp. 421-422, 1867 (part: var. 1).
Sciurus hypopyrrhus ALLEN, Mon. N. Am. Rodentia, pp. 746-750, 1877 (part: No. 7019 from La Union, Salvador); Bull. U. S. Geol. Survey Terr., IV, pp. 881-882, 1878 (part); ALSTON, Proc. Zool. Soc. London, 1878, pp. 662-664 (part); Biol. Cent.-Am., Mamm., pp. 128-131, 1880 (part).

Type locality.—Salvador, Central America. Type in British Museum.

Distribution.—Tropical forests of Salvador, west coast of Central America.

Characters.—Entire upperparts and base of tail dingy yellowish gray; underparts and feet dull buffy ochraceous. Tail rather slender; pelage thin; hairs of back coarse, stiff and shining; under fur short and thin.

Color.—Entire upperparts, including top of head, outside of legs near body, and base of tail all round, nearly uniform dull grizzled buffy gray; backs of ears pale rusty with basal patches of dull buff, and narrow indistinct borders of black; feet, and outside of legs on lower half, dark ochraceous buff; paler or grayer buffy on chin, sides of nose and cheeks; underparts dark dingy buff; tail above, black washed with white; below, with broad median area like back, bordered by line of black and edged with grayish white. Hairs on back black, with broad median rings of pale yellowish gray; under fur dark sooty plumbeous.

Measurements.—Dry skin from La Union, Salvador, No. 7020 adult, U. S. Nat. Museum: total length 545; tail vertebræ 280; hind foot 66.

Cranial characters.—Premolars $\frac{2}{1}$. Skull similar to that of *S. thomasi*, but proportionately narrower and slenderer with much lighter jugals and smaller audital bullæ. It measures: basal length 49; palatal length 26; interorbital breadth 20; zygomatic breadth 34; length of upper molar series 11.

General notes.—The specimen described above was compared with Ogilby's type in the British Museum by Mr. Thomas, who pronounces the two identical, and adds that the type of *S. griseocaudatus* Gray differs from them only in having the color of the belly a little richer. Ogilby described this species from a specimen taken during the voyage of the 'Sulphur,' and later Gray described *S. griseocaudatus* from another specimen collected during the same voyage. By an error, Ogilby stated that his specimen came from the west coast of South America, but Gray gave the locality of his type more correctly as the west coast of Central America. Lesson's *S. pyladei* from San Carlos,

Salvador, as shown by the original description, was typical *S. variegatoides*; this, with the specimen in the U. S. National Museum, definitely determines the region where the species is found.

Specimen examined.—One: from La Union, Salvador.

SCIURUS MANAGUENSIS Nelson. Rio Managua Squirrel.

Sciurus boothiæ managuensis NELSON, Proc. Biol. Soc. Washington, XII, p. 150, June 3, 1898.

Type locality.—Managua River, Guatemala. Type no. 62476 U. S. National Museum.

Distribution.—Humid tropical forests along Managua River, northern Guatemala.

Characters.—Size of *S. boothiæ* but yellower on dorsal surface and uniformly light buffy yellow below. Pelage rather dense; hairs of back coarse, stiff and shining; tail long and narrow. Teats p. $\frac{1}{4}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Colors.—Upperparts, including top of nose and base of tail coarsely grizzled dull yellowish or grayish brown; crown and middle of back washed with shining black; sides of body and outside of legs more suffused with yellowish; feet of type bright buffy yellow only slightly grizzled (much more grizzled in two other specimens); ears edged with black and tipped with thin tuft of rusty hairs; basal patches conspicuous dull buffy yellow; sides of head and chin dingy yellowish or grayish brown; underparts, varying from rich, almost reddish buffy to dingy yellow; tail above black, thinly washed with white; below, with broad median area varying from grizzled grayish brown shaded with yellowish, to yellowish brown, bordered with black and edged with white. Hairs on back black, with broad median rings of dull yellowish buffy, or sometimes grayish.

Variation.—Two of the three specimens examined, including the type, are distinctly suffused with yellowish on back and bright yellow below; the third specimen is pale brownish gray above and much paler, dingier yellow below, but has the lower surface of tail slightly shaded with rusty and the feet and back with only a slight suffusion of yellowish.

Measurements.—Average of 3 adults from type locality (from dried skins): total length 537, tail vertebræ 270; hind foot 62.7.

Cranial characters.—Premolars $\frac{2}{7}$. Skull very similar to that of *S. aureogaster* but somewhat narrower; inner anterior border of auditory bullæ more indented, as in *S. boothiæ*. Two adult skulls from the type locality average: basal length 50.2; palatal length 27; in-

terorbital breadth 19; zygomatic breadth 33.9; length of upper molar series 11.5.

General notes.—This squirrel was originally described as a subspecies of *S. boethiæ* and is closely related to that species, but further study of the material at hand shows such strong differences that it seems best to regard the animals as distinct. The difference in size, more vivid yellow shade, and heavier wash of black on dorsal surface are sufficient to distinguish *S. managuensis* from *S. variegatoides*, which resembles it but is a larger, duller colored species.

Specimens examined.—Three: all from the type locality.

SCIURUS GOLDMANI Nelson. Goldman's Squirrel.

Sciurus goldmani NELSON, Proc. Biol. Soc. Washington, xii, pp. 149-150, June 3, 1898.

Type locality.—Huehuetan, Chiapas, Mexico. Type no. 77903 U. S. National Museum, Biological Survey Collection.

Distribution.—Arid tropical forests along southeastern coast of Chiapas, Mexico, and adjacent part of Guatemala (below 1500 ft.).

Characters.—Entire upperparts coarsely grizzled iron gray with an underlying yellowish or buffy shade; ear patches white and unusually conspicuous (in winter); ear tufts thin, rusty ferruginous; underparts, white. Pelage on dorsal surface thin; hairs coarse, stiff and shining; tail long and narrow. Teats: p. $\frac{1}{4}$ a. $\frac{2}{2}$ i. $\frac{1}{4}$.

Color.—Winter pelage: Nose and crown dark iron gray usually suffused with yellowish or buffy and washed with shiny black; rest of upperparts rather paler, more yellowish iron gray (paler on nape and sides), darker and more washed with shining black along middle of back and rump; fore feet paler, shading through darker gray on outside of legs to yellowish gray of shoulders; outside of thighs like flanks; hind feet grizzled iron gray, toes grayish white; ears, anteriorly dingy grayish with a distinct black border all around, posteriorly the upper half covered by a thin rusty ferruginous tuft and lower half by the large white basal patch; ring around eye narrow, dull buffy brown; sides of nose and cheeks dingy gray or grayish brown; entire underparts white; tail above black, thinly washed with white; below, median area dull grizzled iron gray, varying to grizzled yellowish or rusty, with a narrow black border, broad subterminal area of black, and narrower edge of white. Hairs on back black with broad median rings of pale yellowish gray (sometimes buffy).

Variation.—The main variation is in the color of the back which may be gray with a pale yellowish suffusion, or a deep, slightly rusty, buff grizzled with black.

Measurements.—Average of five adults from type locality: total length, 550.8; tail vertebræ 280.8; hind foot 66.2.

Cranial characters.—Premolars $\frac{2}{1}$. Skull closely resembling that of typical *S. aureogaster* but differing in slightly heavier rostrum, larger and longer audital bullæ, and in having the peg-like first premolar set well inside the anterior angle of the second premolar. Five adult skulls from the type locality average: basal length 51.2; palatal length 26.9; interorbital breadth 19.8; zygomatic breadth 33.9; length of upper molar series 11.3.

General notes.—*Sciurus goldmani* bears a superficial resemblance to *S. colliaci nuchalis* but may be readily distinguished by the black bordered ears, with large white basal patches, and the uniform color of thighs and back. The hairs on the back are coarser and stiffer.

Specimens examined.—Ten: from Huehuetan, Chiapas; and Guatemala.

HESPEROSCIURUS subgen. nov. (Pl. I, fig. 5; Pl. II, fig. 4).

SCIURUS GRISEUS Ord. California Gray Squirrel.

Sciurus griseus ORD., Journ. de Phys., LXXXVII, p. 152, 1818.

Sciurus fossor PEALE, Mamm. and Birds U. S. Expl. Expedition, p. 55, 1848.

Sciurus heermanni LECONTE, Proc. Acad. Nat. Sci., Phila., p. 149, 1852 (type locality California).

Sciurus fossor anthonyi MEARNS, Proc. U. S. Nat. Museum, XX, pp. 501-502, Jan. 19, 1898 (type from Campbell Ranch, Laguna, San Diego Co., California).

Type locality.—The Dalles, Columbia River, Oregon. No type specimen. Named from description.

Distribution.—Pine and oak forests of Transition (and upper border of Austral) zone from extreme southwestern Washington through western Oregon and most of California (except coast belt south of San Francisco) to northern Lower California, Mexico.

Characters.—Size large; tail long and bushy; upperparts gray; underparts white. Pelage full and soft; under fur long and thick; ears thinly haired. Teats: p. $\frac{1}{1}$ a. $\frac{2}{2}$ i. $\frac{1}{1}$.

