PROCEEDINGS

OF THE

Biological Society of Washington

VOLUME X

1896

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1896

COMMITTEE ON PUBLICATIONS

C. HART MERRIAM, *Chairman*

T. S. PALMER

F. H. KNOWLTON

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OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

FOR 1896

(ELECTED DECEMBER 27, 1895)

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VOL. X, PP. VII-XII DECEMBER 31, 1896

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

PROCEEDINGS.

The Society meets in the Assembly Hall of the Cosmos Club on alternate Saturdays at 8 p. m. Brief notices of the meetings are published in '*Science*.'

January 11, 1896—253d Meeting.

Vice-President B. E. Fernow in the chair and one hundred and thirteen persons present.

The following communications were presented:

Gerrit S. Miller, Jr.: The Subgenera of Voles (*Microtinæ*).*

T. S. Palmer: Rabbit Drives in the West.† (Illustrated by lantern slides.)

V. A. Moore: The Flagella of Motile Bacteria with special Reference to their Value in Differentiating Species.‡ (Illustrated by lantern slides.)

January 25, 1896—254th Meeting.

Vice-President B. E. Fernow in the chair and twenty-three persons present.

The following communications were presented:

Charles F. Simpson: On the Extra-limital Mississippi Unios.§

M. B. Waite: The Life History of the Pear Blight Microbe.‖

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*Genera and Subgenera of Voles and Lemmings. <N. Am. Fauna, No. 12, pp. 78, pls. iii, text figs. 40, July 23, 1896.

†The Jack Rabbits of the United States. <Bull. No. 8, Div. Ornithology and Mammalogy, U. S. Dept. Agriculture, chap. V, pp. 47–64, March, 1896.

‡Journ. Am. Public Health Asso., xx, 432–444, October, 1895.

§Am. Nat., 30, 379–384, May, 1896.

‖Bull. No. —, Div. Vegetable Phys. and Path., U. S. Dept. Agric. (In press.)

Pierre A. Fish: The Action of Electricity upon Nerve Cells.*
Vernon Bailey: Tamarack Swamps as Boreal Islands.†

February 8, 1896—255th Meeting.

The President in the chair and thirty-two persons present.
The following communications were presented:
David White: Some new Forms of Palæozoic Algæ from the Central Appalachian Region.
Charles L. Pollard: Observations on the Flora of the District of Columbia.‡
On the call for short notes—
F. V. Coville exhibited *Anhalonium lewinii*, a poisonous cactus from Texas; and
C. L. Pollard discussed *Asclepias albicans* as a desert plant.

February 22, 1896—256th Meeting.

The President in the chair and thirty persons present.
The following communications were presented:
C. Hart Merriam: The American Weasels.§
F. E. L. Beal: The Food of the Bluejay.‖
David White: On the Structure and Relations of *Buthograptus*, *Plumulina*, and *Ptilophyton* from the North American Palæozoic.
Sylvester D. Judd: A Peculiar Eye of an Amphipod Crustacean.
Vernon Bailey: Two Mammals new to the Vicinity of Washington [*Synaptomys cooperi* and *Sorex personatus*].

March 7, 1896—257th Meeting.

The President in the chair and thirty-three persons present.
The following communications were presented:
Adrian J. Pieters: The Influence of Fruit-bearing on the Mechanical Tissue of the Twigs.¶
Edward L. Greene: The Distribution of *Rhamnus* and *Ceanothus* in America.**

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* Proc. Am. Microscopical Soc., xvii, 179–185, 1895.
† Science, NS., iii, p. 250, February 14, 1896.
‡ Published in part in Bot. Gaz., 21, 233–235, 1896.
§ Synopsis of the Weasels of North America. <N. Am. Fauna, No. 11, pp. 35, pls. v, text figs. 16, June 30, 1896.
‖ Yearbook U. S. Dept. Agriculture, 1896. (In press.)
¶ Annals of Botany. (In press.)
** Published in part in Erythea, iv, pp. 83–86, 1896.

F. V. Coville: Different Editions of Some Government Expedition Reports.*

March 21, 1896—258th Meeting.

The President in the chair and forty-seven persons present.

The following communications were presented:

B. W. Evermann: Animals from an Artesian Well at San Marcos, Texas.

In the discussion Dr. Leonhard Stejneger described a remarkable blind salamander occurring in the same well.

C. Hart Merriam: The Big Bears of North America.†

Henry H. Dixon: Recent Researches on the Ascent of Sap in Trees. (By invitation of the Society.)

L. O. Howard: The Shade-tree Question from an Insect Standpoint.‡

Leonhard Stejneger: On the Use of Formaline in the Field.

F. E. L. Beal: The Food of the Cow-bird.

April 4, 1896—259th Meeting.

The President in the chair and forty-five persons present.

The following communications were presented:

V. K. Chesnut: Pfaff's Recent Investigations on *Rhus* Poisoning.

B. T. Galloway: The Action of Copper in Poisoning Fungi.

Barton W. Evermann: The Story of two Salmon.

Frederick V. Coville: Botanical Exploration near the Mexican Boundary.

April 18, 1896—260th Meeting.

The President in the chair and twenty persons present.

The following communications were presented:

W. H. Dall: Exhibition of Skins of the Glacier Bear, *Ursus emmonsi*.

Charles D. Walcott: Preliminary Notes on Middle Cambrian Medusæ.

B. E. Fernow: A Pine Coppice.§

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*Three Editions of Emory's Report, 1848. <Bull. Torrey Bot. Club, vol. 23, pp. 90–92, March, 1896. Three Editions of Stansbury's Report. <*Ibid.*, pp. 137–139, April, 1896.

†Proc. Biol. Soc. Washington, x, pp. 65–83, pls. iv–vi, April 13, 1896.

‡Yearbook U. S. Dept. Agric., 1895, pp. 361–384.

§Garden and Forest, viii, p. 472, 1896.

May 2, 1896—261st Meeting.

The President in the chair and thirty-six persons present.

The following communications were presented:

T. W. Stanton: The Genus *Remondia.**

B. T. Galloway: Recent Advances in Our Knowledge of the Plant Cell.

Under the head of Brief Notes—

L. O. Howard exhibited a photograph of three young women who were triplets.

F. V. Coville exhibited a ball three inches in diameter composed of the hairs of *Trifolium incarnatum* taken from the stomach of a horse which had died from this cause.†

Erwin F. Smith: The Action of Sunlight on *Bacillus tracheiphilus.*

D. Leroy Topping noted the rediscovery of *Ficaria ficaria* in the original locality in the District of Columbia.

Albert F. Woods: The Action of an Overdose of Hydrocyanic Acid Gas on Tomato Plants.

L. H. Dewey: *Sisymbrium altissimum* as a Tumble Weed.‡

May 16, 1896—262d Meeting.

The President in the chair and forty persons present.

The following communications were presented:

The Fauna and Flora of the Islands off the Coast of Southern and Lower California, including the Gulf of California.

Edward L. Greene: The Salient Features of the Flora.

Edgar A. Mearns: The Mammals.

May 30, 1896—263d Meeting.

Dr. William H. Dall in the chair and fifteen persons present.

The following communications were presented:

Theo. Gill: The Characteristics of the Families Salmonidæ and Thymallidæ.§

Barton W. Evermann: The Fishes and Fisheries of Indian River, Florida.

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* To be published in Proc. U. S. National Museum.

† Crimson Clover Hair Balls. <Circular No. 8, Div. of Botany, U. S. Department of Agriculture, pp. 1–4, June 15, 1896.

‡ Tumbling Mustard (*Sisymbrium altissimum*). <Circular No. 7, Div. Botany, U. S. Dept. of Agriculture, pp. 1–8, 1896.

§ Science, NS., III, p. 934, June 26, 1896.

October 24, 1896—264th Meeting.

The President in the chair and forty persons present.

The following communications were presented:

C. Hart Merriam: A New Fir from Arizona.*

F. V. Coville: Notice of Britton and Brown's Illustrated Flora of the Northern United States and Canada.

Erwin F. Smith: A Bacterial Disease of Potatoes, Tomatoes, and Egg-plants.†

Under the head of Brief Notes—

Erwin F. Smith exhibited *Leuconostoc* from a sugar vat in Louisiana.

F. V. Coville exhibited *Protococcus nivalis* and *Nymphæa polysepala.*

C. L. Pollard reported *Iresine paniculata* as an addition to the flora of Washington, D. C.

A. F. Woods: The Spotting of Maple Leaves.

B. E. Fernow: Spiny Plants from Arizona.

C. Hart Merriam reported the addition of a rare shrew (*Sorex veræpacis*) from Guatemala to the U. S. National Museum, making the collection of North American shrews complete.

November 7, 1896—265th Meeting.

The President in the chair and forty-four persons present.

The following communications were presented:

Theo. Gill: The Category of Family or Order in Biology.

C. Hart Merriam: Notes on the Fauna of Oregon.

C. Hart Merriam: Supplementary Notes on Tropical American Shrews.

Under the head of Brief Notes—

F. V. Coville spoke of a new Species of *Juncus.*‡

L. O. Howard: *Hymenopterous* parasites of Shade-tree Insects.

November 21, 1896—266th Meeting.

Vice-President L. O. Howard in the chair and forty-seven persons present.

The following communications were presented:

G. H. Hicks: The Mildews (*Erysipheæ*) of Michigan.§

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* Proc. Biol. Soc. Washn., x, pp. 115–118, November 3, 1896.

† Bull. No. 12, Div. of Vegetable Phys. & Path., U. S. Dept. Agriculture.

‡ Proc. Biol. Soc. Wash'n, x, pp. 127–130, November 14, 1896.

§ To be published in vol. xi, Proc. Biol. Soc.

F. V. Coville: The Inflorescence of the *Juncaceæ.*

Theo. Holm: The Alpine Flora of Pikes Peak and Grays Peak, in Colorado.

C. L. Pollard: Some Further Remarks on Britton and Brown's Illustrated Flora.

Under the head of Brief Notes—

F. V. Coville exhibited an Indian bow made of *Taxus brevifolia.*

Theo. Holm showed a number of rare old books, and discussed the derivation of the generic name '*Macounastrum.*'

December 5, 1896—267th Meeting.

Mr. L. O. Howard, representative of the Joint Commission, in the chair.

Annual address of the President, Surgeon General George M. Sternberg: The Malarial Parasite and other Pathogenic Protozoa. (Illustrated by lantern slides.) *

December 19, 1896—268th Meeting.

(Seventeenth Annual Meeting.)

Vice-President L. O. Howard in the chair and twenty-nine persons present.

The annual reports of the Secretary and Treasurer for the year 1896 were presented, and officers for the year 1897 were elected as follows:

President: L. O. Howard.

Vice-Presidents: Richard Rathbun, C. D. Walcott, B. E. Fernow, F. V. Coville.

Recording Secretary: C. L. Pollard.

Corresponding Secretary: F. A. Lucas.

Treasurer: F. H. Knowlton.

Additional Members of the Council: William H. Ashmead, Edward L. Greene, Ch. Wardell Stiles, F. W. True, M. B. Waite.

The following standing committees were appointed by the chair:

On Communications: B. E. Fernow, chairman; F. V. Coville, M. B. Waite, E. A. De Schweinitz, W. H. Ashmead.

On Publications: C. Hart Merriam, chairman; T. S. Palmer, F. H. Knowlton.

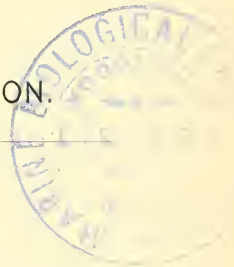
* Public meeting in Builders' Exchange Hall, under the auspices of the Joint Commission, followed by an informal reception and refreshments. Several hundred persons were present.

VOL. X, PP. 1-24 FEBRUARY, 1896

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.



A REVIEW OF THE WEASELS OF EASTERN NORTH AMERICA.

BY OUTRAM BANGS.

The present paper treats of all the weasels of eastern North America west to and including the Great Plains. There is apparently no portion of this vast region not tenanted by at least one member of this cosmopolitan group. Generally one species occupies a very large area, in the central part of which no others are found, so that when two species occur together it is usually at points where the edges of their ranges overlap. It has been my experience that weasels are nowhere very abundant—never sufficiently so to exhaust their food supply. They are held in check by some natural cause, which may be the parasite that attacks the frontal sinuses of these animals as well as those of their relatives, the skunks, mink, and otter. I have seen skulls in such fearful condition that it would seem as if the animal must soon succumb; still there is no proof that the parasite ever does cause death. *Putorius longicauda* and *P. frenatus* are so free from its attacks that it is rare to find a skull of either badly affected. *P. noveboracensis*, on the other hand, suffers so much that it is hard to get perfect skulls, since many are so distorted that the whole interorbital region is unfit for comparison. As far as I can learn, *P. longicauda* occurs in larger numbers than any of our weasels, while *P. noveboracensis* is apparently not an abundant animal anywhere.

Material.

Through the kindness of Dr. C. Hart Merriam, Dr. J. A. Allen, Dr. G. Brown Goode, and Mr. William Brewster, I have been enabled to study the eastern weasels belonging to the Department of Agriculture, the American Museum of Natural History, the United States National Museum, and the Museum of Comparative Zoölogy. Dr. C. Hart Merriam, Mr. Gerrit S. Miller, Jr., Mr. Samuel N. Rhoads, and Mr. John H. Sage have also sent me all the skins of weasels in their private collections. These and the large series in the collection of E. A. and O. Bangs comprise a much larger amount of material than was ever before brought together, and enabled me to examine between five and six hundred skins and nearly as many skulls. Of some of the rarer species, as *P. peninsulæ*, *P. rixosus*, and *P. richardsoni*, there are still very few specimens in existence, and these are mostly old, poor, or imperfect. I am much indebted to Mr. Oldfield Thomas, of the British Museum, for comparisons with the supposed types of *P. richardsoni* and *P. longicauda* which are still in that museum, and for sending me specimens of the European species for comparison with ours.

Subgenus GALE Wagner.

Putorius proper, as restricted to the polecats and the ferrets of the old world, is represented in America by *Putorius nigripes* only. All our other weasels belong to the subgenus *Gale*.

The subgenus *Gale* is distinguished from *Putorius* proper by the slender elongate body, terete tail with a decided pencil, and the slightly palmate feet, rather than by any important structural characters. Skulls of the larger American weasels, such as *frenatus* and *longicauda*, are not essentially different from the skull of *Putorius* proper, and there is a regular gradation through *noveboracensis*, where the male skull resembles the *longicauda* group and the female skull the *richardsoni* group, down to the little, light, smooth skull of *rixosus*, which represents the extreme of differentiation of *Gale*.

Variation.

Sexual variation.—The great difference in size between the sexes of all the species of *Putorius* is now well known, but in no group is it so marked as in the subgenus *Gale*. The different species vary in this respect: in *P. noveboracensis* the difference is greater

than in any of the others, while in *P. longicauda* the sexes are more nearly alike. In adult examples of *P. noveboracensis* the male averages about eighty millimeters more in total length than the female, while in *longicauda*, which is a larger animal, the difference is about sixty millimeters. This sexual difference in size must always be kept in mind in trying to identify weasels, since it may give rise to a great deal of trouble, especially in skins made up by inexperienced collectors, who are unable to determine the sex of their specimens.

Apart from the difference in size, the sexes of most weasels are alike, *noveboracensis* being the only one to show other sexual characters (in this species there is a well marked sexual difference in the skull apart from size).

Variation with age.—Weasels vary much in size with age, continuing to grow for at least a year, and probably after the age can be told by the skull. Very young weasels in the first summer have the tails rather short, the hair of the tail very short and appressed, and the tail tapering off to a point without any decided pencil. In this condition the tail has a very different look from that of the adult. The color of the under parts is often more yellow or buffy in the young than in the adults, but on the whole the young and old do not differ much in external appearance.