Color.—Typical June specimens from Oregon: Upperparts, including top of nose and base of tail, pale gray sometimes with slight traces of yellowish on back; outside of legs similar, but fore legs sometimes a little paler; fore feet varying from dingy grayish white to gray scarcely paler than back; hind feet gray, varying from a little paler than back to grizzled blackish gray, occasionally with white markings on hind feet and toes; ears gray, sometimes suffused with

dingy yellowish brown; basal patches small, dingy gray or yellowish gray; sides of head finely grizzled gray, more whitish than back; ring around eye white, poorly defined; underparts white; tail above black with a thin wash of white; below, with broad median area dark grizzled gray, a rather poorly defined black border, and thin white edge. Hairs on back mostly black, with from one to three rings of white or yellowish, intermixed with others entirely black.

Variation.—The large series examined shows but little individual variation. Winter specimens from northern California are somewhat darker, more iron gray above, with much less black on upper surface of tail so that the underlying gray shows through; the ears are more hairy and inclining to rusty on backs and basal patches.

Measurements.—Average of five specimens from the Columbia River region—near type locality of *S. griseus*: total length 569; tail vertebræ 270.6; hind foot 81.8. Average of five adults from San Diego Co., California—topotypes of '*anthonyi*': total length 566; tail vertebræ 284; hind foot 80.

Cranial characters.—Premolars $\frac{2}{1}$. Skull (pl. I, fig. 5; pl. II, fig. 4) rather long, tapering anteriorly; nasals long, narrowed posteriorly; posterior part of the braincase inflated; audital bullæ small; postorbital process of malar usually ending in a well developed point. Molars unusually massive and the peg-like second premolar stouter than usual. Skulls from the type locality of *S. griseus* '*anthonyi*' average a little smaller than those from the Columbia River region, but the range of individual variation from the two localities is such that it is impossible to find any definite subspecific characters. Five adult skulls from near the type locality in the Columbia River region average: basal length 58.3; palatal length 32.1; inter-orbital breadth 20.8; zygomatic breadth 38.7; length of upper molar series 12.9. Five adult skulls from type locality of *S. griseus anthonyi* average: basal length 56.3; palatal length 30.2; inter-orbital breadth 20.9; zygomatic breadth 37.7; length of upper molar series 11.7.

General notes.—Ord's *S. griseus* is based on the 'Large Gray Squirrel' of Lewis and Clark, which is said to have been found in a narrow tract of country well covered with white oak timber on the upper side of the mountains just below 'Columbia Falls.' From Lewis and Clark's narrative and the well known character of the country it is evident that the place referred to is near The Dalles of the Columbia, which fixes the type locality with some certainty.

A careful comparison of the type and topotypes of '*S. fossor an*

thonyi' in the National Museum, with a large series of typical *S. griseus* from Oregon and Washington, fails to show any character by which they can be satisfactorily separated. The type and some of the topotypes of *anthonyi* can be matched by specimens taken at the same season in Oregon; I am obliged therefore to treat *anthonyi* as synonym of *S. griseus*. Some specimens from the type region of '*anthonyi*' have the feet intermediate in color between *griseus* and *nigripes*.¹

Specimens examined.—Fifty-two: from many localities in Washington, Oregon, and California.

OTOSCIURUS subgen. nov. (pl. I, fig. 2).

SCIURUS DURANGI (Thomas). Durango Squirrel.

Sciurus aberti THOMAS, Proc. Zool. Soc. London, 1882, p. 372; ALLEN, Bull. Am. Mus. Nat. Hist., v, p. 28, April, 1893. (Not *S. aberti* Woodhouse, 1852.)

Sciurus aberti durangi THOMAS, Ann. & Mag. Nat. Hist., 6th ser., xi, pp. 49-50, Jan., 1893.

Type locality.—Ciudad ranch (100 miles west of Durango City, Durango, Mexico. Type no. 82.3.20.16., British Museum.

Distribution.—Pine forests of Transition and lower border of Boreal zones in Sierra Madre, western Durango and Chihuahua, Mexico (alt. 7000-11,000 feet).

Characters.—Similar to *S. aberti*, but much less reddish chestnut on back; sides of nose to eyes usually reddish buffy, feet more or less grizzled gray; tail much less full, and its lower surface uniformly grizzled gray; ears smaller and narrower; ear tufts in winter long (absent in summer). Pelage soft and full; under fur long. Teats: p. $\frac{1}{2}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Color.—Summer pelage: Upperparts, including top of nose and base of tail, dingy gray, with dark rufous or reddish chestnut along back from shoulders to rump, but not reaching base of tail as in *S. aberti*; outside of fore legs rather paler than back; fore feet white or pale gray; outside of hind legs like flanks; hind feet uniform grizzled gray like outside of thighs, or gray mottled irregularly with areas of white and sometimes dingy rusty; a poorly defined black line along flanks separating color of upper and lower parts; sides of nose (to eyes) sometimes dingy gray suffused with brownish but usually reddish brown; same color shading fore part and sometimes all of

¹*S. fossor nigripes* Bryant, Proc. Calif. Acad. Sci., 2d ser., II, pp. 25-26, 1889. [Type from coast region south of San Francisco, probably San Mateo or Santa Cruz Co., Calif.]

white ring around eye; rest of sides of head finely grizzled gray, paler than back; ears dingy gray and thinly haired, sometimes with traces of grizzled gray and black winter tufts; underparts white; tail at base all around like rump; rest of tail above black, heavily washed with white; below uniformly grizzled gray, with narrow indistinct black border, a well marked subterminal black area, and broad white edging. Hairs on back black with two to three rings of grayish white, the rings often becoming rufous on middle of back.

Variation.—In some specimens the upperparts are nearly uniform dingy gray, the chestnut dorsal area being indicated merely by a rusty suffusion along the lumbar region. In those with a distinct chestnut dorsal area, numerous rufous ringed hairs are scattered over the back and flanks, giving the gray a slight brownish tinge. The color of the hind feet is very variable and is scarcely alike in any two specimens, but is never pure white as in *aberti*. One of the most striking and constant characters of this species is the entire absence of white on the underside of the tail.

Measurements.—Average of five adults from vicinity of type locality: total length 486.4; tail vertebræ 235.4; hind foot 71.2. Five adult topotypes of *S. aberti* average: total length 510; tail vertebræ 229.8; hind foot 75.6.

Cranial characters.—Premolars $\frac{2}{1}$. Skull (pl. I, fig. 2) generally similar to that of *S. aberti* but somewhat smaller, with notably smaller molars, and shorter and more slender first premolar; audital bullæ relatively larger; braincase a little less drawn out posteriorly. Five adult skulls from vicinity of type locality average as follows: basal length 50.1; palatal length 27.3; interorbital breadth 19.8 zygomatic breadth 34.5; length of upper molar series 10.8. Five adult skulls of *S. aberti* from type locality average: basal length 52; palatal length 27.8; interorbital breadth 19.8; zygomatic breadth 35.1; length of upper molar series 11.2.

General notes.—The characters which separate this squirrel from *S. aberti* are so constant in the series before me that it seems best to consider it a distinct species. Each species has a well defined range, there being a broad gap in northern Chihuahua and southern Arizona in which neither occurs.

Specimens examined.—Thirty-two: from El Salto (near Ciudad ranch), Durango; Sierra Madre and near Guadalupe y Calvo, Chihuahua (in southwestern corner of State).

Subgenus **TAMIASCIURUS** Trouessart (pl. I, fig. 8).**SCIURUS DOUGLASI MEARNSI** (Townsend). Mearns' Squirrel.

Sciurus hudsonius mearnsi TOWNSEND, Proc. Biol. Soc. Washington, XI, p. 146, June 9, 1897.

Sciurus mearnsi ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., x, pp. 286-287, 1898.

Type locality.—San Pedro Martir Mountains, Lower California (about 7000 ft. alt.). Type no. $\frac{18266}{25170}$. U. S. National Museum.

Distribution.—Pine forest of San Pedro Martir Mountains, Lower California, Mexico. Transition zone.

Characters.—Generally similar to *S. douglasi albolimbatus* but grayer, with feet pale yellowish, or buffy white. Pelage soft and dense; under fur long; tail short and bushy.

Color.—Entire upperparts, including top of nose, outside of forelegs and thighs pale dingy gray, with pale yellowish or rusty suffusion extending from nape along back and out on middle of basal half of tail; sides of nose pale buffy whitish; sides of head grizzled gray, paler than back; ring around eye whitish; ears, in front, like sides of head, behind like crown, with well marked tuft of black hairs, slightly grizzled with gray or dingy fulvous; line along flanks black, distinctly separating color of back from that of underparts; feet pale yellowish white; fore feet inclining to buffy; underparts dingy white; under fur plumbeous, showing through white surface; tail above, median line of basal half like middle of rump, but edged and slightly grizzled with white; rest of upper surface black washed with white tail below, median area of basal two-thirds dingy grizzled gray bordered with black (the black also extends over most of outer third) and narrowly edged with white. Dorsal hairs black with broad median and narrow subterminal rings of pale dull grayish or dingy yellowish (the latter mainly along middle of back).

Variation.—The three specimens of this squirrel before me were taken in April and May and show little variation. They are paler than typical specimens of *albolimbatus* taken at the same season but are not strikingly different.

Measurements.—Average of three adults from type locality (from dry skins): total length 305; tail vertebræ 111.3; hind foot 50.6. (The total length and tail measurements are, no doubt, too short.)

Cranial characters.—Premolars $\frac{2}{4}$. Skull (pl. I, fig. 8) much like that of *S. d. albolimbatus*. The type measures: basal length 41; palatal length 25; interorbital breadth 14.5; zygomatic breadth 28; length of upper molar series 8.