The skull of course varies greatly with age. In young skulls the brain case always looks very large, round, and deep. By actual measurement, however, it is about as in the adult, and as the animal increases in age the rest of the skull grows up to it. The whole rostral portion of the skull is slender and small in the young and gradually becomes broader and heavier as the animal grows older. This change takes place slowly and seems to continue over a long period. Very old examples of any species, but especially of *P. richardsoni* and *P. r. cicognani*, show very broad, heavy rostrums. This is often the surest mark of great age, which a worn and broken condition of the teeth by no means always indicates. All the species of the *longicauda* group and the male of *P. noveboracensis* develop strong sagittal crests with age, while the members of the *richardsoni* group and the female of *P. noveboracensis* keep quite smooth and show only a slight indication of a sagittal crest. The sutures all close very early, and the skull has the appearance of age long before it has attained full size.

Individual variation.—The range of individual variation in color is slight and unimportant. In some forms, noticeably in *P. rich-*

ardsoni cicognani, there is a wide range in size. Just how much of this is due to age and how much to individual variation is hard to tell, as there is in this subspecies a constant increase in size from south north, examples from Minnesota and northern New Brunswick and northward being much larger than those from Massachusetts and Connecticut.

Early History of the Species.

The first work that need be taken into consideration in studying our weasels is the *Fauna Boreali-Americana* of Richardson, published in 1829. In this the author described two species and gave them the names of the common European weasels, *vulgaris* and *erminea*. The latter he divided into two varieties, a large long-tailed one from Carlton House, Saskatchewan, and a large short-tailed one from Fort Franklin, Great Bear lake.

Bonaparte, in his *Fauna Italica* (fasciculus xxii), published in 1838, described a new weasel from the United States which he called *Mustela cicognani*. This was the same animal that Richardson had called *M. vulgaris*. The same year, in Charlesworth's Magazine, Bonaparte named Richardson's two varieties of *erminea* as distinct species, calling the long-tailed one from Carlton House *Mustela longicauda*, and the short-tailed one from Great Bear lake *Mustela richardsoni*. The next year (1839) Richardson, in the 'Zoölogy of Beechey's Voyage,' accepted Bonaparte's conclusions as stated above.

De Kay in 1840, in his 'Report on the Zoölogy of New York,' named a new weasel which he called *Putorius noveboracensis*. He gave no description and his name is a *nomen nudum*. Emmons, the same year (1840), in his 'Report on the Quadrupeds of Massachusetts,' described *P. noveboracensis*, attributing it to De Kay. Of course the name must date from Emmons. It is rather unfortunate, as Emmons gives no type locality. As he was treating only of Massachusetts mammals, it seems advisable to consider Massachusetts the type locality.

Audubon and Bachman in 1842, in the 'Journal of the Academy of Natural Sciences of Philadelphia,' described *Mustela fusca*, which is the same as *M. cicognani* of Bonaparte.

De Kay, in his 'Zoölogy of New York' (1842), in addition to *P. noveboracensis* gives *M. fusca* of Audubon and Bachman, and describes another weasel that he calls *Mustela pusilla*. All but the first are synonyms of *cicognani* Bonaparte.

Audubon and Bachman's 'Quadrupeds of North America' appeared in three volumes, from 1851 to 1853. In this work are given five species of weasels, namely, *Putorius erminеus*, *P. agilis*, *P. fuscus*, *P. pusillus*, and *P. frenatus*. Their *erminеus* and *agilis* are *noveboracensis* (the former the male and the latter the female). Their *frenatus* was a combination of *frenatus* and *xanthogenys*.

In 1857 appeared Professor Baird's great work, 'The Mammals of North America.' He gave six species of weasels as inhabiting eastern North America, namely, *P. noveboracensis*, *P. richardsoni*, *P. cicognani*, *P. pusillus*, *P. longicauda*, and *P. frenata*. All his species were correct except *richardsoni*. This animal he had never seen, and not being aware of the great sexual difference in size, he referred the smaller examples of *noveboracensis*, probably females, to it. His *Putorius pusillus* is the *P. rixosus* of the present paper, he wisely thinking that it was not the *M. pusilla* of De Kay. His *frenatus* was the true *frenatus* of Lichtenstein.

After Baird came a period of great confusion, authors giving all the species or nearly all accorded to eastern North America by Baird from any one locality they happened to be writing about.

Samuels, in his list of the 'Mammals of Massachusetts' (1861–1862), gave four species as inhabiting that State, namely, *richardsoni*, *cicognani*, *pusillus*, and *noveboracensis*. Of course these four were the males and females of our two common species, *cicognani* and *noveboracensis*.

Dr. Gilpin, in his 'Mammals of Nova Scotia' (1866), gave *P. richardsoni*, *P. noveboracensis*, and *P. cicognani* as inhabitants of that province. In reality there is but one weasel in Nova Scotia, and that is *P. cicognani*. I have examined nearly all the skins Dr. Gilpin sent to the United States National Museum and find them labeled *richardsoni* and *cicognani*, according to size. The measurements he gave for the specimen he called *noveboracensis* indicate a total length 100 millimeters greater than the largest male *noveboracensis* I ever measured and are probably erroneous.

Gray, in an article in the Proceedings of the Zoölogical Society of London for 1865, with his usual disregard for all previous names, gives two new ones, namely, "*Putorius erminea*, var. *americana*," which includes *P. longicauda* and *P. noveboracensis*; and for *P. cicognani*, "*Mustela* (*Gale*) *vulgaris*, var. *americana*." Fortunately neither of these names can stand. He based *P. richardsoni* on Baird; the animal is, as already stated, *P. noveboracensis*. In 1869 Gray arranged the American weasels in the same way in his 'Catalogue of the Carnivora in the British Museum.'

The next paper of importance is Allen's list of the 'Mammals of Massachusetts' (1869). Allen degraded all the species of previous authors and lumped all our weasels under the names *Putorius ermined* and *Putorius vulgaris*, allowing *P. frenatus* to stand as a doubtful form.

In 1877 appeared Coues' Fur-bearing Animals. In this work the author recognized four weasels in the whole of North America, namely, *vulgaris*, *ermined*, *longicauda*, and *brasiliensis frenatus*. This arrangement has been followed by most subsequent authors.

The species of the subgenus *Gale* inhabiting eastern North America may be arranged in three groups as follows:

1. Skull large and heavy, much constricted just back of postorbital processes, and developing a strong sagittal crest; postorbital processes well developed; inflated squamosal much reduced ..... *Neogale* Gray.*

Name of species.	Type locality.
Putorius longicauda (Bonaparte)	Carlton House, Saskatchewan.
longicauda spadix subsp. nov.	Fort Snelling, Minn.
brasiliensis frenatus (Licht.)	Valley of Mexico.
peninsulæ Rhoads	Hudson's, Pasco Co., Fla.

2. Skull of male developing sagittal crest; that of female smooth. Inflated squamosal much more reduced in the male than in the female; postorbital processes well developed in both sexes.

noveboracensis Emmons	Massachusetts.

3. Skull light and smooth, not sharply constricted back of postorbital processes; developing only very slight sagittal crest; postorbital processes not well developed; inflated squamosal large and much inflated ..... *Gale* Wagner.

richardsoni (Bp.)	Fort Franklin, Great Bear lake.
richardsoni cicognani (Bp.)	Eastern United States.
rixosus sp. nov.	Osler, Saskatchewan.

KEY TO THE WEASELS OF EASTERN NORTH AMERICA (IN SUMMER PELAGE).

Pelage coarse and harsh.

Tail less than half as long as head and body; a tuft of white hairs in front of ear and sometimes an indistinct white patch on forehead ..... *peninsulæ*.

**Neogale* was proposed by Gray for the bridled weasels on account of the peculiar black and white facial markings. *P. longicauda* also belongs to this group, which is almost worthy of subgeneric rank.

Tail more than half as long as head and body; head with distinct black and white markings or wholly unmarked.
Head with distinct black and white markings.....*frenatus.*
Head without black and white markings.
Upper parts light brown or clay color.....*longicauda.*
Upper parts dark rich brown.....*spadix.*

Pelage fine and soft.
Tail not tipped with black; size smallest.....*rixosus.*
Tail tipped with black; size medium or large.
Tail almost half as long as head and body; feet usually without white markings.....*noveboracensis.*
Tail about one-third as long as head and body; feet usually with white markings.
Under side of tail concolor with back; tail vertebræ in adult male about 80 millimeters.....*cicognani.*
Under side of tail concolor with belly; tail vertebræ in adult male about 100 millimeters.....*richardsoni.*

Putorius longicauda (Bonaparte). Long-tailed Weasel.

Pl. I, figs. 1, 1*a*; II, figs. 1, 1*a*; III, figs. 1, 1*a*.

Mustela (*Putorius*) *erminea* Rich., Fauna Boreali-Americana, 46–47, 1829 (in part: the long-tailed variety from Carlton House).
Mustela longicauda Bonap., Charlesw. Mag. Nat. Hist., II, p. 38, Jan., 1838. No description, but based on Richardson's long-tailed variety of *erminea* from Carlton House, Sask. (Rich., Fauna Boreali-Am., 1, p. 47, 1829).
Putorius longicauda Rich., Zoöl. Beechey's Voyage, p. 10,* 1839.
Baird, Mamm. N. Am., p. 169, 1857.
Coues' Fur-bearing Animals, p. 136, 1877; and of most subsequent authors.

Type locality.—Carlton House, Saskatchewan. The supposed type, a specimen in winter pelage, is in the British Museum.

Geographic distribution.—Northern plains from Saskatchewan and Alberta, south at least to Nebraska and Kansas, west to the Rocky mountains, and east only to the western edge of the eastern forest belt in Minnesota. Apparently abundant throughout its entire range. Inhabits parts of the Canadian, Transition, and Upper Sonoran Zones.

General characters.—Size very large; tail very long, more than one-third of total length, with the black tip short, often scarcely more than the pencil; claws long, sharp, and curved; coat in summer pelage coarse and harsh.

Color.—Summer pelage: Upper parts pale yellowish brown, varying individually from strong tawny to clay color, rather darker on top of head and sides of nose; under parts yellow (varying from buff yellow and maize yellow to pale ochraceous and saffron yellow); line of demarkation between colors of upper and under parts distinct and straight along the sides, color of under parts extending down inside of legs and covering the whole fore feet and toes and inside half of upper surface of hind feet; chin

and upper lips white; tail same color as upper parts, sometimes a little paler below than above, becoming suddenly black at tip, and ending in a long pencil of black hairs; under fur a shade or two lighter than the long hairs. Winter pelage: Pure white all over, with no yellowish tinge; end of tail jet black. The change to a white winter coat apparently takes place over the entire range of the species.

Size.—Average of five adult males from Alberta and Saskatchewan: total length, 445.5; tail vertebræ, 161; hind foot, 51.5. Average of five adult females from Alberta, Saskatchewan, and North Dakota: total length, 385; tail vertebræ, 139; hind foot, 43.5.

Skull.—Short, broad, and massive, developing with age a strong sagittal crest; general shape of brain case, viewed from above, triangular, owing to great width across mastoids and sharp constriction behind postorbital processes; postorbital processes well developed and conspicuous; audital bullæ broad, deep, and short; inflated squamosal much reduced and not nearly flush with under surface of audital bullæ; distance from audital bullæ to postglenoid process very short; mandible large and heavy.

The skull of *P. longicauda* resembles the skull of *Putorius* proper more than that of the smaller members of the subgenus *Gale*.

The dentition is normal, but rather heavy.

Remarks.—*Putorius longicauda* is easily told from all other North American weasels. Its highly developed desert coloration, large size, and long, graceful tail make it one of our finest species. Specimens from Devil's lake, North Dakota, while referable to this species, are rather darker than true *longicauda* and are approaching its eastern subspecies *spadix*.

P. longicauda and its allies seem to be less subject to the attacks of the parasite that lives in the frontal sinuses of all the weasels than the other members of the subgenus *Gale*. The sexual difference in size is not so great in *P. longicauda* as in most of the other species.

Putorius longicauda spadix subsp. nov.

Type from Fort Snelling, Minn., No. $\frac{3265}{17886}$, male, yg. ad., American Museum Nat. Hist., New York, col. by Dr. E. A. Mearns, U. S. A., June 25, 1889. Original number, 812.

Geographic distribution.—The western edge of the eastern forest belt in Minnesota (Fort Snelling and Elk river). The subspecies probably ranges north and south of this region. Further west, where the open, treeless plains are reached, it passes into true *longicauda*.

General characters.—Similar to true *longicauda*, from which it differs in color only.

Color.—Summer pelage: Upper parts Prout's brown, not very different from the color of *P. noveboracensis*, but perhaps a little brighter—very different from the yellowish and clay color of true *longicauda*. Under parts in the type white, with a faint greenish yellow tinge. In two topotypes

(Nos. $\frac{3}{1}\frac{2}{7}\frac{6}{8}\frac{3}{5}$ and 3264, American Museum Nat. Hist.) the belly is buff yellow, and in a skin from Elk river, Minn. (No. 31891, Dept. of Agric. coll.), it is strong buff yellow. All but the type, however, are immature, and the under parts of all are much lighter than in true *longicauda* of the same age. The line of demarkation, owing to the much darker upper and lighter under parts, is very much more distinct than in *longicauda*; it runs in an even line straight along the side. The color of the under parts covers the inside of the legs, under surface of the arms, and the whole of the hands and toes; upper lips and chin, white; tail, same color as back, with a short, black end, and also a long pencil of black hairs; under fur, same color as the long hairs. Winter pelage: Pure white, with no yellowish tinge; end of tail jet black.

The change to a winter white coat takes place over the entire range of the subspecies.

Size.—Type, male, yg. ad.: Total length, 445; tail vertebræ, 160; hind foot, 55. Average of five adult males from Fort Snelling and Elk river, Minn.: Total length, 467; tail vertebræ, 171; hind foot, 54. An adult female topotype measures: total length, 375; tail vertebræ, 123; hind foot, 42.5.

Skull.—Same as in true *longicauda*.

Remarks.—*Putorius spadix* is the dark-colored eastern race of *longicauda*. It seems to inhabit only a small area along the western edge of the eastern forest belt. In color it very closely resembles *P. noveboracensis*, from which it can easily be told by the white feet, longer tail with shorter black tip, and the harsh pelage; and with as great certainty by the skull, which is the same in all its characters as that of true *longicauda*.

Putorius brasiliensis frenatus (Licht.). Bridled Weasel.

Mustela frenata Lichtenstein, Darstell. neuer o. wenig bekannt Saugth., pl. XLII and corresponding text, 1832.
Putorius frenata Aud. and Bach., Quad. N. Am., II, p. 71, 1851 (in part; not plate LX).
Putorius frenatus Baird, Mamm. N. Am., p. 173, 1857. Mex. Boundary Surv., part II, Rept. on Mammals, p. 19, 1859.
Putorius (*Gale*) *brasiliensis frenatus* Coues, Fur-bearing Animals, p. 142, 1877 (part).

Type from vicinity of the city of Mexico.

Geograghic distribution.—Table-land of Mexico from city of Mexico northward to southeastern Texas (north at least to San Antonio and probably east along the coast to Louisiana).

General characters.—Size, largest of all our weasels, tail forming nearly half of the total length and with a short, black tip; hair rather short and coarse; conspicuous black and white markings on the head.

Color.—Upper parts light brown, varying from russet to raw umber, gradually darkening just back of the ears to black; a large spot between

the eyes and two larger bands extending from the throat up between the ear and the eye, white. These markings are very variable. Sometimes the bands are very broad and meet the white spot between the eyes, making a continuous white band around the head; sometimes they are reduced to a few white scattering hairs between the eyes and narrow and broken bands of white in front of the ears. The rest of the head, the ears, nose, and whiskers are black; under parts uniform, strong orange buff, sometimes tinged with ocher yellow; line of demarkation between colors of upper and under parts a little irregular and rather high up; hands, toes, and inside of feet a shade or two lighter than the under parts, but not white; chin and a very narrow border to upper lips white; tail same color as upper parts, its black tip short; under fur same color as long hairs; no seasonal change in color.

Size.—Average measurements of five adult males from Brownsville, Texas: total length, 499; tail vertebræ, 224; hind foot, 46. Average of three adult females from Brownsville, Texas: total length, 412.5; tail vertebræ, 172; hind foot, 36.5.

Skull.—Large and massive, but not differing in any essential characters from that of *P. longicauda;* it is larger and even more constricted back of the postorbital processes, and has a tendency to become more roughened in old age by muscular impressions.

This weasel, like all the *longicauda* group, is very free from the parasite that preys on the frontal bones; dentition normal, but heavy.

Remarks.—The geographic distribution of this weasel is still imperfectly known. In all probability the form has a much wider range than is actually shown by existing specimens. Probably, like many Mexican mammals, it extends east along the Gulf coast to the shores of Louisiana. Its western limit is not known.

Putorius peninsulæ Rhoads. Florida Weasel.

Pl. I, fig. 5; II, fig. 5; III, fig. 5.

Putorius peninsulæ Rhoads, Proc. Acad. Nat. Sci. Phila., p. 152, 1894.
Chapman, Bull. Am. Mus. Nat. Hist., p. 345, 1894.
Putorius ermineæ Chapman, Bull. Am. Mus. Nat. Hist., p. 345, 1894.

Type locality.—Hudson's, Pasco Co., Florida.

Geographic distribution.—The whole of peninsular Florida and probably north into Georgia and the lowlands of South Carolina; inhabits the tropical fauna of Florida and perhaps the Austroriparian zone also.

General characters.—Size medium; tail short; very much shorter than in any other member of the *longicauda* group (less than one-third the total length) and tipped with black for about one-third its length; hair on the tail very short, making the tail look slender; feet slender and sparsely haired; the nails very conspicuous; coat everywhere short, coarse, and very lustrous.

Color.—Upper parts, hair brown, with a slight olivaceous tinge in a fine specimen from Tarpon Springs (No. 2379, coll. S. N. Rhoads); burnt

umber in a specimen from Osceola, Florida (No. 7929, coll. Am. Mus. Nat. Hist.), other skins varying between these two extremes; some white hair on the forehead and behind the eyes, varying in amount in different specimens, from large and well defined white markings in the type* to only a few hairs in the Osceola skin; a conspicuous patch of long white hair in front of opening of ear; under parts pale yellow (primrose yellow to pale buff yellow); line of demarkation between colors of upper and under parts high up and rather irregular. The color of the under parts covers under side of arms and whole of hands and extends down inside of legs, covering toes and inside half of upper surface of feet; upper lips and chin and under side of head back as far as the jaw white; tail same color as back, gradually shading to black at the tip, with a short black pencil; no seasonal change in color.

Size.—The size of the male of this weasel is a matter of doubt. An old adult breeding female from Tarpon Springs (No. 2379, coll. of S. N. Rhoads) measures: total length, 374; tail, 127; pencil, 20; hind foot, 44.5 (measured in flesh by W. S. Dickinson).†

Skull.—The skull of *P. peninsulæ* is quite different in many particulars from that of any other weasel I have examined, but clearly places the species in the *longicauda* group. It is large and massive, developing a strong sagittal crest with age; brain case very large and deep (viewed from above triangular with the great construction back of postorbital process and breadth across the mastoids of all the *longicauda* group); postorbital processes well developed; inflated squamosal more reduced than in any of our species, not excepting *longicauda;* audital bullæ extremely large, broad, and deep; mandible short and very heavy.

The dentition is much heavier throughout than in other species of about the same size, with the exception of the last upper molar, which is smaller. For instance, the old adult skull from Tampa bay, although smaller than male skulls of *noveboracensis* or *longicauda* of the same age, shows all the teeth to be actually larger, except the last upper molar, which is smaller than in either of these species.

Remarks.—Mr. Rhoads first described this remarkable weasel from a single unsexed skin, accompanied by the rostral portion of the skull and the whole lower jaw. He considered the specimen an adult female. It probably is a female, as it is about the size of the Tarpon Springs specimen, but is far from adult, as shown by the fact that the sutures are still plainly visible and the teeth unworn. One of the characters he gives is the position of the lower incisors, which are so crowded as to throw the second

* In the type these markings may be exaggerated by albinism, as it has a large, irregular white spot in the middle of the back and a white line on top of the head between the ears, a place where albinism in mammals usually shows itself.

† The measurements of the type taken from the dried skin, and therefore unreliable, are: total length, 375; tail vertebræ, 100; hind foot, 40.

incisor of each mandible behind the other incisors, giving the appearance of a double row of teeth. This condition is merely individual, and is not shown in other skulls of *peninsulæ*. It can be found in many examples of any species.

In the American Museum collection is a skin (No. $\frac{12455}{8610}$), with, unfortunately, only a fragment of the skull left, from Yemassee, in the southeast corner of South Carolina, which I refer with some doubt to *P. peninsulæ*. The specimen is labeled male. The skin is much shrunken and affords no actual measurement, except that of the hind foot, which is 41 millimeters, one millimeter more than in the type of *P. peninsulæ*, also measured from the dry skin. The colors are about as in *peninsulæ*, but the tuft of white hair in front of the ear is not present, and the yellow of the under parts, while covering the whole hand and inside of the arms, does not extend down the legs, but ends about the middle of the thighs, as in *noveboracensis*. The toes, however, are yellow. The fragment of skull has the teeth; they are a trifle heavier than in the average males of *noveboracensis*, while the animal is evidently smaller and has a shorter tail.

All the existing specimens of *peninsulæ* are very nearly of a size. If both sexes are represented, *peninsulæ* is remarkable for the slight difference in size between the male and the female. Male weasels always greatly outnumber the females, and it would be strange if all the seven examples of *peninsulæ* were females. This is a point of great interest, and can only be settled by properly sexed and measured male specimens, which I hope will turn up before long, as I believe that *P. peninsulæ* is far from a rare animal in Florida. I heard of it several times at Micco, where it is apparently not uncommon, but was able to get only the skull referred to below.*

I have been told by a reliable man, who used to live in south central Georgia, that a weasel is common there, and that he frequently caught them when trapping for other animals. Of course, he could not tell the species, but I fancy it is *peninsulæ*.

P. peninsulæ is known at present by only a few rather fragmentary and one good sexed and measured specimens, as follows: The type, No. 1515, coll. S. N. Rhoads, from Hudson's, Pasco county, Florida (a rather young, unsexed, and unmeasured skin, with a small part of the skull); No. 61490, U. S. Nat. Mus., from Polk county, Florida, winter 1893–1894, N. R. Wood, collector (good skin, without sex or skull); No. $\frac{3177}{6544}$, coll. Dr. C. Hart Merriam, from Tampa bay, Florida (an old adult, a poor unsexed and unmeasured skin, with a rather more perfect skull than the type, only the occipital part being gone); No. 7927, Amer. Mus. Nat. Hist., from Osceola, Florida (a good but unsexed and unmeasured skin, with no skull); No. 3053, coll. E. A. and O. Bangs, from Micco, Florida (a nearly perfect,

*The great difficulty is in trapping successfully in Florida with any kind of baited trap. Where there are hogs this is practically impossible, and in other places turkey buzzards, opossums and raccoons make the trapper's life a burden.

rather young skull); No. 2379, coll. of S. N. Rhoads (a fine adult breeding female, with the six mammæ plainly visible in the skin, taken November 11, 1895, at Tarpon Springs, Florida, by W. L. Dickinson, with a nearly perfect skull), and No. $\frac{12}{8}\frac{15}{6}\frac{}{16}$, Amer. Mus. Nat. Hist., from Yemassee, in the lowlands of South Carolina.

Putorius noveboracensis Emmons. New York Weasel.

Pl. I, figs. 2, 2*a*; II, figs. 2, 2*a*; III, figs. 3, 3*a*.

Putorius noveboracensis DeKay, New York Survey, p. 18, 1840 (*nomen nudum*). Zoölogy of New York, Mammalia, p. 36, 1842.
Emmons, Rept. Quad. Mass., p. 45, 1840.
Baird, Mammals N. Am., p. 166, 1857.
Samuels, Ann. Rept. Agric. Mass., p. 156, 1861–1862.
Putorius erminea Thompson, Nat. Hist. Vermont, p. 31, 1842.
Aud. and Bach., Quad. N. Am., II, p. 56, plate LIX, 1851.
Putorius agilis Aud. and Bach., Quad. N. Am., III, p. 184, plate CXL, 1854 (the female, not *Mustela agilis* of Tschudi).
Putorius richardsoni Baird, Mamm. N. Am., p. 164, 1857 (probably the female).
Samuels, Ann. Rept. Agric. Mass., p. 155, 1861–1862.
Mustela erminea Var. *Americana* Gray, P. Z. S., p. 111, 1865 (part); Cat. Carnivora, British Mus., p. 89, 1869 (part).
Mustela richardsoni Gray, P. Z. S., p. 112, 1865 (based on Baird); Cat. Carnivora, British Mus., p. 90, 1869 (based on Baird).
Putorius ermineus Allen, Bull. Mass. Comp. Zoöl., 1, p. 167, 1869 (part); Proc. Bost. Soc. Nat. Hist., XIII, p. 183, 1869.
Putorius (*Gale*) *erminea* Coues, Fur-Bearing Animals, p. 109, 1877 (part), and of most subsequent authors.

Type locality.—State of Massachusetts.

Geographic distribution.—Eastern United States from southern Maine, southern New Hampshire, and southern Vermont south to North Carolina (Raleigh, N. C.) and probably farther; west at least to Indiana and Illinois (Denver, Ind., and Warsaw, Ill.). Inhabits the Carolinian and Transition zones of the east and just touches the lower part of the Canadian zone. Apparently very rare at the northern and southern extremes of its range and attaining its greatest abundance in lower Transition and upper Carolinian country.

General characters.—Size large; tail long (more than one-third of the total length), with the black end from one-third to one-half the length of the tail; feet slender and small; pelage full and soft.

Color.—Summer pelage: Upper parts rich, deep reddish brown, varying from Prout's brown to Vandyke brown, generally rather darker along the middle of the back; under parts white to pale yellow (usually white in northern examples and yellow in southern); line of demarkation between colors of upper and under parts very irregular and low down, often leaving only a narrow band of white along the middle of the belly. This white band frequently encloses spots of brown. The color of the under parts generally extends half way down the inside of the thighs and to the wrists, the whole of the feet and upper sides of arms and hands being brown. The upper lips are usually but not always brown (in some examples they are broadly edged with white, as in *richardsoni* and *cicognani*).

The tail is the same color as the upper parts for about half its length, then begins gradually to darken, and is tipped with black; under fur the same color as long hairs. Winter pelage: The winter pelage is white or brown, according to latitute; it is white only in the northern part of the animal's range.* In the brown winter pelage the color is usually about the same as in summer, but the coat is, of course, much longer and fuller. I have seen a few winter skins that had not turned white, but were much lighter than the usual summer pelage. One of these (No. 2184, collection S. N. Rhoads, Chester county, Penn., December 16, 1890) has the whole upper parts a beautiful pale drab which fades almost insensibly into the white of the under part. In the white winter pelage the animal is white all over, with generally a yellowish tinge on the posterior half of the upper parts and the whole of the under parts, and with a conspicuous black tip to the tail, usually covering about one-third of its length.

Size.—Average of ten adult males from lower Transition zone: total length, 407; tail vertebræ, 139.5; hind foot, 47. Average of ten adult females from lower Transition zone: total length, 324.5; tail vertebræ, 108; hind foot, 34.5.

Skull.—There is great sexual difference, in addition to that of size, in the skulls of *P. noveboracensis*, which seems peculiar to this species. The postorbital processes are well developed in both sexes. The male skull is large and develops a sagittal crest with age; the general shape of the brain case, viewed from above, is less triangular than in the *longicauda* group, being not so sharply constricted back of the postorbital processes and rather narrower across the mastoids; the audital bullæ are large and deep; the inflated squamosal is much reduced, but usually not quite to the same extent as in the *longicauda* group. The female skull is small and does not develop a sagittal crest; the general shape of the brain case, viewed from above, is nearly oblong, as in the *richardsoni* group; the inflated squamosal is large and much inflated and nearly flush with the lower surface of the audital bullæ; the audital bullæ and inflated squamosal meet in a rounding line (in the *richardsoni* group this line is usually straight). The female skull can be told from that of any of the *richardsoni* group with great certainty by its well developed postorbital processes.

The dentition is much heavier in the male than in the female, the difference being more marked than in other species.

Remarks.—*P. noveboracensis* is very generally distributed over the Atlantic tier of States from North Carolina to New Hampshire. It is the only weasel found in the Carolinian zone, but

* In northern New York and Vermont *P. noveboracensis* always assumes a white winter coat. In northern Massachusetts it sometimes does. I have two specimens, caught in the same trap at Wayland, Mass., one January 11, 1875, in the white pelage and the other January 12, 1875, in the brown pelage. In central Connecticut it never changes, as shown by large series from Liberty Hill, Conn., taken all through the winter, from October to March.

begins to overlap the range of *P. richardsoni cicognani* in Connecticut and New York, and thence northward gradually gets rarer as *cicognani* becomes commoner, until in the Canadian zone we have *cicognani* alone.

There is a slight variation in the color of the under parts, which to a certain extent is geographical, for southern examples as a rule have the belly yellow and northern ones have it white, but the difference is not altogether constant, and does not warrant dividing *noveboracensis* into two races.

It is unfortunate that DeKay cannot have the credit of naming this weasel, and still more so since we know that Emmons and DeKay were fast friends, and that Emmons meant to give him full credit of his discovery. The type locality of *P. noveboracensis* must, I think, be considered to be Massachusetts although Emmons in describing it mentions no locality in that State, nor even the State itself, but says only: "It is common to the middle and northern States." Of course, Emmons was writing only of the mammals of Massachusetts, which fact may be assumed to tie the type locality down to that State.

The male *noveboracensis* is more often seen than the female, and appears to be much commoner. In examining large series of weasels of any species one is always struck by the great preponderance of males, outnumbering the females about 5 to 1. There may be, however, some other cause to account for this, since the males are perhaps easier to trap or more active or courageous and therefore more often seen and killed; hence an examination of skins alone may give a false idea of the relative numbers of the sexes.

The sexual difference in size is very striking in *P. noveboracensis*. The male is a large and powerful weasel and does not hesitate to attack and kill animals the size of the cotton-tail rabbit and the domestic hen, while the female is such a little slender creature that it seems almost incredible that she can nurse and bring up a litter of males each of which soon grows to be much larger than herself. On June 5, 1894, some men at work on our place, at Wareham, Massachusetts, saw three weasels of this species cross a road and go into a stone wall. They immediately ran for a gun, and by imitating the squeaking of a mouse succeeded in attracting one, the adult female, out of the wall and shot her. I saw that she had been nursing, and placed some steel traps along the wall in positions where the other two would

go into them when they came back that way, as they were sure to do. The morning of June 9 I had them both. They were males, and although still retaining their milk teeth, each was very much larger than his mother.

Putorius richardsoni (Bonaparte). The American Ermine.

Pl. I, figs. 3, 3*a*; II, figs. 3, 3*a*; III, figs. 6, 6*a*.

Mustela richardsoni Bonaparte, Charlesw., Mag. Nat. Hist., II, p. 38, Jan. 1838 (based on specimen from Fort Franklin, Great Bear lake, Rich., F. B. A., p. 47, 1829).

Rich., Zoöl. Beechey's Voy., p. 10,* 1839 (not *Putorius richardsoni* Baird).

Putorius (*Gale*) *erminea** Coues, Fur-bearing Animals, p. 109, 1877 (in part).

Type locality.—Fort Franklin, Great Bear lake. The supposed type, a specimen in winter pelage, is still in the British Museum.

Geographic distribution.—Arctic America east at least to Fort Albany, on the west coast of James bay, and thence northwest to Alaska, where it reaches the Pacific coast. Whether *richardsoni* reaches the Atlantic coast or not is still a matter of doubt, but if it does it must be in the extreme

* The name of the European ermine or stoat has appeared a good deal in our literature, but wholly without warrant. In 1869, in his Catalogue of the Mammals of Massachusetts, Dr. J. A. Allen attempted to prove that all our weasels, excepting the bridled weasel and what he called *P. vulgaris* (probably a mixture of *cicognani* and *rixosus*) belonged to the European species, *P. erminea*. Doctor Allen never mentioned the crania of any of the weasels of which he treated and appears never to have consulted them, but went blindly ahead in an attempt to prove a preconceived theory—that all the carnivora of Europe, Asia, and North America were the same. One land bear, one wolf, one red fox, one mink, one ermine, and one weasel is what he allowed to the whole northern hemisphere. He was substantially followed by Dr. Coues, in his Fur-bearing Animals, in 1877, with the exception that Coues recognized *P. longicauda* as distinct. Since then the name *P. erminea* has been frequently used for American weasels of very different species.