Specimens examined.—Three: all from type locality.

ARÆOSCIURUS subgen. nov. (pl. I, fig. 3.)**SCIURUS OCULATUS** Peters. Black-backed Squirrel.

- Sciurus capistratus* LICHTENSTEIN, Abhandl. K. Akad. Wiss., Berlin (1827), p. 116, 1830. (Not *S. capistratus* Bosc, 1802.)
Sciurus carolinensis SAUSSURE, Rev. et Mag. de Zool., 2e ser., XIII, p. 4, 1861. (Not *S. carolinensis* Gmelin, 1788.)
Sciurus oculatus PETERS, Monatsber. K. Akad. Wiss., Berlin 1863, p. 63.
Sciurus hypopyrrhus ALLEN, Bull. U. S. Geol. Survey Terr., IV, pp. 881-882, 1878 (part).
Sciurus niger melanonotus THOMAS, Proc. Zool. Soc. London, pp. 73-74, pl. VI, 1890; ALLEN, Bull. Am. Mus. Nat. Hist., v, p. 30, 1893; *Ibid.*, IX, p. 198, 1897.

Type locality.—Mexico, probably near Las Vigas, Vera Cruz. Type no. 1434 Berlin Museum.

Distribution.—Pine and oak forests of Transition and Boreal zones in northern Puebla, western Vera Cruz (Cofre de Perote—Mt. Orizaba), Hidalgo, eastern Queretaro, and southeastern San Luis Potosi, Mexico (alt. 6000-12,000 feet).

Characters.—Size large; upperparts gray with large black or blackish area along middle of back; belly buffy. Pelage rather soft and dense; under fur long; tail long and full. Teats: p. $\frac{1}{4}$ a. $\frac{2}{2}$ i. $\frac{1}{4}$.

Color.—Crown between ears, and broad band along middle of back from shoulders to base of tail, black or blackish, shading on edges to dark gray like remainder of upperparts; ring around eye well marked, buffy whitish or buffy; cheeks usually grizzled gray like sides of neck but sometimes washed with buff; ears dingy gray frequently washed with dull buff of variable intensity; basal ear patch varying from dingy white to dark buffy (sometimes absent in summer); feet varying from grizzled gray washed with buffy to rich buff shading to gray on outside of fore legs; outside of lower hind legs varying from gray like rest of thigh to dark rusty brownish. Underparts varying from white with pale dull buffy suffusion to rich ochraceous buff; tail above black, heavily washed with white; below, with broad median area of grizzled yellowish gray, bordered with black and heavily edged with white. Hairs of back black, with one or two rings of gray, yellowish gray or brownish gray, mixed with other hairs wholly black.

Variation.—The black dorsal band is usually present, sometimes continuous from crown to tail (as in a specimen from Tulancingo), and varies from 25 to 50 mm. in width; but in two specimens from the Cofre de Perote, Vera Cruz, and in nearly all from Pinal de Amoles, Queretaro, it is represented only by a black wash. The buff on underparts of the latter specimens is decidedly richer than on ordi-

nary examples with black backs, and is equally intense in specimens from Encarnacion, Hidalgo, which have the well-marked black dorsal band. Two specimens from Villar, San Luis Potosi, in worn summer pelage, differ in being uniform gray on back, scarcely darker along median line, but they agree with the Pinal de Amoles specimens in the rich, buffy underparts. The buff on feet accompanies and varies in intensity with same color on underparts. The only melanistic specimen in the series is from Pinal de Amoles, Queretaro.

Measurements.—Average of five adults from type locality: total length 542.8; tail vertebræ 269; hind foot 72.7.

Cranial characters.—Premolars $\frac{1}{1}$. Skull (pl. I, fig. 3) proportionately broader and heavier than that of *ludovicianus*; rostrum shorter and heavier; interorbital breadth greater; top of braincase broader and less convex on interparietal outline; occiput decidedly broader and more depressed; audital bullæ appreciably larger and more drawn out anteriorly and posteriorly. Three adult skulls from the type locality average as follows: basilar length 54.6; palatal length 28.5; interorbital breadth 20.3; zygomatic breadth 36.3; length of upper molar series 11.

General notes.—Peters described *Sciurus oculatus* in 1864 from a specimen collected by Deppe in eastern Mexico. Thomas redescribed the species in 1890 as *S. niger melanonotus*, from specimens taken at Las Vigas, Vera Cruz. Specimens from Las Vigas agree perfectly with the original description of *S. oculatus*, and since this locality is on the route followed by Deppe it may be considered the type locality.

Habits.—This species properly belongs to the pine forests of the Transition and Boreal zones from 7500–12,000 feet, but at Villar, San Luis Potosi, near the northern border of its range, we found it in the oaks of the Upper and Lower Austral zones (5500–6000 feet) where it was feeding on acorns and wild figs in the canyon bottoms. Ordinarily its main food supply is obtained from various species of pines.

Specimens examined.—Forty-six: from Mt. Orizaba, Puebla; Cofre de Perote and Las Vigas, Vera Cruz; Real del Monte, Tulancingo and Encarnacion, Hidalgo; Pinal de Amoles, Queretaro; Villar, San Luis Potosi (6000 feet).

SCIURUS OCULATUS TOLUCÆ Nelson. Toluca Squirrel.

Sciurus oculatus toluca NELSON, Proc. Biol. Soc. Washington, XII, pp. 148–149, June 3, 1898.

Type locality.—North slope of the Volcano of Toluca, State of Mexico, Mexico. Type no. 55927 U. S. National Museum, Biological Survey collection.

Distribution.—Pine and oak forests of Transition and Boreal zones on tableland slope of the Sierra Madre in the State of Mexico, from the Volcano of Toluca north to border of Michoacan; also arid mountains of southern and western Queretaro, central and eastern Guanajuato, and southern San Luis Potosi, Mexico (alt. 7500–12,000 feet).

Characters.—Paler than *S. oculatus*, with a wash of blackish, or blackish brown along middle of back; underparts dingy whitish, with only a faint suffusion of buffy. Pelage and teats as in *S. oculatus*.

Color.—Top of head and broad median line down back to base of tail, gray with a faint blackish or dull brownish wash shading laterally into clearer grizzled gray; latter color, however, with slight shading of yellowish on subterminal rings of some hairs; ring around eye grayish white with pale buffy shade; rest of sides of head dingy gray suffused with dull buffy or pale brownish; ears dull gray shaded with buffy; patch behind ear dingy whitish; feet grayish white with buffy wash, usually deeper than on underparts; outside of fore legs and thighs like flanks; thighs near feet suffused with yellowish brown; tail above black, heavily washed with white; below, along median line grizzled yellowish gray or pale yellowish brown, bordered with black and broadly edged with white. Hairs of back black with one or two rings of gray, yellowish or brownish gray, mixed with other hairs wholly black.

Variation.—A single melanistic specimen from the type locality is the only one seen. The four normal specimens show little variation, and this mainly in the amount of buffy on the feet and in the intensity of the dark wash along middle of back.

Measurements.—Average of four adults from type locality: total length 531; tail vertebrae 263; hind foot 68.7.

Cranial characters.—Premolars $\frac{1}{4}$. Skull much like that of *S. oculatus*, but in nearly all of the specimens examined the nasals are much narrower posteriorly with a corresponding increase in breadth of the premaxillaries. Two adult skulls from type locality average as follows: basilar length 54; palatal length 29; interorbital breadth 20.5; zygomatic breadth 36.7; length of upper molar series 11.

General notes.—This form resembles specimens of *S. oculatus* from Pinal de Amoles very closely in the color of the back, but may be distinguished at once by the whitish ear patches and whitish ventral surface. It was named for the Volcano of Toluca, the type locality.

Specimens examined.—Seven: from Volcano of Toluca, Mexico; Tequisquiapan, Queretaro; mountains north of Guanajuato city, Guanajuato, Mexico.

SCIURUS ALLENI Nelson. Allen's Squirrel.

- '*Sciurus carolinensis*??' BAIRD, Mamm. N. Am., pp. 263-264, 1857 (Santa Catarina, Nuevo Leon, Mexico).
Sciurus carolinensis var. *carolinensis* ALLEN, Mon. N. Am. Rodentia, pp. 706-709, 716, 1877 (part: from Nuevo Leon, Mexico).
Sciurus carolinensis ALSTON, Proc. Zool. Soc. London, pp. 658-659, 1878; Biol. Cent.-Am., Mamm., pp. 124-125, June, 1880 (part: from Nuevo Leon, Mexico).
Sciurus arizonensis ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., III, p. 222, May, 1891 (part: from San Pedro Mines, Nuevo Leon, Mexico).
Sciurus alleni NELSON, Proc. Biol. Soc. Washington, XII, pp. 147-148, June 3, 1898.

Type locality.—Monterey, Nuevo Leon, Mexico. Type no. $\frac{25731}{33131}$ U. S. National Museum, Biological Survey Collection.

Distribution.—Open pecan and other forests of Lower Sonoran zone near Monterey, Nuevo Leon, extending up to oak and pine forests of Transition zone near Victoria and Miquihuana, Tamaulipas, Mexico (alt. 2000-8500 ft.).