There is really no need for confusing the European ermine and various closely related species or subspecies with any of our weasels. The only North American species that resemble it are *richardsoni* and *cicognani*, but from either of these it can be recognized at once by much larger size and by the greater extent of black on the tail and the immensely long pencil. The skull can be told from any North American member of the subgenus *Gale* at a glance. The brain case is shallow behind, with narrow supraoccipital. The audital bullæ are shallow and flat and the basioccipital broad. The skull can be distinguished by these peculiarities and its much greater size from any of our species with inflated squamosals. These are the only ones it need be compared with.

north.* Apparently abundant over the whole of this vast region and probably shades into *cicognani* in the transcontinental forest belt at the south of its range.

General characters.—Largest of the short-tailed American weasels. Tail short (a little more than one-fourth of the total length), tip black, pencil long and bushy; feet, large and broad; coat, very long, full, and soft.

Color.—Summer pelage: Upper parts pale yellowish brown, ranging from nearly raw sienna to nearly raw umber and intermediate shades, only a little darker than the upper parts of *P. longicauda*, under parts varying from primrose yellow to maize yellow; line of demarkation between colors of upper and under parts high up, straight and unbroken. Color of under parts covers under side of arms and hands, inside of legs and toes; upper lips and chin white; tail above, same color as back; below, same color as belly (usually all the way down to the black tip). This yellow under side of the tail is peculiar to this species, so far as I know, and is shown by every specimen except one that I have examined. This one is an adult breeding female (No. 4349, U. S. Nat. Mus.) from Fort Albany, James bay. It has the under side of the tail not yellow, but yet lighter than the upper side. This specimen is the most southerly and easterly example of *richardsoni* that I have seen and is probably shading toward *cicognani*. The under fur is the same color as the long hairs. Winter pelage: Pure white all over, often tinged with yellow on the tail, hind quarters, and belly; end of tail, for a little more than pencil, jet black; coat extremely long and full; feet very heavily furred. The change to a white winter coat takes place over the entire range of the species.

Size.—The type, evidently a male, although no sex was given, measured: head and body, 11 inches (280 mm.); tail, 4 inches (102 mm.). The only other specimens measured in the flesh are two in the United States National Museum. One of these (No. 5696, from Fort Simpson, December 20, 1860, male, Bernard R. Ross) measured: head and body, 10.30 inches (261.5 mm.); tail, 4.25 inches (107.5 mm.); hind foot, 1.70 (43 mm.). The other (No. 2065, "Barren Grounds," June 28, 1864, male, McFarlane) measured: "extreme length," 13 inches (330 mm.).

Skull.—Skull smooth and light, without pronounced sagittal crest, although in very old examples there is a slight sagittal development; general shape of brain case, viewed from above, oblong, owing to great breadth across interorbital region and relatively short distance across mastoids; postorbital processes short, blunt, and not well developed; audital bullæ long and deep and meeting the inflated squamosal in almost a straight line; inflated squamosal large, much inflated, and almost flush with auditaj

* On page 149 of Appendix No. IV, vol. II of Ross' Voyage, 8vo, 1819, is a description of a weasel killed at the west side of Baffin's bay. The description is quite minute, and the measurements given are: "From the tip of the nose to the insertion of the tail, eight inches and a half [= 218 mm.]; to the tip of the tail, eleven inches and a half [= 292 mm.]." The breast and belly are said to be yellow. The sex is not given.

bullæ; distance from audital bullæ to post-glenoid process much greater than in the large weasels of the *longicauda* and *noveboracensis* groups.

The skulls of the weasels of this group differ more widely from those of *Putorius* proper than do skulls of the *longicauda* group or of the male *noveboracensis*.

Remarks.—When Professor Baird wrote his 'Mammals of North America' he had never seen a specimen of *richardsoni*, the animal he called *richardsoni* being the small examples of *noveboracensis*, probably females. Since that time the National Museum has accumulated a large series of this interesting weasel, but most of the skins are in poor condition, unmeasured, unsexed, and accompanied only by fragmentary skulls, which are inside the skins. Still there are a few skulls in good condition accompanying the skins taken in Alaska by the indefatigable Nelson; measurements of these are given in the tables. A large proportion of the known skins came from points in Alaska, but there are many from stations that completely surround the type locality from Fort Albany to Franklin bay. The principal localities are Fort Albany, Fort Simpson, Fort Resolution, Fort McPherson, Big Island, Fort Rae, Fort Good Hope, Hudson bay, Fort Anderson, Anderson river, Peel's river, Yukon river, Franklin bay, Plover bay, Fort Yukon, mouth of Porcupine river, Norton sound, St. Michaels, and Point Barrow. They were collected for the most part by E.W. Nelson, B. R. Ross, R. McFarlane, George McTavish, J. Reid, R. Kennicott, L. Clarke, Jr., J. Lockhart, C. L. McKay, and Lieut. P. L. Ray.

Putorius richardsoni cicognani (Bonaparte). The small brown Weasel.

Pl. I, figs. 4, 4*a*; II, figs. 4, 4*a*; III, figs. 2, 2*a*.

Mustela (*Putorius*) *vulgaris* Rich., Fauna Boreali-Am. Quad., p. 45, 1829.
Mustela cicognani Bonaparte, Fauna Italica, fasc. XXII, 1838, Charlesw. Mag., II, p. 37, Jan., 1838.
Putorius cicognani Rich., Zool. Beechey's Voyage, p. 10,* 1839.
Baird, Mamm. N. Am., p. 161, 1857.
Samuels, Rept. Agric. Mass., p. 154, plate I, fig. 6, 1861–1862.
Gilpin, Trans. Nova Scotia Inst., II, p. 13, 1866 (read March, 1866).
Putorius richardsoni Gilpin, Trans. Nova Scotia Inst., p. 15, 1866 (read March, 1866).
Putorius vulgaris Emmons, Rept. Quad. Mass., p. 44, 1840.
Thompson, Nat. Hist. Vermont, p. 30, 1842.
Allen, Proc. Boston Soc. Nat. Hist., XIII, p. 183, 1869; Bull. Mus. Comp. Zoöl., I, p. 167, 1870.
Merriam, Mammals Adirondacks, p. 54, 1882.
Mustela fusca Aud. and Bach., Journal Acad. Nat. Sci. Phila., VIII, pt. II, p. 288, 1842.
DeKay, Zoöl. New York, I, p. 35, 1842.

Putorius fuscus And. and Bach., Quad. N. Am., III, p. 184, pl. 140, 1853.
Mustela pusilla DeKay, Zoöl. New York, I, p. 34, plate XIV, fig. I, 1842.
Putorius vulgaris var. *Americana* Gray, P. Z. S., p. 113, 1865; Cat. Carnivora British Mus., p. 91, 1869.
Putorius (*Gale*) *erminea* Coues, Fur-Bearing Animals, p. 109, 1877 (in part).

Type locality.—Eastern United States.

Geographic distribution.—Northeastern North America from Long Island and Connecticut north to Labrador and Newfoundland, west at least to Minnesota (Fort Snelling and Elk river), and probably following the transcontinental forest belt nearly, if not quite, across the continent; inhabits the whole of the Hudsonian, Canadian, and Transition zones.

P. richardsoni cicognani is the characteristic weasel of northeastern North America and the only one occupying a large area in the Canadian and Hudsonian zones. It extends south to the southern limit of the Transition zone, but no farther. It begins to overlap the range of *P. noveboracensis* in the lower Canadian zone, and thence southward gradually becomes rarer as *noveboracensis* becomes commoner, until it disappears altogether in the valley of the lower Hudson. I have never seen a specimen from any point farther south. All through Connecticut, Massachusetts, New York, New Hampshire, and Vermont both species occur together.

General characters.—Size small; tail short, a little more than one-fourth of the total length tipped with black; feet large and broad.

Color.—Summer pelage: Upper parts rich, dark brown, varying from Prout's brown to almost seal brown, examples in fresh pelage sometimes having the peculiar purplish tone of seal brown; ear often bordered by a narrow white margin (not a lingering of the white coat, as I have often seen it in the young that had never changed to the white winter dress), which in worn midsummer specimens usually disappears. Southern specimens are rather darker, as a rule, than northern ones. Under parts usually pure silvery white in the more southern examples, but sometimes tinged with greenish yellow in specimens from Newfoundland and Labrador. The line of demarkation between colors of upper and under parts is high up, straight, unbroken, and very distinct, owing to the great contrast in color. Occasionally a specimen can be found with one or more irregular spots of brown on the chest and belly. The color of the under parts covers the under sides of the arms and hands and the inside of the legs and the toes. Upper lips always white; tail same color as back, both above and below, with a short black tip, which, including the pencil, occupies about one-third of the tail; under fur about the same color as the long hair. Winter pelage: Pure white all over, with usually a strong yellowish tinge on the hindquarters, tail, and belly; end of tail for a little more than the pencil, jet black; coat long and full; feet heavily furred. The change to a white winter pelage takes place over the entire range of the subspecies. In Connecticut *P. richardsoni cicognani* always turns white in winter, while *P. noveboracensis* never does.

It is rather curious that in changing back to the brown summer coat in spring (the change taking place in March or April, according to locality)

the white hairs persist longer in a well defined spot between the eyes and in front of the ears than elsewhere on the head. In the bridled weasel this spot between the eyes is a constant character, and in *P. peninsulæ* the white patch in front of the ears is a constant character; and still these weasels have no white winter coat.

Size.—Average of ten adult males from the lower Canadian and Transition zones: total length, 285; tail vertebræ, 77.5; hind foot, 37. Average of three adult females from the lower Canadian and Transition zones: total length, 254; tail vertebræ, 69; hind foot, 30.5.

P. cicognani varies somewhat in size all through its range, but apart from this individual variation there is a gradual increase from south to north, and specimens from Newfoundland and Labrador and also those from Lake Edward and Godbout, Quebec, are nearly equal in size to *richardsoni*. A specimen from Codroy, Newfoundland (No. 3751, male, old adult, coll. E. A. and O. Bangs), measures: total length, 339; tail vertebræ, 97; hind foot, 48.

Skull.—Skull smooth and light, not developing sagittal crest with age. It differs very little from the skull of *richardsoni*, but perhaps is a little narrower and deeper, with the inflated squamosal a trifle more inflated and larger, and usually quite flush with the audital bulla, from which it is separated by an almost straight line; mandible and teeth rather lighter.

Two skulls from Codroy, Newfoundland (Nos. 1164 and 1177, coll. E. A. and O. Bangs), present a very remarkable character that I have never seen in any other skulls of *Gale*. Each has an extra molar on each side of the upper jaw, placed behind the regular last upper molar. These teeth are small and round, but well shaped and symmetrical on the two sides.

Remarks.—Bonaparte first described this little weasel under the name *Mustela cicognani* (*Fauna Italica*, fasc. xxii, 1838), giving a very brief and imperfect account of it, and no definite type locality; but his description indicates this animal and can apply to no other. Furthermore, the following statement, made by him the same year in Charlesworth's Magazine of Natural History, leaves no doubt as to the animal he had. He said: "During my stay in the United States I only saw a small species of *Mustela*, very common throughout the Union, which all the naturalists at that time considered as the *M. vulgaris*. I at once perceived that it was not that European animal, and that it approached more to the *M. erminea*. From that remark of mine the name was changed, as, for example, in Dr. Godman's Natural History. I have since, in my Iconography of the Italian Fauna, speaking of the new *M. boccamela*, taken an opportunity of revising the group *Mustela*, and of distinguising the American under the name of *M. cicognanii*, as it is intermediate between the two European species." *P. cicognani*, before Bonaparte separated it, was, as he states, generally confused with the European *P. vul-*

garis (= *P. nivalis*). Richardson's *P. vulgaris* from Carlton House, Saskatchewan (Fauna Boreali-Americana, I, p. 46), is clearly this species. It was an adult female and the measurements given were taken before skinning. Richardson himself positively states this on page 10* of the Zoölogy of Beechey's Voyage.*

Professor Baird, in 1857, gave a clear and accurate description of *P. cicognani* (Mammals of North America, 161–162), but unfortunately he was not followed by subsequent authors.

Although the extremes of *richardsoni* and *cicognani* are very different-looking weasels, the evidence seems to prove that they are only races of one species. The larger light-colored weasels from Newfoundland and Labrador may safely be considered as intermediate, though rather nearer *cicognani*, while the Fort Albany specimen, referred to under *richardsoni*, is an intermediate, rather nearer to *richardsoni*.

Putorius rixosus sp. nov. Least Weasel.

Pl. I, fig. 6; II, fig. 6; III, fig. 4.

Putorius pusillus Baird, Mamm. N. Am., p. 159, 1857 (not DeKay).
Putorius vulgaris Coues, Fur-Bearing Animals, p. 102, 1879 (in part).

Type from Osler, Saskatchewan, No. 642, female, young adult, coll. E. A. and O. Bangs, coll. by W. C. Colt, July 15, 1893. Original No., 79.

Geographic distribution.—Arctic and boreal America from Alaska south at least to Saskatchewan and Moose Factory.

General characters.—Size very small; tail very short, without black; pencil short.

Color.—Summer pelage: Upper parts rich reddish brown, from burnt umber to Vandyke brown; under parts pure white in every example but the type. The type has the under parts a soiled white or pale drabbish, that I attribute rather to staining than to coloring matter in the hair itself, as many of the hairs when taken singly are white; line of demarkation between colors of upper and under parts high up and even; color of under parts covering under side of arms and hands and inside of legs and toes; upper lips white; tail to very end same color as back; under fur same color as the long hairs. Winter pelage: Entirely pure white all over, including end of tail. The change to a white winter pelage probably takes place over the entire range of the species.

Size.—Type (female yg. ad.): Head and body, 150; tail, 31 (taken in flesh by collector, W. C. Colt).

* In many worn midsummer specimens of *P. cicognani* the black tip to the tail fades to a blackish brown, and is then not in very marked contrast to the rest of the tail. Specimens in this condition may have strengthened the opinion, so generally held by early writers, that the animal was identical with the European *P. nivalis*.

Skull.—Skull very small and light, with the same oblong brain case and large inflated squamosal as in all the *richardsoni* group, from which it differs in exceedingly small size only.

Remarks.—This rare and little known weasel was first described by Baird in 1857. But Baird referred it to *Mustela pusilla* of DeKay, with the remark, "It is barely possible that the specimen here described may be different from the New York species as given by Dr. DeKay." De Kay's *M. pusilla* was the *M. cicognani* of Bonaparte, as shown by his description and measurements and by its geographical distribution.

P. rixosus is at present very imperfectly represented in collections. There are a few skins in the United States National Museum from points in Arctic America, from Fort Albany to Alaska. Most of these skins are in poor condition and have what is left of the skull inside the skin. They are also unsexed. There are two very good skins from Moose Factory, Ontario, made by C. Drexler (No. 5532, Museum Comparative Zoölogy, Cambridge, Mass., and No. 4231, United States National Museum. The latter is labeled male, but I think it is really a female). Two of the Alaska examples are in winter pelage and are pure white all over, including the end of the tail. One from the upper Yukon (No. 13904, collected by E. W. Nelson) is apparently a male. All the others are apparently females. Even this male, although unmeasured, is, so far as can be judged, smaller than full-grown females of the European *P. nivalis*.

In summer pelage *P. rixosus* can be distinguished from the European *P. nivalis* by its darker color, and at all seasons by its very much smaller size.

Dr. Coues, in his 'Fur-Bearing Animals,' speaks of larger examples with longer tails, the ends of which are dusky, and refers such specimens to this species (which he called *P. vulgaris*). In this he was in error, as was Professor Baird in considering No. 2319 from Steilacoom, Washington, to be this animal. I have seen many such, and in every case close examination has proved them to be the young of either *P. richardsoni* or *P. cicognani*, with the milk dentition plainly visible. The short, closely haired tails of young weasels of this group, with the end not distinctly black, owing to the hairs of the tail not being full grown, gives them a superficial resemblance to *P. rixosus*. But in all such cases the teeth at once tell the story. Two specimens in the National Museum, No. 5686, from Big Island, and No. 5691, from Fort Rae, are very good examples in point.

P. rixosus is, I believe, the smallest known carnivorous animal.

Table of Average Cranial Measurements of Putorius.

Name.	Locality.	Sex and age.	Number of specimens.	Basilar length from anterior lip of foramen magnum to front of premaxillary.	Occipito-nasal length.	Greatest zygomatic breadth.	Greatest mastoid breadth.	Breadth across post-orbital processes.	Distance from audital bulla to post glenoid process.	Greatest length of lower jaw.
P. longicauda	Alberta, Sask., and N. Dak	♂ ad.	6	47.4	46.8	29.6	25.8	14.0	3.7	29.0
"	Alberta, Mont., and N. Dak	♀ ad.	6	42.8	42.4	25.7	22.9	12.0	3.9	25.4
P. l. spadix	Fort Snelling and Elk river, Minn.	♂ ad. ♀ ad	5	48.2	47.6	29.5	25.8	14.4	3.3	30.4
"	" " "		2	44.1	42.3	25.1	22.5	11.9	3.6	26.5
P. frenatus	Brownsville, Texas	♂ ad.	6	50.5	49.3	30.2	25.8	14.3	4.0	31.2
P. peninsulæ	Tarpon Springs, Fla	♀ ad.	1	45.8	46.2	26.8	24.2	14.4	3.0	29.4
P. noveboracensis	Liberty Hill, Conn	♂ ad.	10	45.4	45.6	26.5	22.4	14.2	4.4	27.8
"	" " "	♀ ad.	6	37.9	38.3	20.8	18.3	11.0	4.6	21.6
P. richardsoni	St. Michaels and Yukon, Alaska.	♂ ad.	6	43.2	43.7	26.3	22.8	13.9	5.0	25.4
"	" " "	♀ ad.	3	37.8	38.8	21.7	19.1	12.0	4.8	21.1
P. r. cicognani	Codroy, Newfoundland	♂ ad.	7	41.3	41.5	23.5	20.3	12.3	5.1	23.3
"	Bucksport, Maine	♂ ad	5	39.0	39.9	21.6	19.4	11.3	5.2	21.7
"	Ossipee, N. H	♂ ad	4	38.6	39.0	20.9	18.8	10.7	5.3	21.2
"	Liberty Hill, Conn	♂ ad.	1	37.2	37.2	19.8	18.2	9.8	5.0	20.0
"	Codroy, Newfoundland	♀ ad.	3	36.6	36.2	19.3	17.1	10.3	5.1	18.9
"	Mt Forest, Ontario	♀ ad.	1	32.6	33.2	17.8	16.0	8.8	5.0	17.4
P. rixosus (type)	Osler, Sask	♀ ad.	1	.....	27.2	14.2	13.4	7.0	3.8	14.0
P. ermineus	England	♂ ad.	1	46.0	46.6	28.0	24.0	14.0	5.2	28.4
"	"	♀ ad.	1	40.6	42.4	24.2	21.2	13.4	5.2	23.2
P. nivalis	"	♂ ad.	4	35.8	35.7	20.7	18.1	10.4	4.1	20.0
"	"	♀ ad.	3	31.5	31.7	16.9	15.3	9.0	4.4	17.3

Table of Average Measurements.

Name.	Locality.	Sex and age.	Total length.	Tail.	Hind foot.	No. of specimens in average.
Putorius longicauda	Wingard, Sask	♂ old ad.	466.0	173.0	50.0	1
" "	Osler, Sask	♂ ad.	440.5	158.0	.....	2
" "	Wingard, Sask	♀ old ad.	417.0	162.0	48.0	1
" "	South Edmonton, Alberta	♀ yg. ad.	389.0	145.0	45.0	1
Putorius longicauda spadix	Fort Snelling, Minn. (type loc.)	♂ ad.	461.0	170.5	54.4	5
" " "	" " " "	♀ old ad.	375.0	123.0	42.5	1
Putorius brasiliensis frenatus	Brownsville, Texas	♂ ad.	496.4	220.0	47.1	7
" " "	" " "	♀ ad.	416.0	172.0	36.6	3
Putorius peninsulæ	Tarpon Springs, Fla	♀ ad.	374.0	127.0	44.5	1
Putorius noveboracensis	Liberty Hill, Conn	♂ ad.	407.9	138.4	47.5	10
" " "	" " "	♀ ad.	319.0	106.5	33.7	6
Putorius richardsoni	Fort Franklin, Great Bear lake	♂ ad.	*	102.0	.....	1
" " "	Fort Simpson, Mackenzie river	♂ ad.	†	107.5	43.0	1
Putorius richardsoni cicognani	Codroy, Newfoundland	♂ ad.	327.3	94.7	46.1	7
" " "	Bucksport, Maine	♂ ad.	298.9	82.1	39.2	5
" " "	Ossipee, N. H	♂ ad.	277.8	79.6	36.6	5
" " "	Liberty Hill, Conn	♂ ad.	261.0	60.0	34.0	1
" " "	Codroy, Newfoundland	♀ ad.	256.7	77.3	33.3	3
" " "	Mt. Forest, Ontario	♀ ad	258.5	74.0	31.5	1
Putorius rixosus (type)	Osler, Sask	♀ ad.	181.0	31.0	.....	1
" "	Yukon, mouth of Porcupine river, Alaska.	♀ ad.	177.5	17.5	.....	1
Putorius ermineus	England	♂ ad.	393.0	123.0	47.0	1
" "	"	♀ ad.	314.0	88.0	40.0	1
Putorius nivalis	Scotland	♂ ad.	257.5	52.0	31.0	2
" "	"	♀ ad.	237.0	49.0	26.0	1

* Head and body, 280. † Head and body, 261.

EXPLANATION OF PLATES.

Plates I and II.

(Explanation of figures the same in both plates.)

Fig. 1. *Putorius longicauda* (Bonap.).

1. ♂ ad. Wingard, Saskatchewan (No. 73183, U. S. Nat. Mus., Dept. Agric. coll.).

1*a*. ♀ ad. Wingard, Saskatchewan (No. 75483, U. S. Nat. Mus., Dept. Agric. coll.).

2. *Putorius noreboracensis* Emmons.

2. ♂ ad. Adirondacks, New York (No. 3843, Merriam coll.).

2*a*. ♀ ad. Adirondacks, New York (No. 5598, Merriam coll.).

3. *Putorius richardsoni* (Bonap.).

3. ♂ ad. St. Michaels, Alaska (No. 36243, U. S. Nat. Mus.).

3*a*. ♀ ad. St. Michaels, Alaska (No. 36246, U. S. Nat. Mus.).

4. *Putorius richardsoni cicognani* (Bonap.).

4. ♂. Bucksport, Maine (No. 4247, coll. E. A. and O. Bangs).

4*a*. ♀. Mt. Forest, Ontario (No. 789, coll. E. A. and O. Bangs).

5. *Putorius peninsulæ* Rhoads.

♀ old. Tarpon Springs, Florida (No. 2379, coll. S. N. Rhoads).

6. *Putorius rixosus* nob.

♀ ad. (type). Osler, Saskatchewan (No. 642, coll. E. A. and O. Bangs).

Plate III.

Fig. 1. *Putorius longicauda* (Bonap.).

1. ♂ ad. Wingard, Sask. (No. 73183, U. S. Nat. Mus., Dept. Agric. coll.).

1*a*. ♀ ad. Wingard, Sask. (No. 75483, U. S. Nat. Mus., Dept. Agric. coll.).

2. *Putorius richardsoni cicognani* (Bonap.).

2. ♂. Bucksport, Maine (No. 4247, coll. E. A. and O. Bangs).

2*a*. ♀. Mt. Forest, Ontario (No. 789, coll. E. A. and O. Bangs).

3. *Putorius noreboracensis* Emmons.

3. ♂ ad. Adirondacks, New York (No. 3843, Merriam coll.).

3*a*. ♀ ad. Adirondacks, New York (No. 5598, Merriam coll.).

4. *Putorius rixosus* nob.

♀ ad. (type). Osler, Sask. (No. 642, coll. E. A. and O. Bangs).

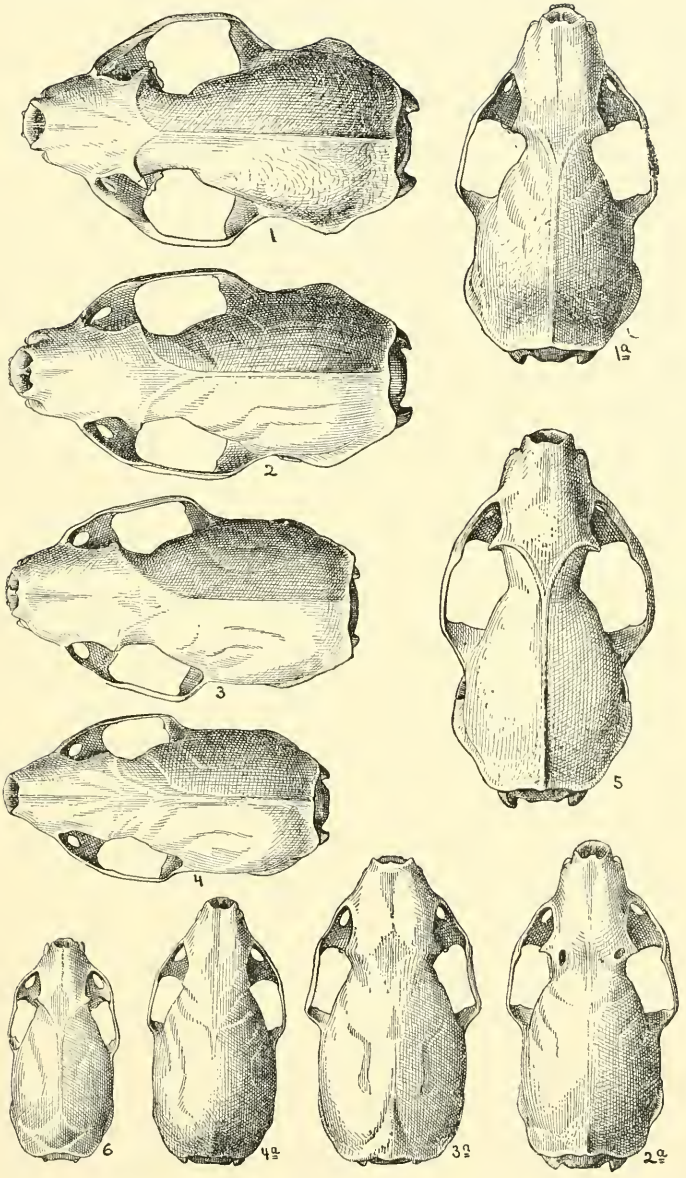
5. *Putorius peninsulæ* Rhoads.

♀ old. Tarpon Springs, Florida (No. 2379, coll. S. N. Rhoads).

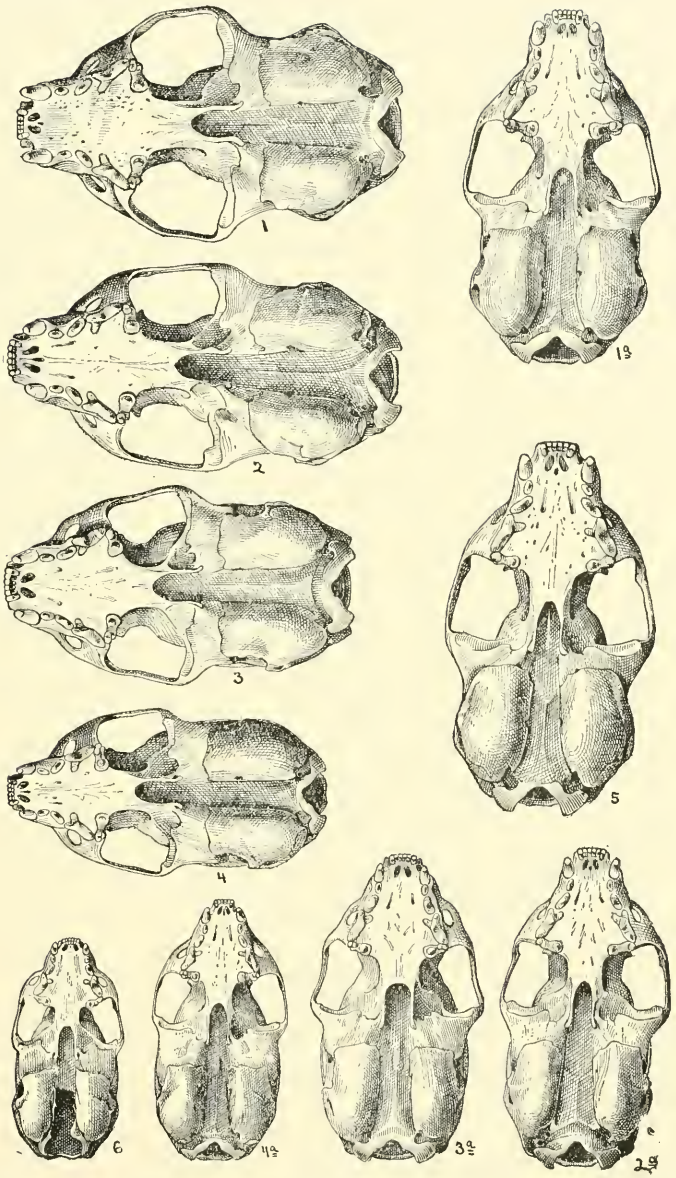
6. *Putorius richardsoni* (Bonap.).

6. ♂. St. Michaels, Alaska (No. 36243, U. S. Nat. Mus.).

6*a*. ♀. St. Michaels, Alaska, (No. 36246, U. S. Nat. Mus.).



1. PUTORIUS LONGICAUDA
2. P. NOVEBORACENSIS
3. P. RICHARDSONI
4. P. CICOGNANI
5. P. PENINSULÆ
6. P. RIXOSUS



1. PUTORIUS LONGICAUDA
2. P. NOVEBORACENSIS
3. P. RICHARDSONI
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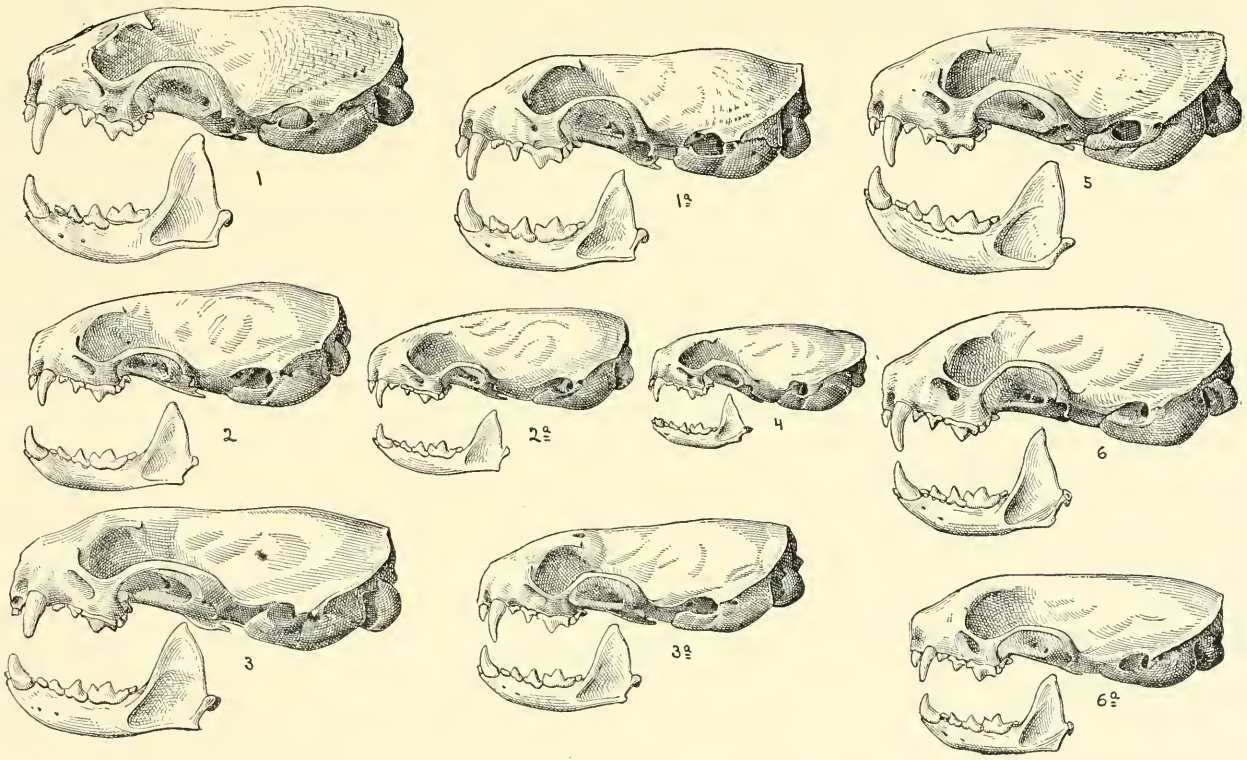
6. P. RIXOSUS



1. PUTORIUS LONGICAUDA 2. P. CICOGNANI 3. P. NOVEBORACENSIS 4. P. RIXOSUS 5. P. PENINSULÆ 6. P. RICHARDSONI

Vol. X, pp. 25-28 February, 1896

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

THE FLORIDA DEER.