Characters.—Upperparts nearly uniform grayish brown or yellowish brown, much as in *Sciurus carolinensis*; feet gray; underparts white. Pelage on back soft and rather dense; tail rather full. Teats: p. $\frac{1}{4}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Color.—*Winter pelage*: Entire upperparts yellowish brown, finely grizzled with gray and black, usually darker along back and grayer along sides; top of head similar, but usually a little darker; eye with distinct ring of dingy whitish shaded with buff on outer border; sides of head grizzled dusky gray, often suffused with yellowish brown; ears and basal patch brownish gray; fore feet and outside of fore legs whitish gray, frequently more or less washed with buffy; hind feet whitish gray, usually with a spot of dark buffy on middle of upper surface; outside of thighs like flanks but often with a browner shade near feet; underparts white; color of upper- and lowerparts usually separated by a narrow line of pale grayish; base of tail all around like back; tail above black, heavily washed with white, the yellowish brown or yellowish gray under color often showing through; below with broad median area of grizzled yellowish brown or yellowish gray, narrowly bordered with black and edged with white. Hairs of back black, with one and often two rings of gray, buffy, or buffy brown, the two colors sometimes on same hair and sometimes on distinct hairs. The pelage in summer is darker and more yellowish brown than in winter—due to absence of most of the gray or white tips to hairs.

Variation.—The striking differences in proportions between specimens from the lowlands near Monterey and those from the mountains near Miquihuana (alt. 8500 ft.) as shown by the average measurements are not accompanied by similar differences in color. The upperparts are sometimes grizzled brown and vary from that to nearly clear gray. A specimen from the San Pedro Mines, Nuevo Leon, has the upperparts dark yellowish brown, darkest (thinly washed with black) on top of head. The eye is surrounded by a ring of dark buff, the fore feet are washed with buff and the hind feet with grayish white. Another specimen in similar pelage was taken at Miquihuana, Tamaulipas, in June; a winter specimen from Rio San Juan, Nuevo Leon, is almost as dark but has grayer sides and feet. No signs of melanism seen.

Measurements.—Average of five adults from vicinity of type locality: total length 471; tail vertebræ 217; hind foot 60.6. Average of five adults from mountains near Miquihuana, Tamaulipas: total length 465; tail vertebræ 230.4; hind foot 65.8.

Cranial characters.—Premolars $\frac{1}{1}$. Skulls of *S. alleni* are only distinguishable from those of *S. oculatus* by their smaller size. Five adult skulls from region of type locality average: basilar length 50.4; palatal length 26.3; interorbital breadth 18.4; zygomatic breadth 33.7; length of upper molar series 10.5. Five adult skulls from near Miquihuana average: basal length 50; palatal length 25.6; interorbital breadth 18.1; zygomatic breadth 33.7; length of upper molar series 10.3.

General notes.—*Sciurus alleni* bears a close superficial resemblance to *S. carolinensis* of Texas, but has only a single premolar. From *S. o. toluca* it differs mainly in smaller size, grayer feet and whiter belly. The type of this species came from near Monterey, Nuevo Leon. By a slip of the pen in the original description the type locality was given as Monterey, Tamaulipas. Baird called attention to this squirrel in 1857, under the name '*Sciurus carolinensis*??' and gave the essential characters which separate it from *S. carolinensis*. Subsequent authors have referred it to the same species or to *S. arizonensis*, but a series in the collection of the Biological Survey shows that it is a well defined species most nearly related to *S. oculatus*. Neither *S. carolinensis*, nor any close relative of that species occurs in Mexico.

Specimens examined.—Twenty-two: from Monterey, Linares, Rio de San Juan, and San Pedro Mines, Nuevo Leon; near Victoria and Miquihuana, Tamaulipas.

SCIURUS NAYARITENSIS Allen. Nayarit Squirrel.

Sciurus alstoni ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., II, pp. 167-170, October, 1889 (Not *S. alstoni* Anderson, 1878).

Sciurus nayaritensis ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., II, p. vii, footnote, Feb. 1890 (new name for *S. alstoni* ALLEN); *Ibid.*, III, p. 185, 1890; *Ibid.*, V, p. 30, April, 1893.

Type locality.—Sierra Valparaiso, Zacatecas, Mexico. Type no. 1985 American Museum of Natural History, New York.

Distribution.—Pine and oak forests of the Transition Zone in the Sierra Madre and outlying spurs of western Zacatecas, southern Durango, eastern Tepic and southern Jalisco, Mexico (alt. 6500-9000 ft.).

Characters.—Size large; back dark gray; ears rusty, belly and feet white. Tail bushy; ears thinly haired; pelage thick and soft; under fur long. Teats: p. $\frac{1}{4}$ a. $\frac{2}{3}$ i. $\frac{1}{4}$.

Color.—Upperparts dark gray, with underlying rusty yellowish showing through; broad ring around eye white; rest of sides of head gray, frequently shaded with rusty brown; ears varying from dingy grayish to dull rusty brown; outside of fore legs varying from white to grayish white, or white suffused with buffy; fore feet dingy white often suffused with buffy; outside of hind legs paler or more washed with whitish than back; hind feet grayish white, often washed with buffy; toes whitish suffused more or less with buffy; underparts white; tail above at base like back, rest of upper surface black heavily washed with white; below, with broad ferruginous median area, heavy black border, and broad white edge, the white often extending as a wash over the entire lower surface. Hairs on back rusty yellow (sometimes ferruginous) with broad subterminal black rings and narrow white tips.

Variation.—Among 17 winter specimens from the type locality 10 have a more or less strong wash of rusty on the back part of crown and nape—thus forming a poorly defined nape patch; and one has a similar rusty wash along middle of lumbar region. This winter series is more whitish on the back than summer specimens from the Nayarit Mts. at Santa Teresa, Tepic; and a series taken in September near Plateado, Zacatecas, agrees with the one from Santa Teresa. These summer skins have numerous scattered hairs on the back entirely black; others rusty yellow, or dull rufous, with sub-basal and subterminal black rings, with or without white tips; the white tips when present generally smaller than in the Valparaiso specimens. The result is a generally darker, more rusty, back and an increase of buffy or rusty buff on feet and outside of fore legs. The surface of the tail has less white and the ferruginous median area below is consequently more

distinct. This is probably the summer pelage but may possibly represent a local form. Two specimens from Santa Teresa have the entire underparts dark rusty buffy and are the only ones showing this color below.

Measurements.—Average of five adults from type locality: total length 565.8; tail vertebræ 272; hind foot 77.5.

Cranial characters.—Premolar $\frac{1}{4}$. Upper molars broader and heavier than in *S. oculatus*, but otherwise the skulls are scarcely distinguishable. Five adult skulls from the type locality average: basilar length 55.5; palatal length 28.4; interorbital breadth 20.7; zygomatic breadth 37.1; length of upper molar series 11.7.

General notes.—The type of *S. alstoni* Allen came from the Sierra Valparaiso, but in renaming the species Dr. Allen called it *S. nayaritensis* from the Nayarit Mts., a part of the Sierra Madre about 100 miles southwest of the type locality.

Specimens examined.—Forty-one: from Sierra Valparaiso, Sierra Madre, and Plateado, Zacatecas; Sierra Madre, northern Tepic; Sierra de Juanacatlan and Barranca Beltran (east base Sierra Nevada de Colima), Jalisco.

SCIURUS APACHE Allen. Apache Squirrel.

Sciurus griseoflavus THOMAS, Proc. Zool. Soc. London, 1882, p. 372 (not *S. griseoflavus* Gray, 1867).

Sciurus niger ludovicianus THOMAS, Proc. Zool. Soc. London, 1890, p. 73, footnote.

Sciurus apache ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., v, p. 29, March 16, 1893.

Type locality.—Mountains of northwestern Chihuahua (near Bavispe River?), Mexico. Type no. $\frac{5370}{430\frac{1}{2}}$, American Museum of Natural History, New York.

Distribution.—Mixed oak and pine forests of Transition zone in the Sierra Madre of western Durango and Chihuahua, eastern Sonora and northeastern Sinaloa, Mexico, and the Chiricahua Mountains of southern Arizona.

Characters.—Size large, about equalling *S. ludovicianus* to which it bears a strong general resemblance in color, but is readily distinguishable by its gray ears, darker, more iron gray upperparts, dull rusty ferruginous hind legs and black upper surface of the tail which is thinly washed with pale yellowish white, or rusty buff. Pelage thick and soft; ears thinly haired. Teats: p. $\frac{1}{4}$ a. $\frac{2}{2}$ i. $\frac{1}{4}$.

Color.—*Summer pelage:* Upperparts including top of nose and base of tail dark, sometimes almost iron gray, often washed but never

strongly shaded with yellow. Crown and back darker, often becoming blackish along middle of rump and on base of tail; top of back sometimes, and flanks commonly, washed with pale yellowish; sides of head grizzled gray and dark fulvous, the gray sometimes predominating; ring around eye well marked and varying from buffy white to rich fulvous buffy; ears dingy gray sometimes suffused with pale buffy; a scanty basal patch of dull buffy or orange buff sometimes present; feet and often most of fore legs and entire underparts varying from dark dull buffy yellow to rich orange yellow, sometimes suffused with rusty; hind feet usually a little darker than fore feet; outside of hind legs varying from gray suffused with dull rusty to uniform rusty sometimes with a strong tawny rufous shade that extends over inside of thighs; tail above black, with a wash varying from pale yellowish white to rusty yellow; below with broad median area varying from yellowish rusty to dull rusty rufous with a broad indistinct black border and broad edge of pale yellowish, or rusty buffy, the latter colors often forming a wash over entire lower surface. Hairs of back black, with small white or pale yellowish tips and broad buffy or yellowish basal or sub-basal rings.