BY OUTRAM BANGS.

It has been known for many years that the Florida deer differed enormously in size from its more northern representative, and while most writers on the subject have mentioned this, no one has as yet separated the two. Until recently there has been a great lack of museum specimens of our larger mammals, and this fact alone can account for the Florida deer's remaining so long unnamed.

The Florida deer is little more than half the size of the deer of the northeastern United States, and, in addition to this, there are such other differences as decide me to give it full specific rank. The color of the Florida deer at all seasons is rather darker than that of *Cariacus americanus* (Erxleben),* and unlike the latter,

* The name *Cervus virginianus* Boddaert is so well known and has stood for our eastern deer so long that it seems like sacrilege to change it, but it is antedated by seven years by Erxelben's name *Cervus dama americana*. Erxleben proposed this name on page 312 of his Syst. Regni Animalis, Mammalia, 1777. In a separate paragraph at the end of his article on *Cervus dama* he asks if *americanus* is different, as supposed by Pennant (Differtne vere *americanus* vti Pennanto videtur?). He quotes a part of Pennant's description and gives synonymy, so that the name will have to stand. He gives its distribution as Virginia and Carolina.

Mr. Oldfield Thomas (in Ann. and Mag. of Nat. Hist. (6), xv, p. 193, Feb., 1895) points out that Gloger's generic name *Dorcelaphus* equals and antedates by one year Lesson's name *Cariacus*, but as *Dorcelaphus* is undoubtedly also antedated by other names, it seems wiser to keep the well-known name *Cariacus* until this point is definitely settled.

it undergoes no decided change in pelage between winter and summer. The hair is about the same color, consistency, and length throughout the year, with only the change due to actual wearing and fading. Apart from size there are some very decided cranial and dental characters which separate the two species. The most striking of these is the shape and size of the nasal and maxillary bones and the very large molar and premolar teeth of the Florida animal.

In the years 1893 and 1894 Mr. F. L. Small collected in Citrus county, Florida, five fine specimens of the Florida deer. These are now in the collection of E. A. and O. Bangs, and, with two superb deer lately sent me by Mr. Alvah G. Dorr from Bucksport, Maine, have served in defining the Florida species. Incidentally I have examined a large number of skulls and skins from various localities in the northeast. In comparing deer from Florida and Maine we have, of course, the extreme of differentiation in the east, but, as far as I have been able to ascertain, the deer of Virginia and Carolina does not differ essentially from that of Maine.

The Florida deer may be described as follows:

Cariacus osceola sp. nov.

Type No. 2394, coll. of E. A. and O. Bangs, female, young adult (2 to 3 years old) from Citronelle, Citrus county, Florida, coll. by F. L. Small, December 29, 1893. Original No. 1107.

General characters.—Size small; general color dark; hair short and fine at all seasons.

Color (of type specimen in fresh autumnal pelage).—Upper parts of back, neck, and head a mixed dark and light brown, each hair banded, dark brown at the tip, then yellowish brown, then dark brown and Isabella color at the base. The dark brown color predominates in a narrow median band along the back and is most intense on the neck and between the ears. On the flanks and along the sides the hairs are not banded, but are Isabella color at base and cinnamon at tips; sides and under surface of neck cinnamon; throat, belly, inside of legs, and arms white; ears sparsely haired; upper surface dark brown, many of the hairs tipped with yellow; inside surface white; the hairs of the upper side of tail are dark-red brown at base and cinnamon at tips; under side of the tail white, the hairs very long; eyelashes jet black.

An old male topotype (No. 2392, July 17, 1894), in worn midsummer coat, has lost the banding of the hairs and is a bright russet cinnamon above, which extends to the front of the eyes. The muzzle is very sparsely haired, and of a grizzled hair brown color, with a black spot

behind each nostral. The tail is broadly edged with black at the base and black above at the tip.

An old male from Blitches Ferry, Citrus county, Florida (No. 2391, October 24, 1894) in fresh autumnal pelage is very dark above, the lower dark band of the hairs extending to their base and imparting to the whole upper parts a rich dark-brown color, variegated by the yellow bands of some of the hairs; tail not edged with black, but like that of the type.

A half-grown female topotype (No. 2395, August 9, 1894) has the hairs of the back unbanded and is clay color above, beautifully marked with small irregular white spots.

Size.—The only specimen measured in the flesh (No. 2391, male, old adult, from Blitches Ferry, Citrus county, Florida) afforded the following: Total length, 1,600; tail vertebræ, 280; hind foot, 500 (measured by the collector, F. L. Small).

The skull.—The skull of *Cariacus osceola* is very small; it is different in general shape from that of *C. americanus*, being much narrower and proportionally longer; the zygomatic arch lies much closer to the skull, and thus heightens its slender appearance; the nasal bones are long and slender, being about the length and about half the width of those of *C. americanus;* the whole rostral portion is slender. In *C. osceola* the nasal and premaxillary bones meet. In *C. americanus* the nasal and premaxillary are separated by a forward arm of the maxillary. (This arm of the maxillary varies somewhat in width, but is present in every skull of *C. americanus* I have examined, young and adult, while in every skull of *C. osceola*, both young and adult, that I have seen it is altogether absent.)

The teeth.—The molar and premolar teeth of *C. osceola* differ enormously in size from those of *C. americanus*. Every tooth is actually larger than the corresponding tooth in *americanus*, and the tooth row consequently longer.

The antlers.—The antlers of the male *C. osceola* apparently never attain a great size. No. 2391, which is a very old deer with four prongs, only measures 413 millimeters across the greatest stretch of his antlers, and the antlers themselves are small and light. *C. americanus* No. 4999, from Bucksport, Maine, is about the same age as No. 2391 and has also four prongs; they are much larger and heavier and measure across the greatest stretch 636 millimeters.

The Florida deer is of very general distribution over the whole of peninsular Florida, but in the more thickly settled and accessible parts of the State it has been much reduced in numbers of late. Its northern range is unknown to me, and I am therefore unable to state whether or not it overlaps the range of *C. americanus*.

Cranial Measurements of Cariacus americanus (Erxl.) *and Cariacus osceola* Bangs.

Number.	Sex and age.	Locality.	Basilar length (basion to front of premaxillary).	Occipito-nasal length.	Zygomatic breadth across middle of orbits.	Mastoid breadth.	Least interorbital breadth.	Greatest length of nasals.	Least breadth of nasals.	Length of upper tooth row on alveoli.	Greatest length of single half of mandible.	Length of lower tooth row on a veoli.
C. americanus.												
4999	♂ old ad	Maine, Bucksport.....	296.0	259.5	136.0	109.0	82.0	96.0	26.0	79.5	240.5	82.0
5000	♀ old ad.	" "	259.0	231.0	121.5	90.0	72.0	90.0	24.0	66.5	221.0	73.5
C. osceola.												
2391	♂ old ad.	Florida, Blitches Ferry, Citrus county.	254.5	229.5	113.0	91.0	70.0	87.5	17.5	76.0	216.0	78.0
2392	♂ old ad.	Florida, Citronelle, Citrus county.	263.0	241.0	114 5	94.0	67.0	93.0	18.0	77.0	229.5	84.0
2394	♀ ad.....	Florida, Citronelle, Citrus county.	220.0	202.0	91.0	70.5	51.5	83.0	14.0	73 0	194.5	80.0
2393	♀ ad..	Florida, Citronelle, Citrus county.	211.0	197.5	94.5	69 0	59.9	80.0	15.5	72.5	189.0	82.0

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

FOURTH LIST OF ADDITIONS TO THE FLORA OF WASHINGTON, D. C.

BY THEO. HOLM.*

The present paper is supplemental to Prof. Lester F. Ward's 'Guide to the Flora of Washington and Vicinity.'† It constitutes the fourth addition, and I have followed the same principles of nomenclature and arrangement as in the above-cited work of Professor Ward. I have also, in accordance with my previous addition,‡ not only enumerated such species as are new to the flora, and which are marked with an asterisk, but have also included a number of the rarer species recorded from new localities.

In spite of the fact that comparatively few of the Washington botanists are interested in the local flora, we have, nevertheless, succeeded in accumulating a very considerable amount of material for the study of the geographical distribution of plants within the limits of the flora. It is very interesting to see that several of the plants that have been recorded as new in the later additions are only new so far as concerns Professor Ward's flora. Several of them were already recorded by Brereton in his Prodromus,§ but not included in the list given by Professor Ward.

* Presented at a meeting of the Biological Society of Washington, November 30, 1895.

† Bulletin No. 22, U. S. National Museum, 1881.

‡ Holm, Theo.: Proc. Biol. Soc., vol. vii, 1892, pp. 105–132.

§ Brereton, John A.: Floræ Columbianæ Prodromus. Washington, 1830.

These species belong almost exclusively to the fourth category, under which Professor Ward (l. c., p. 14) has designated a number of plants which he thought had either been exterminated or had accidentally disappeared since the publication of the Prodromus. Some of these plants are now known to be quite abundant in certain localities; for instance, *Apocynum androsæmifolium*, *Rhexia mariana*, *Polygala verticillata*, *Polygonum tenue* and *Cyperus flavescens*.

This fact seems to show that the flora of the District is yet but imperfectly known. There are, indeed, many and most interesting localities that have not yet been explored, and I will merely recall the fact that the southern and southeastern part of the District is still almost unknown. There is that interesting locality where Mr. G. W. Oliver obtained so many rare plants, which was recorded in the third addition as "the vicinity of Silver Hill."

This locality comprises the large forests, with creeks and sphagnum swamps, which lie between Silver Hill post-office and Surattsville, Prince George's county, Md. A visit to these forests shows us only too clearly that there is certainly a good deal of work to be done before we should venture to declare that we know our local flora. We meet here with species which are either not recorded in Professor Ward's flora or only enumerated as rare and of which several have been observed to occur in the greatest abundance, such as *Ilex glabra*, *Rhyncospora cephalantha*, *Agrostis elata*, *Uniola gracilis*, *Aristida purpurascens*, *Xyris flexuosa*, etc. The same is the case with several other places which have only been lately explored. Brookland, for instance, is the home of twenty species of *Panicum*, several of which have never been noticed before, although they are very common; there grow, also, *Apocynum androsæmifolium*, *Sporobolus vaginaflorus and Agrostis elata* quite abundantly.

But, besides these truly indigenous species, I have also noted some others, which have been accidentally introduced—*e. g.*, *Tribulus maximus* * and *Leptochloa mucronata*,† both of which appeared suddenly in the Agricultural grounds. *Leptochloa* was very abundant, with ripe seeds, and it may, therefore, also spread to other parts of the city and become a well-established citizen.

Among the species enumerated in the following list are several

* Found by G. H. Hicks.

† Found by the author.

which Professor Ward had considered so common that no special locality was recorded. Extended researches have, however, induced me to arrange some of these among the rarer plants, and I thought, also, that in this way a better idea of their distribution might be obtained.

3. Clematis Virginiana L.

Along the Canal road near the Eighth lock. G. H. Hicks.

10. Anemone nemorosa L.

Banks, Four-Mile Run. R. R. Gurley.

13. Ranunculus pusillus Poir.

A very large specimen was collected in a stagnant pool by Piney Branch, at the north end of Seventeenth street. G. H. Hicks.

26. Aconitum uncinatum L.

Near Chevy Chase. G. H. Hicks.

40. Papaver dubium L.

Bank of Potomac above Rosslyn, Va., near the Seventh lock along the Canal road. G. H. Hicks.

45. Fumaria officinalis L.

Along Bates road near Bunker Hill. The author.

47. Nasturtium sylvestre R. Br.

Potomac flats near the Seventh lock. G. H. Hicks.

51. Nasturtium Armoracia Fries.

Along a ditch near Terra Cotta, escaped. The author.

55. Arabis dentata T. & G.

Along the Canal road near the Seventh lock. G. H. Hicks.

61. Cardamine hirsuta L. (*C. intermedia* Horn.)

Rock Creek. G. H. Hicks. The Zoölogical Park; in full bloom the 10th of May, 1895. The author.

* **62*a*. Cardamine parviflora** L.

Shaded woods in Brookland; in moist, rich soil near Terra Cotta. The author.

* **62*b*. Cardamine silvatica** Link.

Terra Cotta swamp; Rock Creek. The author.

* **62*c*. Cardamine Pennsylvanica** Muhl.

Meadow near Rosslyn. T. H. Kearney, Jr. Rock Creek near the Zoölogical Park; in creeks on the Virginia shore of the Potomac, one mile above Aqueduct Bridge. In flower the second week of May. The author.

It seems, according to the Synoptical Flora of North America,* that these species of *Cardamine* are not well understood in this country. The difficulty in distinguishing them is evidently due to insufficient European material for comparison. The name *Cardamine hirsuta* L. is very mislead-

* Vol. I, part I. Continued and edited by B. L. Robinson, 1895, page 158.

ing, and I have therefore added as a synonym *C. intermedia* Horn. This name is used by Professor Lange,* since Linnæus undoubtedly included Link's *sylvatica* under his *hirsuta*, until Hornemann separated them, naming the last of these '*intermedia*.' † They are very different from each other, and we add the following characters as supplemental to those already given in the Synoptical Flora (l. c.):

Cardamine hirsuta L. (*C. intermedia* Horn).

Basal leaves very numerous and persisting for a long time, large and forming a dense rosette; they are most often smooth; the terminal leaflet is larger than the lateral ones, orbicular or reniform. Flowering stems, several, simple or with a few branches, ascending from a decumbent base. The uppermost pods surmount the flowering part of the raceme.

This species is said to be "abundant about Washington, D. C.," which is evidently a mistake. It might have been confounded with *C. sylvatica* Link.

Cardamine parviflora L.

The basal leaves are few in number and early fading; the plant is strictly annual; otherwise the description in the Synoptical Flora (l. c.) corresponds very well to this species.

Cardamine silvatica Link.

This species is not mentioned in the Synoptical Flora. The basal leaves are few, early fading; those of the stem numerous, with large and broad divisions, the margin dentate. The pods are borne on more or less horizontal pedicels, and the uppermost ones are hardly surpassing the flowering part of the raceme. The plant is most often biennial in the vicinity of Washington, but occurs also as a perennial in Europe.

63. Dentaria heterophylla Nutt.

The Zoölogical Park. The author.

63a*. **Dentaria cardiophylla** Robinson.

Described in the Synoptical Flora (l. c., p. 155).

Collected in Rock Creek by George R. Vasey.

72. Camelina sativa (L.) Crantz.

Near Rosslyn, Va. T. H. Kearney, Jr.

77a*. **Lepidium Draba.**

Lincoln Park. A. G. Maesins.

80. Helianthemum Canadense Michx.

Sand hills near Terra Cotta. The author.

82. Viola lanceolata L.

Bladensburg. M. B. Waite.