Variation.—The amount of individual variation is comparatively small; the back becomes a little paler or darker, the color on outside of thighs more or less intense, and color of lower parts varies in intensity as already described.

Measurements.—Average of five adults from northern Chihuahua: total length 565.8; tail vertebræ 279; hind foot 79.2.

Cranial characters.—Premolars $\frac{1}{1}$. Skull much larger than that of *S. oculatus*, with audital bullæ proportionately smaller. Five adult skulls from western Durango average as follows: basilar length 56.4; palatal length 28.7; interorbital breadth 21.5; zygomatic breadth 37.5; length of upper molar series 11.9.

General notes.—Although the color of *Sciurus apache* is very much like that of *S. ludovicianus*, the form of the skull shows that it belongs to the subgenus *Aræosciurus*, of which *S. oculatus* is the type.

During the summer of 1898 we found *S. apache* common in the mixed forest of pines and oaks on the mountains of western Durango. They live in hollow oaks, entering by a knot hole or broken branch and were rarely seen on the pines. The upper limit of their range overlaps the lower limit of *S. durangi* but neither occupies much territory of the other. The type of this fine squirrel came from the region once occupied by the Apache Indians for whom it was named.

Specimens examined.—Thirty-three: from El Salto (southwest of Durango City), Durango; near Guadalupe y Calvo, Bavispe River, and Sierra Madre near Arizona border, Chihuahua; Sierra de Choix, northeastern Sinaloa, Mexico; and the Chiricahua Mountains, Arizona.

SCIURUS ARIZONENSIS HUACHUCA Allen.
Huachuca Squirrel.

Sciurus arizonensis huachuca ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., VI, p. 349, Dec. 7, 1894; *Ibid.*, VII, p. 245, 1895.

Type locality.—Huachuca Mountains, southern Arizona. Type no. $\frac{9021}{7316}$ American Museum of Natural History, New York.

Distribution.—Pine and oak forests of Transition zone, in northeastern Sonora, Mexico, and Huachuca Mountains, southern Arizona.

Characters.—Generally similar to *S. arizonensis* but with a broad band of gray over back of neck and shoulders, separating the median grizzled yellowish or pale rusty area into a narrow patch on crown and ears and a larger one on lumbar region and rump. Pelage full and soft; tail long and bushy. Teats: p. $\frac{1}{4}$ a. $\frac{2}{2}$ i. $\frac{1}{4}$.

Color.—May specimens from Ft. Huachuca, Arizona: upperparts, including top of nose and base of tail, pale grizzled gray with rusty yellow wash on back of crown, lumbar region and rump; sides of neck, flanks, and outside of hind legs somewhat paler than top of shoulders; fore feet and outside of legs grizzled grayish white, sometimes pale gray; hind feet pale grizzled gray; ring around eye whitish, or slightly buffy; sides of head whitish gray often with postocular yellowish brown suffusion; ears dingy grayish or dull yellowish, sometimes with small patch of dull gray or rusty yellow behind base; underparts white; tail above black washed with white, heaviest along border; below, broad median area grizzled rusty, dull orange yellow or yellowish brown, with heavy black border and broad white edge. Hairs on back black with white tips and broad yellow sub-basal or basal rings, or with subterminal buffy yellow rings, mixed with other hairs wholly black. Winter pelage similar to that of summer but a little grayer on sides of body and outside of legs and feet; ears more thickly haired and dull rusty with basal patches of same color; white on tail more distinct.

Variation.—The type of *huachuca* has a dull yellowish wash on crown, and the ears and basal ear patches are rusty; the rest of the upperparts are grizzled gray, darker along middle of back where an intermixture of rusty forms a small irregular patch; the flanks, outside

of legs and feet are paler. This specimen is exceptionally gray on the back, as it lacks the usual well defined yellowish area on rump. Several worn summer specimens from Huachuca have the area about the mouth and inside of fore feet and legs stained deep brown from the juice of walnut shells, and the underparts of a number of specimens are dingy buffy, probably due to the same cause.

Measurements.—Average of four adults from type locality: total length 517; tail vertebræ 247; hind foot 70.5.

Cranial characters.—Premolars $\frac{1}{4}$. Skull similar to that of *S. ocellatus*, but rostrum heavier; parietal region slightly more inflated; occiput higher and narrower; foramen magnum higher, narrower and obtusely triangular; audital bullæ decidedly smaller. Four adult skulls from type locality average: basal length 53.5; palatal length 27.5; interorbital breadth 19.9; zygomatic breadth 36.5; length of upper molar series 10.9. Four adult skulls of *arizonensis* from near type locality average: basal length 53.2; palatal length 27.1; interorbital breadth 20.1; zygomatic breadth 36.4; length of upper molar series 11.4.

General notes.—This is not a strongly marked subspecies but the separation of the yellowish dorsal area by the gray band across the shoulders and neck seems to be constant and is accompanied by differences in size. A specimen from the Santa Catalina Mountains, Arizona, between the type localities of *arizonensis* and *huachuca*, is exactly intermediate between the two forms.

Specimens examined.—Twenty-six: from Huachuca Mountains, Arizona, and Sonora, Mexico (32 miles south of Nogales).

Subgenus **PARASCIURUS** Trouessart. (pl. I, fig. 1.)

SCIURUS LUDOVICIANUS LIMITIS Baird.

Texas Fox Squirrel.

Sciurus limitis BAIRD, Proc. Acad. Nat. Sci. Phila., VII, p. 331, 1855; Mamm. N. Am., p. 256, 1857.

Sciurus niger var. *ludovicianus* ALLEN, Mon. N. Am. Rodentia, pp. 724-731, 1877 (part: southwest Texas and Nuevo Leon, Mexico).

Type locality.—Devils River, Texas. Type no. 351 U. S. National Museum.

Distribution.—Wooded parts of Lower Sonoran zone in southwestern Texas and adjacent parts of Nuevo Leon and Coahuila, Mexico.

Characters.—Similar to *S. ludovicianus* but considerably smaller, with slenderer tail, thinner pelage and paler colors. Pelage thin, hairs of back rather harsh; under fur thin. Teats: p. $\frac{1}{4}$ a. $\frac{2}{2}$ i. $\frac{1}{4}$.

Color.—Entire dorsal surface, including top of nose and base of tail, uniform pale yellowish gray; sides of head dull, dark buffy yellow, grizzled on cheeks with gray and black, sometimes with a slight reddish shade; ring around eye buffy; ears dingy rusty, or buffy yellow; feet dark yellowish buffy shading into gray on upper part of fore legs; outside of hind legs like back but with a buffy or dull rusty wash near feet; underparts varying from orange buff to pale, slightly reddish rusty; tail above, grizzled black and gray with a thin wash of grayish or pale grayish yellow; below, with broad median area of rusty ferruginous or yellowish rusty, often grizzled with black, a narrow black border and thin edging of grayish or pale yellowish. Hairs on back black, with broad subterminal and basal or sub-basal rings of pale yellowish or buffy; along sides of body often tipped with white.

Variation.—The series at hand shows very slight individual and little if any seasonal variation. The difference lies mainly in the intensity of the yellow or rusty and the amount of grayness on the back,

Measurements.—Average of five adults from region of type locality: total length 482.2; tail vertebræ 234; hind foot 65.2.

Cranial characters.—Premolars $\frac{1}{1}$. Compared with *S. ludovicianus* the skull (pl. I, fig. 1), is very much smaller. Two adult skulls from Fort Clark, Texas, average: basal length 50; palatal length 25.5; interorbital breadth 18; zygomatic breadth 33.5; length of upper molar series 10.5.

Specimens examined.—Fourteen: from near the mouth of Devils River, Fort Clark, and Nueces River, Texas.

Subgenus **GUERLINGUETUS** Gray. (pl. I, fig. 7.)

SCIURUS ÆSTUANS HOFFMANNI Peters.

Hoffmann's Squirrel.

Sciurus æstuans var. *hoffmanni* PETERS, Monatsber. K. Akad. Wiss., Berlin, 1863, pp. 654–655; THOMAS, Proc. Zool. Soc. London, 1880, p. 401 (*Macroxus griseogenæ* Gray, referred to this form).

Macroxus xanthotus GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, p. 429, 1867.

Macroxus griseogenæ GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, pp. 429–430, 1867 (part: Costa Rica).

Sciurus æstuans var. *rufoniger* ALLEN, Mon. N. Am. Rodentia, pp. 757–763, 1877 (part: Costa Rica).

Sciurus griseogenys ALSTON, Proc. Zool. Soc. London, pp. 667–668, 1878 (part: Costa Rica, Veragua and Panama.)

Sciurus hoffmanni ALLEN; Bull. U. S. Geol. Survey Terr. iv. pp. 885–886, 1878.

Sciurus æstuans ALSTON, Biol. Cent.-Am., Mamm., pp. 132-133, 1880 (part: Costa Rica and Panama).

Sciurus æstuans hoffmanni ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., III, pp. 206-207, 1891; *Ibid.*, IX, p. 35, 1897; ALFARO, Mamíferos de Costa Rica, p. 31, 1897.

Type locality.—Costa Rica, Central America.