90. Viola striata Ait.

Near Glen Echo, along the Canal road. G. H. Hicks. On the Virginia shore of the Potomac, two miles above Aqueduct Bridge. The author.

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*Lange, Joh. Haandbog i den Danske Flora. Kjöbenhavn, 1886–'88, page 629.

†Hornemann, l. W. Oekonomisk Plantelære, 1821–'39, page 714.

94. Viola tricolor L., var. **arvensis** Ging, is **V. tenella** Muhl.

96. Polygala incarnata L.

Near Chevy Chase; Takoma. G. H. Hicks. In pine woods in several places around Brookland. The author.

99*a*. Polygala Curtissii Gr., var. **pycnostachya** Gr.

Near Carlins, Va.; Takoma. G. H. Hicks. Terra Cotta swamp; near Surattsville, Prince George County. G. W. Oliver and the author.

100. Polygala ambigua Nutt.

In a dry field along the Walker road near Surattsville. The author.

101. Polygala verticillata L.

Bunker Hill; Brookland. The author. Near Chevy Chase. G H. Hicks.

***104*a*. Saponaria Vaccaria** L.

Along the railroad track near University Station; in bloom third week of May, 1894. The author.

106. Silene nivea D. C.

Bank of Potomac, two miles above Aqueduct Bridge, Va. G. H. Hicks.

108. Silene Armeria L.

Among wheat near Garrett Park. The author.

122. Anychia dichotoma Michx.

Open places in the pine woods around Brookland. The author.

145. Linum striatum Walt.

Very abundant in Terra Cotta swamp, near the railway track. The author.

149. Geranium columbinum L.

Hillside near Aqueduct Bridge, on the Virginia shore. The author.

158*a*. Ilex glabra (L.) Gr.

Abundant in woods along the Walker road between Camp Spring P. O. and Surattsville. G. W. Oliver, W. T. Swingle, and M. B. Waite.

161. Ilex lævigata Gr.

With the preceding.

174. Acer saccharinum Wang.

This species has spread from the city parks to the woods between Eckington and the Catholic University. The author.

194*a*. Trifolium medium L.

Reported by Mr. G. B. Sudworth and published in the Third Addition to the Flora of the District; not this species, but merely a form of *T. pratense* L.

216. Desmodium ciliare D. C.

Common in open pine woods, Brookland. The author.

217. Desmodium Marilandicum Boott.

Very scarce in dry fields, Brookland. The author.

230. Clitoria Mariana L.

Near Carlins, Va., near Fort Reynolds, Va. G. H. Hicks.

234. Phaseolus perennis Walt.

Near Carlins, Va., and near Fort Reynolds. G. H. Hicks.

250. Spiræa Aruncus L.

Very common near Garrett Park. The author.

256. Rubus hispidus L.

Exceedingly abundant in the swamps near Surattsville. W. T. Swingle, M. B. Waite and the author.

259. Rubus cuneifolius Pursh.

Dry hillside near Silver Hill P. O. The author.

270. Poterium Canadense B. & H.

Terra Cotta swamp. The author.

272. Rosa setigera Michx.

Along Rock Creek below Pierce's Mill. G. H. Hicks.

278. Pirus coronaria L.

South Brookland. Robert Ridgway.

295*a*. Ribes floridum l'Her.

Near the Baptist Church in Brookland, 1895. Now destroyed. The author.

300. Drosera rotundifolia L.

Common in swamps between Camp Spring P. O. and Surattsville. G. W. Oliver and the author.

304. Proserpinaca palustris L.

Not common. One mile above Glen Echo. T. H. Kearney, Jr.

304*a*. Callitriche Austini Eng.

Several places in the woods around Brookland. The author. It is evidently not rare, but overlooked. It grows in deep shade on black, rich soil.

305. Callitriche verna L.

Pool near Piney Branch, at the north end of Seventeenth street. G. H. Hicks.

316*a*. Oenothera pumila L.

Near Surattsville. W. T. Swingle and M. B. Waite.

317. Oenothera sinuata L.

A single specimen was collected in a dry field, South Brookland. The author.

327. Hydrocotyle ranunculoides L.

Under Bennings bridge. The author. Above Rosslyn. G. H. Hicks.

339. Chaerophyllum procumbens Crantz.

Not common, and has only been observed along the Potomac shore, on both sides of the river, but especially on the Virginia side. It has been collected on the Maryland side along the Canal, near the Seventh lock, by G. H. Hicks.

345. Pastinaca sativa L.

Clover field in South Brookland; along the electric car track near Eckington. The author.

* **348***a*. **Caucalis Anthriscus** Huds.

A single specimen near Bathing Beach, back of the Monument grounds; July 5, 1894. G. H. Hicks.

351. Aralia nudicaulis L.

High Island. T. H. Kearney, Jr. Blagden's Run. G. H. Hicks.

384. Fedia olitoria Vahl.

Island of the Potomac, near the Seventh lock. G. H. Hicks. South Brookland. The author.

The specimens which Mr. Hicks has collected were rather robust for the typical species. The corolla was, however, light blue. Therefore I have not hesitated in recording them under this species.

390*b*. **Eupatorium semiserratum** D. C.

Great Falls. The author.

391. Eupatorium hyssopifolium L.

Woods near Glen Echo. G. H. Hicks. Brookland. The author.

391*a*. **Eupatorium altissimum** L.

Island in Potomac, near the Seventh lock. G. H. Hicks.

400. Eupatorium aromaticum L.

Rock Creek. G. H. Hicks.

402. Mikania scandens L.

Swamp between Eckington and the Catholic University. Robert Ridgway.

426. Sericocarpus solidagineus Nees.

Rather rare. Dry field, Surattsville. The author.

430. Aster concolor L.

Surattsville. The author.

494*a*. **Bidens connata** Muhl., var. **comosa** Gray.

Bank of Potomac, opposite mouth of Cabin John's Run, Md. G. H. Hicks. Ditch near Metropolis View; along a creek near the Catholic University. The author.

497*a*. **Galinsoga parviflora** Cav.

Near Bureau of Engraving and Printing. G. H. Hicks. Massachusetts avenue, between Fourteenth and Fifteenth streets. The author.

504*a*. **Senecio vulgaris** L.

Potomac flats near Bureau of Engraving and Printing. G. H. Hicks.

536. Tragopogon porrifolius L.

Near Eckington, escaped. The author.

539. Lobelia puberula Michx.

Rock Creek. G. H. Hicks. Swamp near Silver Hill. The author.

542. Specularia perfoliata A. DC.

A form without corolla is common in shaded woods around Brookland. The author.

543. Campanula Americana L.

Island of the Potomac, opposite the Eighth lock. G. H. Hicks.

543*a*. Campanula aparinoides L.

Terra Cotta swamp; quite abundant among *Lilium superbum*. The author.

551. Gaultheria procumbens L.

Burnt Mills; near Surattsville. M. B. Waite.

564. Pyrola secunda L.

Garrett Park. P. H. Dorsett.

565. Pyrola chlorantha Swtz.

Garrett Park. P. H. Dorsett.

566. Pyrola elliptica Nutt.

Garrett Park. The author.

567. Pyrola rotundifolia L.

Near Chevy Chase. G. H. Hicks.

569. Monotropa Hypopitys L.

The typical form is not rare in the District and seems to correspond exactly to the European plant. But a very peculiar form has also been collected, which differs from the description given of *M. Hypopitys* so much that it seems to represent a distinct species. It is, for instance, of a red, almost blood-red, color and densely pubescent all over. I have secured some material of the European plant, preserved in alcohol, and it is my intention to give a detailed account of the characters, morphological and anatomical, so as to decide whether we shall consider this plant to represent a species or only a variety. It has been collected in Rock Creek by G. H. Hicks and near Arundel (Anne Arundel County, Md.), by M. B. Waite.

570. Dodecatheon Meadia L.

Near Cabin John's Bridge. A. J. Pieters.

585*a*. Apocynum androsæmifolium L.

Very common in low grounds in South Brookland. The author.

589. Asclepias rubra L.

Sphagnum swamp near Surattsville. J. Krause and the author.

594. Asclepias obtusifolia Michx.

Not common. Brookland. The author.

595. Asclepias variegata L.

The Zoölogical Park; Blagden's mill-race. G. H. Hicks. Brookland. The author.

597. Asclepias verticillata L.

In pine woods at Brookland. The author.

605. Gentiana ochroleuca Froel.

Blagden's Run; Glen Echo. G. H. Hicks. Brookland. The author.

608. Phlox paniculata L.

Near Glen Echo. G. H. Hicks.

615*a*. Phacelia Covillei Wats.

Island near the Seventh lock. G. H. Hicks. Very abundant on High Island. M. B. Waite.

617. Phacelia parviflora Pursh.

About two miles above Aqueduct Bridge, on the Virginia shore of the Potomac. The author. Along the Canal road near the Seventh lock. G. H. Hicks.

623. Myosotis laxa Lehm.

In a pool near the north end of Seventeenth street and Piney Branch. G. H. Hicks.

634. Ipomæa lacunosa L.

The Canal road near the Seventh lock. G. H. Hicks.

635. Convolvulus spithamæus L.

Very abundant in open thickets in North and South Brookland. The author. Ivy City. T. H. Kearney, Jr.

637. Convolvulus arvensis L.

Along the electric car track between Eckington and the Catholic University. The author.

643. Physalis pubescens L.

Bank of the Potomac back of the Twelfth lock. G. H. Hicks.

643*a*. Physalis Philadelphica Lam.

Bank of Potomac opposite mouth of Cabin John's Run. G. H. Hicks.

657. Pentstemon lævigatus Soland.

Common in South Brookland. The author.

660. Herpestis nigrescens Bth.

Great Falls (Virginia side). M. B. Waite.

666. Veronica Americana Schwein.

Potomac Boat Club landing, Virginia. G. H. Hicks.

669. Veronica serpyllifolia L.

Woodley Park. The author.

671*a*. Veronica hederifolia L.

The Virginia shore of the Potomac, two miles above Aqueduct Bridge. The author.

680. Melampyrum Americanum Michx.

Takoma Park. G. H. Hicks.

681. Orobanche minor L.

Magnolia Run. G. H. Hicks.

682. Aphyllon uniflorum Gr.

North Brookland. The author.

686. Utricularia gibba L.

Opposite the Eleventh lock, Maryland. G. H. Hicks.

724. Monarda punctata L.

Not common. Rock Creek near Brightwood. G. H. Hicks. North Brookland. The author.

725. Lophanthus nepetoides Bth.

Bank of the Potomac near the Twelfth lock, Maryland. G. H. Hicks.

732*a*. Scutellaria parvula Michx.

On dry, sandy soil, North and South Brookland. The author.

745. Plantago Patagonica Jacq. var. **aristata** Gr.

East Brookland; around Allentown, Prince George County, Md. The author. Near Fifteenth and W streets. G. H. Hicks. Near Chevy Chase. M. B. Waite.

747. Amarantus paniculatus L.

Near Pierce's mill. G. H. Hicks. Around Silver Hill, Prince George County. The author.

749. Amarantus albus L.

Near Bureau of Engraving and Printing. G. H. Hicks.

***769*a*. Polygonum Muhlenbergii** Watson.

Potomac flats, opposite the Eighth lock, Maryland. G. H. Hicks.

773*a*. Polygonum tenue Michx.

Abundant in dry fields, Brookland; sandy soil near Terra Cotta. J. Krause and the author.

780. Rumex Britannicus L.

Potomac flats near Rosslyn, Va. G. H. Hicks.

781. Rumex verticillatus L.

With the preceding. G. H. Hicks.

800. Euphorbia commutata Engelm.

Glen Echo. T. H. Kearney, Jr. and G. H. Hicks.

843. Quercus ilicifolia Wang.

Abundant near Laytonsville and Goshen, Montgomery County, Md. George B. Sudworth.

901. Habenaria tridentata Hook.

Near Chevy Chase. G. H. Hicks. North Brookland. The author.

904. Habenaria lacera R. Br.

Terra Cotta swamp. The author. Swamp near Surattsville. J. Krause and the author.

911. Pogonia ophioglossoides Nutt.

Sphagnum swamp near Surattsville. W. T. Swingle and M. B. Waite.

912. Pogonia verticillata Nutt.

North Brookland; near Terra Cotta. The author.

922. Cypripedium pubescens Willd.

Blagden's Mill, Rock Creek. R. R. Gurley. Burnt Mills. M. B. Waite. South Brookland. The author.

925. Aletris farinosa L.

Very common around Surattsville. The author. Near Arundel, Md. M. B. Waite.

955. Trillium sessile L.

Island near the Seventh lock. G. H. Hicks.

957. Veratrum viride Ait.

Magnolia Run. L. H. Dewey. Garrett Park. The author.

***962*a*. Muscari racemosa** Nutt.

Island near the Seventh lock. G. H. Hicks.

982. Commelina hirtella Vahl (*C. erecta* L)
Bennings Bridge. The author.

***982*a*. Commelina communis** L.
Magnolia Run, Rock Creek Park. G. H. Hicks.

983. Commelina Virginica L.
Flats of the Potomac under Chain Bridge. The author.

985. Xyris flexuosa Muhl.
Along the railroad track near Carlins, Va. G. H. Hicks. Sphagnum swamps in the woods near Surattsville. The author.

988*a*. Cyperus aristatus Rottb. (*C. inflexus* Muhl.).
Muddy bottom of Potomac, opposite mouth of Cabin John Run, Md. G. H. Hicks.

998. Cyperus retrofractus Torr.
South Brookland. The author.

***999*a*. Kyllinga pumila** Michx.
Holmead swamp. M. B. Waite.

***1000*a*. Hemicarpha subsquarrosa** Nees.
Potomac flats opposite the Ninth lock, Md. G. H. Hicks.

***1004*a*. Eleocharis intermedia** Schult.
Opposite the Eighth lock, Md. G. H. Hicks.

1007. Scirpus planifolius Muhl.
On dry, grassy slopes in the Zoölogical Park. The author.

1010. Scirpus debilis Pursh.
Potomac flats opposite the Ninth lock, Md. G. H. Hicks. Sphagnum swamp near Silver Hill. The author.

1017. Eriophorum Virginicum L.
Sphagnum swamp near Surattsville. The author.

1019, Fimbristylis capillaris Gr.
Along the railroad track near Carlins, Va. G. H. Hicks. North Brookland. A. J. Pieters.

1020. Rhyncospora alba Vahl.
Sphagnum swamp near Surattsville. The author.

1021*a*. Rhyncospora cephalantha Gr.
Common in swamps around Surattsville and Silver Hill. The author.

1024. Scleria pauciflora Muhl.
Grassy knoll near Aqueduct Bridge on the Virginia shore of the Potomac. The author.

1025. Carex polytrichoides Muhl.*
Magnolia Run, Rock Creek Park; Sphagnum swamp near Surattsville. The author.

1026. Carex Willdenovii Schk.
Bunker Hill; Corcoran's woods. The author.

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* Professor Charles F. Wheeler has kindly revised the entire collection of the genus *Carex* recorded here.

1030a*. **Carex conjuncta** Boott.
High Island. The author.

1030b*. **Carex alopecoidea** Tuckerm.
Low meadow near the Insane Asylum. The author.

1031. **Carex stipata** Muhl.
Rock Creek woods. G. H. Hicks. Near Surattsville. The author.

1035a*. **Carex Muhlenbergii** Schk., var. **enervis** Boott.
High Island and along the Canal road; not rare. G. H. Hicks and the author. Bunker Hill. The author.

1040. **Carex lagopodioides** Schk.
The name should be changed to *C. tribuloides* Wahlbg.

1040a*. **Carex tribuloides** Wahlbg., var. **reducta** Bailey.
Common in shady places around Brookland; Insane Asylum. The author.

1047. **Carex torta** Boott.
Cabin John Run. G. H. Hicks.

1051. **Carex Shortiana** Dew.
High Island, near the river shore. The author.

1055. **Carex glaucodea** Port.
Bunker Hill. Open woods in North Brookland. The author. Along the towpath, C. and O. Canal, near Georgetown. T. H. Kearney, Jr.

1056. **Carex pallescens** L.
Grassy knoll near Aqueduct Bridge, on the Virginia shore of the Potomac. The author.