Distribution.—Humid tropical forests of Costa Rica, south to Valley of upper Cauca River, Colombia.

Characters.—Size similar to that of *S. æstuans*, but color much darker and more rusty brown on back, more ferruginous red on underparts, and tail heavily washed with bright ferruginous. Tail broad and flat; pelage soft and rather thin.

Color.—Entire upperparts, including top of nose and base of tail, finely grizzled dark yellowish or rusty brown; top of head and middle of back usually a little darker than sides and sometimes blackish; outside of legs and feet similar to back but often more yellowish or rusty; ears usually a little darker rusty than top of head, with small basal patch of dingy fulvous or dull rusty; sides of head more yellowish or rusty than back; ring around eye dark buffy or sometimes rusty yellowish; chin and throat dull buffy yellowish, sometimes suffused with rusty; rest of underparts varying from dull rusty buff to deep ferruginous; tail above black, heavily washed with bright ferruginous, sometimes becoming paler but always strongly ferruginous; below with broad median area of grizzled black and dark yellowish brown, bordered with black and edged with ferruginous. Hairs on back, black with narrow sub-terminal rings of buffy or rusty yellow, sometimes with similar sub-basal rings.

Variation.—The amount of variation seems to be comparatively small. Specimens from Talamanca and Santa Clara in eastern Costa Rica are darker than those from elsewhere in that country. Some from the valley of the upper Cauca River, Colombia, are a little paler or more olivaceous than Costa Rica specimens, but others from the same district are indistinguishable.

Measurements.—Averages of four adults from eastern Costa Rica: total length 426.6; tail vertebræ 187; hind foot 54.3.

Cranial characters.—Premolars $\frac{1}{1}$. Skull (pl. I., fig. 7) rather broad, braincase arched and inflated over interparietal region and constricted posteriorly, so that the occipital region is a little drawn out; audital bullæ small and rounded. Five adult skulls from central and eastern Costa Rica average: basal length 43.2; palatal length 23.3; interorbital breadth 17; zygomatic breadth 31.3; length of upper molar series 9.

General notes.—A specimen of *hoffmanni* from Costa Rica (no. 12058 U. S. Nat. Museum) has been compared with the type of *Macroxus xanthotus* Gray by Mr. Thomas, who writes that they are the same except that Gray's type is immature. The distribution of *M. griseogena* Gray was given as extending from Venezuela to Mexico, but it is scarcely necessary to state that no species of squirrel has this range. Mr. Thomas writes that the question of the type of *griseogena* is very difficult, but it seems best, as with *tephrogaster*, to take the first named specimens (Dyson's) as the type (B. M. 47.2. 1. 3). This is the only one mentioned by Gray which exactly agrees with his description, and since Venezuela specimens agree best with 47.2. 1. 3. that country becomes the type locality for *M. griseogena*. Mr. Thomas compared a specimen of *S. astuans* from Venezuela (no. 11733 U. S. Nat. Museum) with the type of *griseogena* and found them to agree very closely. The Venezuela squirrels seem to represent a form of *astuans* paler and less rufous than *hoffmanni*.

Specimens examined.—Twenty-five: from Boruca, Talamanca, Luis, San José and Santa Clara, Costa Rica; Rio Lima, Las Pabas, Los Tambos, Rio Zapata, Rio Pescado and upper Cauca Valley near Cali, Colombia.

SCIURUS RICHMONDI Nelson. Richmond's Squirrel.

Sciurus richmondi NELSON, Proc. Biol. Soc. Washington, XII, pp. 146-147, June 3, 1898.

Type locality.—Escondido River (50 miles above Bluefields), Nicaragua. Type no. $\frac{36481}{48851}$ U. S. National Museum, Biological Survey Collection.

Distribution.—Dense humid tropical forests of the lowlands along the Escondido River.

Characters.—Similar to *S. astuans hoffmanni* but underparts more ochraceous and tail washed with dull yellow. Pelage thin and soft; tail slender. Teats: p. $\frac{1}{4}$ a. $\frac{2}{2}$.

Color.—Upperparts, including top of nose and base of tail, nearly uniform dark, ochraceous brown, darker on crown and along middle of back; outside of fore legs and feet like sides of neck, and more ochraceous than back; outside of thighs like back, hind feet sometimes like thighs, but usually more ochraceous; ears like crown, a small dingy yellow basal patch sometimes present; side of head paler or more yellowish brown than back, with a narrow ring of dark brownish buffy about eye; underparts varying from dark buffy yellow

to dingy ferruginous; tail above black, thinly washed with dull yellowish; below, with broad median area grizzled yellowish brown, indistinctly and narrowly bordered with black and thinly edged with dull yellow. Hairs on back, black with narrow subterminal (sometimes median) ring of rusty yellow.

Variation.—The series at hand shows comparatively little variation. Four specimens representing the summer pelage (May 10 to Sept. 27) are rather darker above and dingy ferruginous below. Specimens in winter pelage (October to May) have more ochraceous backs and yellow bellies. Apparently there is no seasonal difference in the tail.

Measurements.—Average of five adults from type locality: total length 361.4; total vertebræ 169.4; hind foot 51.6.

Cranial characters.—Premolars $\frac{1}{1}$. Skull averaging a little smaller than that of *S. hoffmanni* but otherwise very similar. Five adult skulls from the type locality average: basal length 42.1; palatal length 22.1; interorbital breadth 16.3; zygomatic breadth 30.4; length of upper molar series 8.3.

General remarks.—*Sciurus richmondi* bears a general resemblance to *S. deppei* but is readily recognized by its yellow washed tail and single premolar. It differs from the still nearer *S. æstuans hoffmanni* of Costa Rica by the yellower back and underparts and the slender, yellow washed tail.

Specimens examined.—Eighteen: all from the type locality.

BAIOSCIURUS subgen. nov. (pl. I, fig. 4.)

SCIURUS DEPPEI Peters. Deppe's Squirrel.

Sciurus deppei PETERS, Monatsber. K. Akad. Wiss. Berlin, 1863, p. 654; ALSTON, Proc. Zool. Soc. London, 1878, pp. 668–669, (part; Mexico, Guatemala, and Honduras); ALLEN, Bull. U. S. Geol. Survey Terr., IV, p. 885, 1878; ALSTON, Biol. Cent.-Am., Mamm. p. 133, 1880 (part; Mexico, Guatemala, and Honduras); SUMICHRAST, La Naturaleza, v, p. 324, 1882; THOMAS, Proc. Zool. Soc. London, 1890, p. 74; ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., IX, p. 190, 1897.

Macroxus tephrogaster GRAY, Ann. & Mag. Nat. Hist., 3d ser., XX, p. 431, 1867 (part; Mexico, Guatemala, and Honduras); Ann. & Mag. Nat. Hist., 4th ser., X, p. 408, 1872.

Macroxus taniurus GRAY, Ann. & Mag. Nat. Hist., 3d ser., XX, p. 431, 1867.

Macroxus griscogena GRAY, Ann. & Mag. Nat. Hist., 3d ser., XX, p. 429, 1867 (part: Mexico [and Honduras?]).

Type locality.—Papantla, Vera Cruz, Mexico. Type in Berlin Museum.

Distribution.—Humid Tropical and Austral zones from Truxillo,

Honduras, northward along mountains on both coasts of Guatemala and Chiapas, to the Isthmus of Tehuantepec, and thence along the east coast of Mexico to Papantla, Vera Cruz (alt. below 6000 feet, sporadically up to 9000 feet).

Characters.—Size small; upperparts dark rufous or olive brown; fore feet and outside of fore legs dark gray in typical specimens (like back in others); tail above black thinly washed with white. Tail slender; pelage soft and rather full; under fur long; ears long and thinly haired. Teats: p. $\frac{1}{4}$ a. $\frac{1}{4}$ i. $\frac{1}{4}$.

Color.—Eighteen specimens from near type locality: Upperparts including top of nose and base of tail, uniform finely grizzled dark rusty brown varying to dull dark yellowish brown; ears like crown, with small basal patch of white or dingy fulvous; sides of head paler and more yellowish than back; outside of fore legs and fore feet dark gray, contrasting with color of back; outside of hind legs like back, with hind feet similar but a little darker; underparts white, or grayish white, sometimes buffy on breast and inside of thighs, and color of flanks sometimes extending in on inguinal area and inside of thighs; tail above, black thinly washed with white; below, with broad median area varying from grizzled ferruginous brown to dark yellowish brown, bordered with black and edged with white. Dorsal hairs black, with broad subterminal and sub-basal rings of yellowish or rusty brown.

Variation.—This species presents considerable individual variation, but in view of its wide distribution there is remarkably little geographical variation. Seasonal changes of pelage are not marked, the only notable differences being the frequent absence, in summer, of the ear patches and white tip of the tail, which is thus left black. There are no signs of melanism. Specimens from the vicinity of Jico and Las Vigas, Vera Cruz, and elsewhere in the higher parts of the range of the species are considerably larger than those from the low country near the type locality, but without accompanying differences in color. Specimens from the damp forests of eastern Mexico are somewhat darker along the middle of back, with underparts more inclining to fulvous than in those from interior and western Chiapas. The series from southwestern Chiapas, and a specimen from Truxillo, Honduras, are more olivaceous above and clearer white below. A specimen from central Guatemala (Coban to Ciusec) is decidedly darker and more rusty above and below than the average, but other Guatemala specimens are nearly typical. Most specimens have the underparts soiled whitish or grayish, but there is every gradation through pale buffy to dark fulvous and rusty rufous. A Verreaux specimen (no. $\frac{3}{37} \frac{61}{107}$ U. S. National Mu-

seum), labeled 'Mexique' is dark rusty red on chest and middle of belly. A half-grown specimen from Catemaco, Vera Cruz, has the middle of back darker than usual, the chin dingy white, rest of underparts deep rusty fulvous, and the usual white tips of hairs at end of tail replaced by rusty fulvous. A specimen from Ocuilapa, Chiapas, has the underparts, outside of thighs and hind feet washed with ferruginous. One from west-central Vera Cruz has the underparts plumbeous gray with a faint whitish wash. Specimens from the region of the type locality usually have the outside of fore legs and fore feet finely grizzled dark gray, contrasting with back, but in those from farther south the color of the back usually extends over this area.

Measurements.—Average of 5 adults from vicinity of type locality: total length 384; tail vertebræ 182.4; hind foot 54.4. Average of five specimens from just below Las Vigas, Vera Cruz: total length 393.9; tail vertebræ 173.4; hind foot 57.5.

Cranial characters.—Premolars $\frac{2}{1}$. Skull (pl. I, fig. 4) in general like that of *S. hoffmanni* but proportionally more slender and otherwise distinguished by the small upper premolar and longer audital bullæ. Skulls from Jico and Las Vigas, Vera Cruz, are sometimes larger than ordinary specimens of *S. hoffmanni* but the differences in proportion remain the same. Four adult skulls from the vicinity of the type locality average: basal length 42.5; palatal length 21.6; interorbital breadth 15.2; zygomatic breadth 28.6; length of upper molar series 9.2.

General notes.—*Macroxus tephrogaster* is unquestionably a synonym of *Sciurus deppei*. In the original description of *M. tephrogaster* Gray mentions specimens from Mexico (Sallé), Guatemala, Bogotá and Honduras. Mr. Thomas writes that the Sallé specimen from Mexico (B. M. 56. S. 1. 11) may be taken as the type, since it agrees exactly with Gray's description. A nearly typical specimen of *S. deppei* from Jico, Vera Cruz (no. 54,981, U. S. National Museum) was sent Mr. Thomas, who writes that it "matches the type of *tephrogaster* and may be accepted as typical." This proves beyond question that *S. tephrogaster* is a synonym of *S. deppei*. Mr. Thomas also writes that the type of *Macroxus tenturus* Gray described from Guatemala, differs from a specimen of *S. deppei* (no. 63671, U. S. Nat. Museum) from Motzorongo, Vera Cruz, only in having the chest and belly washed with yellow—merely a matter of individual variation.

Habits.—This species lives in dense humid forests and passes much of its time seeking food on the ground. It is quiet and not often heard, though now and then one will chatter and scold at an intruder.

In some places it is very abundant, notably on the east slope of the Cofre de Perote above Jico, Vera Cruz, and on the mountains above Tapachula, Chiapas.

Specimens examined.—Seventy three: from Papantla, Jico, Las Vigas, Jalapa, Cordova, Motzorongo and Catemaco, Vera Cruz; Metlatoyuca and Huachinango, Puebla; Reyes and mountains near Santo Domingo, Oaxaca; Ocuilapa, San Cristobal, Pinabete and Tumbala, Chiapas; Coban to Clusec and central-western Guatemala; Truxillo, Honduras.

SCIURUS NEGLIGENS Nelson. Little Gray Squirrel.

Sciurus arizonensis ALSTON, Biol. Cent.-Am., Mammalia, pp. 125-126, 1880 (part: from Tampico, Tamaulipas, Mexico).

Sciurus depppei ALLEN, Bull. Am. Mus. Hist., N. Y., III, p. 222, 1891 (part: from Valles, San Luis Potosi; and Victoria, Tamaulipas, Mexico).

Sciurus negligens NELSON, Proc. Biol. Soc. Washington, XII, p. 147 June 3, 1898.

Type locality.—Alta Mira, Tamaulipas, Mexico. Type no. 93028 U. S. National Museum, Biological Survey Collection.

Distribution.—Arid tropical forests of lowlands in extreme northern Vera Cruz, eastern San Luis Potosi, and southern half of Tamaulipas, Mexico (below 1000 ft.).

Characters.—Size of *S. depppei*; ears longer and dull rusty; upperparts rather pale grayish brown; underparts white or pale buffy yellow. Pelage soft and rather thin; tail thin and slender. Teats: p. $\frac{2}{2}$ a. $\frac{1}{1}$ i. $\frac{1}{1}$.

Color.—Upperparts, including top of nose and base of tail, rather pale, finely grizzled grayish brown, generally with a slight yellowish or dull rusty suffusion, most marked posteriorly; sides of head and neck, and sometimes nape, dingy yellowish brown; ears varying from dingy rusty to dark ferruginous; a small dingy white basal patch usually present; fore feet, outside of legs, and sometimes adjacent part of shoulders, dull gray; outside of thighs and hind feet usually like rump, but toes sometimes gray; underparts white, varying to uniform deep fulvous or almost rusty yellow; inside of thighs pale buffy in white bellied specimens; chin and throat usually white; tail above black, thinly washed with white; below with broad median area grizzled and varying from yellowish to grayish brown, bordered by a thin line of black and thinly edged with white. Hairs of back black, with narrow subterminal and sub-basal rings of yellowish gray or yellowish brown.

Variation.—The main variation is in the amount of rusty on the ears, and in the color of the underparts, which ranges from white to deep buffy yellow. Some specimens are considerably grayer above—less shaded with yellow—than others. No melanistic specimens seen. Spring and autumn specimens show no seasonal differences.

Measurements.—Average of five adults from type locality: total length 387.4; tail vertebræ 188.2; hind foot 54.

Cranial characters.—Premolars $\frac{2}{1}$. Skull indistinguishable from that of typical *S. deppei*. Four adult skulls from type locality average: basal length 41.7; palatal length 21.4; interorbital breadth 15.3; zygomatic breadth 28.4; length of upper molar series 9.1.

General notes.—*Sciurus negligens* closely resembles *S. deppei* in size and general appearance, and inhabits the more arid country lying north of the region occupied by the latter species. It is readily distinguished from *S. deppei* by the much grayer color of the upperparts.

Habits.—These squirrels are most numerous in the stunted forests of ebony, 15 to 25 feet high, which cover great areas in their range and furnish their main food supply. We found them in the greatest abundance at Velasco, San Luis Potosi, where the ground under the trees was strewn with gnawed seed pods.

Specimens examined.—Twenty-three: from Alta Mira and Victoria, Tamaulipas; and Velasco and Jilitla, San Luis Potosi.

Subgenus **MICROSCIURUS** Allen (pl. I, fig. 6; pl. II, fig. 2.)

SCIURUS ALFARI Allen. Alfaro's Pigmy Squirrel.

Sciurus (Microsciurus) alfari ALLEN, Bull. Am. Mus. Nat. Hist., N. Y., VII, p. 333, Nov. 8, 1895; *Ibid.*, IX, p. 35, 1897.

Sciurus alfari ALFARO, Mamíferos de Costa Rica, pp. 31–32, 1897.

Type locality.—Jiménez, Costa Rica. Type no. $\frac{11290}{9554}$, American Museum of Natural History, New York.

Distribution.—Dense humid forests of northern, eastern and southwestern Costa Rica.

Characters.—Size very small; ears short and rounded, upperparts dark, minutely grizzled reddish brown, the reddish most intense on nose and sides of head; ring about eye reddish buffy. Pelage soft and dense; tail slender. Teats: p. $\frac{1}{1}$ a. $\frac{1}{1}$ i. $\frac{1}{1}$.

Color.—(Of type): Entire upperparts including ears and outside of legs, minutely grizzled dark brown, suffused with dull rufous; rufous most intense on head and brightest on narrow ring about eye; feet and toes grizzled rusty brown slightly paler than back; chin, throat,

chest and inside of fore legs pale dull ferruginous, shading posteriorly into dark brown, with only a slight wash of reddish along middle of belly and inside of thighs; tail at base like back; remainder of tail all around, grizzled dark reddish brown and black with fine yellowish brown tips to hairs; hairs of extreme tip forming a black pencil. Hairs on back black with narrow subterminal rings of rusty yellowish.

Variation.—Two adults, including the type and one partly grown young, show but little variation except in color of underparts. The immature specimen is slightly more reddish on back and tail; the cheeks, chin, throat, chest and line down middle of abdomen are dark dull ferruginous, and the sides of abdomen are similar to flanks. The other adult is like the type except in the dull brownish buffy of the underparts.

Measurements.—Average of two adults (from dry skins): total length 251; tail vertebræ 109; hind foot 37.

Cranial characters.—Premolars $\frac{2}{1}$. Skull (pl. I, fig. 6; pl. II, fig. 2) short, broad, and much arched over top of braincase, the convex outline descending in an almost unbroken curve to edge of occiput; rostrum short and broad, especially at base where the upper parts of the premaxillaries are very broad and heavy; jugals very broad vertically, much more so than in the other species examined in this subgenus. Measurements of type skull: basal length 29.5; palatal length 14.2; interorbital breadth 13; zygomatic breadth 22; length of upper molar series 6.

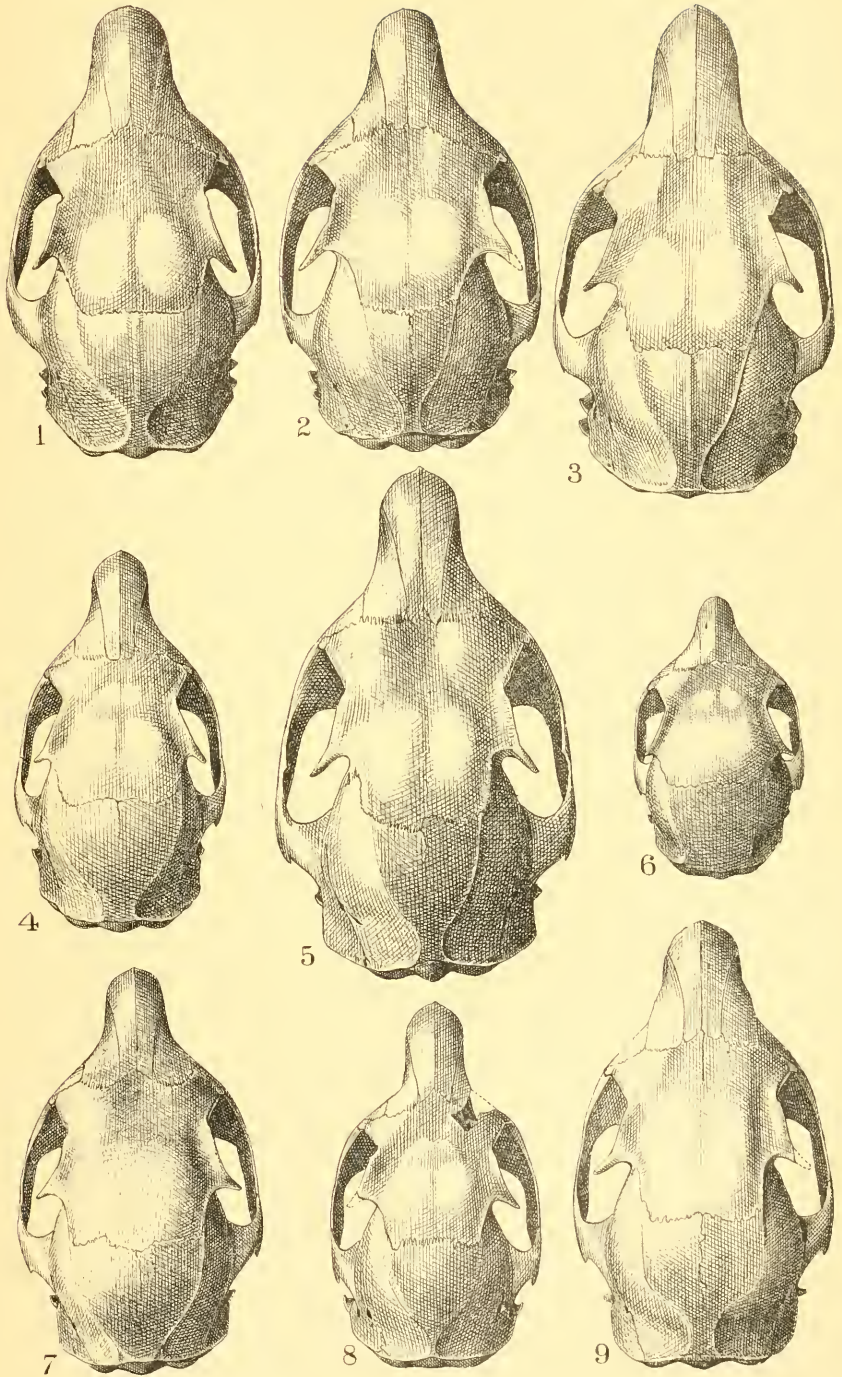
General notes.—Little is known about the interesting squirrels of the subgenus *Microsciurus*, but, as suggested by Dr. Allen, further work in Central and South America is revealing other species. Mr. Cherrie collected the type in the forest on the slope of the Volcano of Turrialba, near Jiménez, Costa Rica, and the species has been found since in several other parts of the country.

Specimens examined.—Three: from Jiménez, San Carlos, and Reventazon, Costa Rica.

PLATE I.

Skulls of 9 subgenera of Tropical American Squirrels.
[Natural size.]

- Figs. 1. *S. (Parasciurus) ludovicianus limitis*. Kickapoo Springs, Texas.
(No. $\frac{2296}{3049}$ ad. U. S. Nat. Mus.)
2. *S. (Otosciurus) durangi*. El Salto, Durango, Mexico.
(No. 94580 ♂ ad. U. S. Nat. Mus.)
3. *S. (Aræosciurus) oculatus*. Las Vigas, Vera Cruz, Mexico.
(No. 54238 ♂ ad. U. S. Nat. Mus.)
4. *S. (Baiosciurus) deppei*. Huauchinango, Puebla, Mexico.
(No. 92998 ♀ ad. U. S. Nat. Mus.)
5. *S. (Hesperosciurus) griseus*. Trout Lake, Washington.
(No. 89006 ♀ ad. U. S. Nat. Mus.)
6. *S. (Microsciurus) alfari*. Jiménez, Costa Rica.
(No. 9554 ♂ ad. Am. Mus. Nat. Hist.)
7. *S. (Guerlinguetus) æstuans hoffmanni*. Talamanca, Costa Rica.
(No. 2811 ♂ ad. Am. Mus. Nat. Hist.)
8. *S. (Tamiasciurus) douglasi mearnsi*. San Pedro Martir Mts., Lower
California, Mexico.
(No. 25170 ad. U. S. Nat. Mus.)
9. *S. (Echinosciurus) aureogaster*. Alta Mira, Tamaulipas, Mexico.
(No. 93034 ♀ ad. U. S. Nat. Mus.)



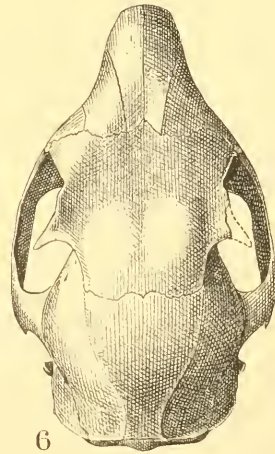
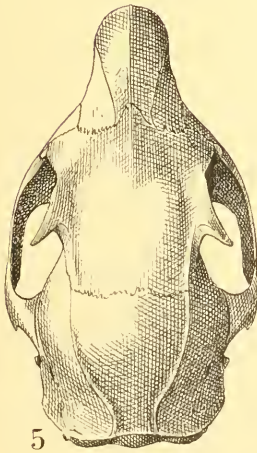
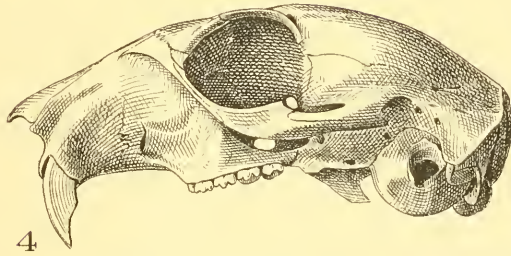
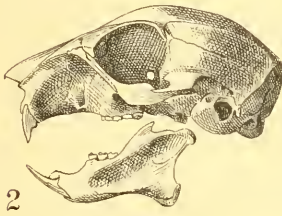
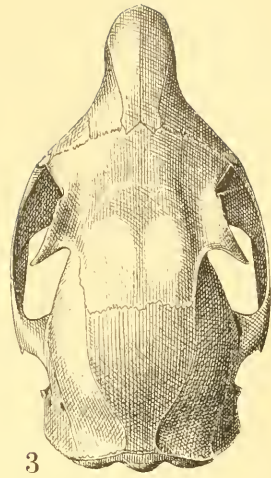
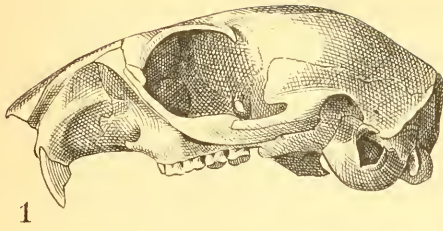
SKULLS OF MEXICAN SQUIRRELS.



PLATE II.

Skulls of Tropical American Squirrels. [Natural size.]

- Figs. 1. *S. (Echinosciurus) boothiae belti*. Escondido River, Nicaragua.
(No. 48847 ♀ ad. U. S. Nat. Mus.)
2. *S. (Microsciurus) alfari*. Jiménez, Costa Rica.
(No. 9554 ♀ ad. Am. Mus. Nat. Hist.)
3. *S. (Echinosciurus) poliopus*. Cerro San Felipe, Oaxaca, Mexico.
(No. 68183 ♀ ad. U. S. Nat. Mus.)
4. *S. (Hesperosciurus) griseus*. Trout Lake, Washington.
(No. 89006 ♀ ad. U. S. Nat. Mus.)
5. *S. (Echinosciurus) boothiae belti*. Escondido River, Nicaragua.
(No. 48847 ♀ ad. U. S. Nat. Mus.)
6. *S. (Echinosciurus) thomasi*. Talamanca, Costa Rica.
(No. 23367 ad. U. S. Nat. Mus.)



SKULLS OF MEXICAN SQUIRRELS.





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