1063. **Carex platyphylla** Carey.
Shaded places on the rocks near Aqueduct Bridge, on the Virginia shore of the Potomac. The author.

1065. **Carex retrocurva** Dew.
On the rocks near Aqueduct Bridge, on the Virginia shore of the Potomac. The author.

1067. **Carex laxiflora** Lam.
The type seems to be rare; near the Insane Asylum. Lester F. Ward. Brookland. The author.

1072a*. **Carex laxiflora** Lam., var. **divaricata** Bailey.
Near Washington, D. C. George Vasey. Rock Creek. G. H. Hicks.

1072*b*. **Carex laxiflora** Lam., var. **patulifolia** Carey.
Common in the woods around Brookland. The author.

1074. **Carex oligocarpa** Schk.
Rare. On shaded rocks on the Virginia side of the Potomac near Aqueduct Bridge. The author.

1075. **Carex umbellata** Schk.
Bunker Hill; sandy hills around Terra Cotta. The author.

1076. **Carex Emmonsii** Dew.
In Professor Ward's catalogue is *C. varia* Muhl.

*1078*a*. **Carex communis** Bailey.

This species has undoubtedly been observed before in the District, but confounded with *C. Pennsylvanica* Lam. It is closely related to this last, from which it differs, however, by its cespitose growth without stolons. The scales of the staminate and fertile inflorescences are usually purplish, but lighter than those of *C. Pennsylvanica*. It is very common on the rocks of the Potomac shore, Virginia. The author.

*1078*b*. **Carex communis** Bailey, var. **Wheeleri** Bailey.

With the preceding. The author.

1080. **Carex pubescens** Muhl.

Cabin John Run; the Zoölogical Park. The author.

1081. **Carex prasina** Wahl. (*C. miliacea* Muhl.).

Woodley Park; the Potomac shore, three miles above Aqueduct Bridge, Va. The author.

1090. **Carex lupulina** Muhl.

Near Rosslyn, Va.; Potomac flats. G. H. Hicks. The Zoölogical Park. William Hunter.

1091. **Carex folliculata** L.

Takoma. T. H. Kearney, Jr. Magnolia Run, Rock Creek Park; abundant in the woods along Walker road, between Camp Spring P. O. and Surattsville. The author.

1092. **Carex squarrosa** L.

Near Chevy Chase circle. G. H. Hicks. Garrett Park. The author.

1093. **Carex stenolepis** Torr.

Common in South Brookland. The author.

1101. **Sporobolus asper** Beauv.

High Island. L. H. Dewey.

1101*a*. **Sporobolus vaginæflorus** Torr.

Common in low grounds, Brookland; the lawns in the Smithsonian Park, and around the Catholic University. The author.

*1104*a*. **Agrostis elata** Trin.

Common in pine woods, Brookland; also in the deciduous forests along Walker road, near Silver Hill, Surattsville, etc. The author.

1107. **Muhlenbergia sobolifera** Trin.

Woods in North Brookland, but very scarce. The author.

1114. **Calamagrostis Nuttalliana** Steud.

Takoma. F. L. Scribner, T. H. Kearney, Jr., and L. H. Dewey.

1119. **Aristida purpurascens** Poir.

Along the roads; very common near Allentown and Surattsville.

1125*a*. **Eatonia obtusata** Gr.

Dry fields, North Brookland. The author.

*1126*a*. **Eatonia Dudleyi** Vasey.

Brookland. Terra Cotta. The author. Rock Creek. L. H. Dewey.

This species is recorded in Professor Ward's Flora of the District as a slender wood form of *E. Pennsylvanica* Gr.

1126b*. A hybrid between **Eatonia Pennsylvanica** Gr. and **Trisetum palustre** L.

Has been described by Dr. George Vasey,* who found several specimens of this peculiar form in a low meadow on the banks of Hunting Creek, near where it empties into the Potomac River, a mile below Alexandria, Va.

1136. **Poa sylvestris** Gr.

High Island; on the Virginia shore of the Potomac near Aqueduct Bridge. The author.

1137. **Poa flexuosa** Muhl.

The Zoölogical Park. The author.

1143. **Eragrostis Purshii** Schrad.

Abundant along the railroad track between University Station and Terra Cotta. The author.

1153*a*. **Bromus tectorum** L.

Near the Navy Yard. The author.

1158. **Uniola gracilis** Michx.

Rock Creek. G. H. Hicks. Several places in the woods between Silver Hill and Surattsville. The author.

1172. **Phalaris Canariensis** L.

Waste grounds south of the Bureau of Engraving. G. H. Hicks.

1172*a*. **Phalaris arundinacea** L.

Ditch near Bates Road. The author.

1179. **Panicum proliferum** Lam.

Very common along the streets in Brookland. The author.

1180a*. **Panicum capillare** L., var. **minima** Engelm.

Common on dry, sandy soil in Brookland; near Silver Hill. The author.

1183a*. **Panicum commutatum** Schultes.

Extension of Kenesaw Avenue, Rock Creek. G. H. Hicks. Takoma; Four Mile Run. T. H. Kearney, Jr. Common in Brookland; near Surattsville; Terra Cotta. The author.

1185. **Panicum microcarpon** Muhl.

Takoma. T. H. Kearney, Jr. Brookland. The author.

1186. **Panicum viscidum** Ell.

Brookland; Terra Cotta swamp near the railroad track. The author.

1187. **Panicum scoparium** Lam.

Great Falls. F. L. Scribner.

1187*a*. **Panicum sphærocarpon** Ell.

Bunker Hill; North Brookland. The author. Takoma. T. H. Kearney, Jr.

1188a*. **Panicum ramulosum** Michx.

Sphagnum swamp near Takoma. F. L. Scribner and T. H. Kearney, Jr.

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* Botanical Gazette, vol. ix, 1884, p. 165.

1188*b*. Panicum nitidum Lam.
North Brookland; Bunker Hill. The author.

* **1188*c*. Panicum lanuginosum** Ell.
Brookland; Garrett Park. The author.

* **1188*d*. Panicum pubescens** Lam.
Brookland. The author.

1197. Tripsacum dactyloides L.
Near Silver Hill. The author.

1198 Erianthus alopecuroides Ell.
Takoma. F. L. Scribner. Field between Jackson City and Arlington, Va. G. H. Hicks.

1219. Woodwardia angustifolia Smith.
Very abundant in the woods near Surattsville. The author.

1229. Aspidium cristatum Swtz.
Numerous fruit-bearing specimens were observed near Chevy Chase. G. H. Hicks.

1236. Cystopteris fragilis Bernh.
Flats under Chain Bridge. The author.

1240. Lygodium palmatum Swtz.
Near Arundel, Md. M. B. Waite.

1245. Botrychium ternatum Swtz., var. **dissecta** Milde.
Near Chevy Chase circle. G. H. Hicks. Along Bates road near Terra Cotta swamp. The author.

1247. Ophioglossum vulgatum L.
In the woods near Garrett Park. M. B. Waite.

1252. Selaginella rupestris Spring.
Rediscovered near Great Falls by M. B. Waite.

1253. Selaginella apus Spring.
Swamp near Silver Hill. The author.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON.

ON A SMALL COLLECTION OF MAMMALS FROM LAKE EDWARD, QUEBEC.

BY OUTRAM BANGS.

Early in September, 1895, my brother, E. A. Bangs, and I made a short collecting trip to Quebec. Our original plan was to spend all our time at Roberval, on Lake St. John, the most northern locality reached by railroad in eastern North America. But Lake St. John proved a great disappointment. The town of Roberval lies in a dreary valley, that seems wholly destitute of mammalian life. The forest has been cleared away and the barren fields and desolate scrub are wholly unfit to supply the needs of even the smaller mammals. Had we been fitted for camping out we could undoubtedly have found a rich field up one of the many rivers that pour their waters from every direction into this great basin; but we were not. After wasting two days in a vain endeavor to find any place within walking distance of Roberval suited to our work, we turned our backs on Lake St. John and went down the railroad about sixty-five miles to Lake Edward.

The town of Lake Edward is on the northern end of the lake of the same name, and lies in the heart of a rich Hudsonian forest. The lake is about twenty-three miles long and terminates in the Jeannotte river. A great part of the shores of both lake and river are still clothed in primeval forests, but the busy saw-mill at Lake Edward, with its daily consumption of five hundred logs, is fast eating up this old growth and leaving behind only white birch and small second-growth spruce and fir.

This forest contains very few species of trees, of which the white birch is the commonest, with spruce and fir in about equal numbers next, and now and then a solitary white pine. The mountain ash and the spiked maple are very common, but hardly attain to the dignity of trees. In many places where the forest has been burnt a dense growth of raspberry bushes and dwarf cherry immediately springs up, and it is many years before the trees again take possession of the land. The monotony of the forest is here and there broken by little alder swamps along the many brooks, or by open sphagnum barrens with their clumps of *Ledum latifolium* and *Kalmia glauca*. In this northern latitude the fallen trees lie on the ground for a long time without decaying, and the accumulation of centuries covered by a luxuriant growth of moss makes walking through the forest a matter of the greatest difficulty. There are no roads anywhere, all the logging being done by water, but the abundance of lakes connected by rivers or brooks makes the country very accessible by canoe.

Trapping in the northern forest in the tangled mass of fallen trees and granite boulders covered by a deep growth of moss is a very different thing from trapping in open country. In the open southern woods, with but little rubbish on the ground, one takes as much in traps that have been set a week or ten days in one spot as one does the first day, and when the supply is used up, it is then little use to move the trap, as all the small mammals from near about have already found it. It is not so in the northern forest, where distance means much more and the small mammals are very local and do not travel far. The first day or two will exhaust the supply in one spot, but a move of only a few yards will again yield specimens in about the same number.

We were disappointed in not getting *Phenacomys*, but it is possible that the animal does occur here locally.

There were a few mammals we knew to occur in the immediate vicinity of Lake Edward that we were unable to get, and perhaps it is as well to mention these. Flying squirrels and chipmunks were said by the Indians and French Canadians to occur, but we saw none. Moose and caribou were both quite plentiful. I found a fresh caribou track one morning where the animal had come out of the forest and walked along the railroad for about a mile.

The red fox was abundant, and we found many signs. The section man on the railroad told me foxes were sometimes killed

by the train, and that he had picked them up on several occasions when going over the road on his hand-car in the morning. The trappers get otter every winter, and the black bear is fairly common. The wolverine is still sometimes met with and occasionally this expert trap robber proves a great nuisance to the trapper in the winter by finding his line of deadfalls, following it up, demolishing every one, and eating the bait and any animal that may have been caught.

Sciurus hudsonicus Erxl. Red Squirrel. 5 specimens.

Red squirrels were extremely abundant and a great nuisance, as they persisted in getting into our mouse traps, and as the traps were usually not strong enough to kill them outright they carried away a great many. A few that were caught around the neck in the Schnyler mouse traps were killed. We also caught a great number in steel traps baited with salt pork or meat.

Castor canadensis Kuhl. American Beaver. 3 specimens.

Beaver are still quite common in all this region, but are relentlessly pursued by the Indians and are decreasing very fast. The nearest beaver to Lake Edward were on the Jeannotte river. We were too busy to go after them ourselves and so hired two Indians and sent them down the Jeannotte. In five days they returned with a whole family of beaver—an old male and female and three young. Unfortunately they had utterly ruined the old female and one of the young by shooting them in the heads with their rifles. The old male was a very fine, large beaver and according to the Indians was five years old. The specimen measured: total length, 1,130; tail, 410; hind foot, 176.

The same two Indians, in the winter of 1894-1895, killed sixty beaver and told me they expected to get about forty this winter. In addition to the Indians, there are many other trappers working this country every season with great thoroughness, and the beaver stand but a poor chance.

Synaptomys fatuus sp. nov. Northern Lemming Mouse. 9 specimens.

Type No. 3857, coll. of E. A. and O. Bangs; female adult, from Lake Edward, Quebec, September 28, 1895. Total length, 125; tail, 16; hind foot, 19. E. A. and O. Bangs, collectors.

General characters.—Slightly smaller and darker than *S. cooperi*, with smaller and lighter skull and much narrower and shorter incisors. Coat very long and full.

Color.—Upper parts sepia brown, thickly interspersed with black-tipped hairs; under parts slate gray, with in places a slight brownish tinge; feet drab; tail nearly unicolor, slightly paler below, darker at the tip, and sparsely haired.

Skull.—The skull, as compared with that of *S. cooperi*, is rather smaller and narrower, with less spread to the zygomata and more slender rostrum.

Teeth.—The molar teeth are substantially the same as in *S. cooperi*, but the incisors are very much narrower and shorter.

Measurements of nine Specimens of S. fatuus.

No.	Sex and age.	Date.	Total length.	Tail.	Hind foot.
3857	♀ ad.	Sept. 25, 1895	125	16	19
3855	♂ yg. ad. . .	Sept. 27, 1895	114	11 (bobtail)	18
3854	♂ ad.	Sept. 24, 1895	123	20	18.5
3858	♀ yg. ad. . .	Sept. 27, 1895	114	15	17.5
3859	♀ yg. ad. . .	Sept. 24, 1895	113	19	19
3856	♀ yg. ad. . .	Sept. 27, 1895	114	15	17
3861	♂ yg.	Sept. 19, 1895	110	17.5	18
3860	♂♂ yg.	Sept. 17, 1895	111	16	18
3862	♂ yg.	Sept. 25, 1895	93	15	17

This strange little animal was common about Lake Edward and inhabited every variety of country—the sphagnum bogs, the deep spruce forest, and the banks of little streams. It lived everywhere in the deep moss. It was hard to trap and seemed not to care for any kind of bait, but blundered into the traps that happened to be in its way. We caught thirteen examples of *S. fatuus*, four of which were so badly eaten by shrews or mice as to be worthless.

Microtus fontigenus* sp. nov. Forest Meadow Mouse. 8 specimens.

Type No. 3837, coll. of E. A. and O. Bangs, female adult from Lake Edward, Quebec, September 28, 1895. Total length, 151; tail, 41.25; hind foot, 21. E. A. and O. Bangs, collectors.

General characters.—Size small; colors dark, with no rufous shades; rostrum very slender; audital bullæ very large and round.

Color.—Upper parts dark sepia brown, with a slight admixture of black-tipped hairs; under parts olive gray to smoke gray; tail sparsely haired and bicolor, black above, gray beneath.

Skull.—The skull is small, with very slender rostrum, and differs from that of any *Microtus* I am familiar with in having very large and round audital bullæ, about as in the genus *Erotomys*. The basioccipital is narrow and does not have a distinct median keel.

Teeth.—The pattern of enamel folding of the molar teeth is substantially as in *M. pennsylvanicus*.

Size.—No. 3837, female adult (type): total length, 151; tail, 41.5; hind foot, 21. No. 3840, male adult: total length, 150; tail vertebræ, 45; hind foot, 21.

This *Microtus* was not common. We found it usually along the banks of the little spring brooks in the deep forest and in small sphagnum bogs, where it lived under old logs or in holes in the moss, after the manner of an *Erotomys*. Nowhere did it make runways like those of *M. pennsylvanicus*,

* Fontigena = born beside springs or fountain heads; a poetical term applied to the Muses, and therefore appearing in literature only in the feminine.

and it appeared to be confined to the forest. I hunted in vain the marshy spots and alder swamps and the cleared fields, places *M. pennsylvanicus* would have delighted in, but found no trace of any *Microtus* there, and trapping in such localities yielded nothing but shrews. We caught only eight examples of *M. fontigenus*.

Microtus chrotorrhinus (Miller). Rufous-nosed Meadow Mouse. 9 specimens.

This beautiful little inhabitant of the deep spruce forest was not common. I consider it one of the rarest of our small mammals. It is easy to catch, and a day or two of trapping in any place is usually sufficient to capture all that are there. *M. chrotorrhinus* is apparently wholly diurnal. On account of the depredations of shrews I visited our traps regularly twice a day—once at daylight in the morning and again just before dark. I never found a *chrotorrhinus* on any morning visit. Although these specimens were taken nearly three hundred miles north of the type locality (Mt Washington, New Hampshire), they are in every way typical and show no approach to *M. xanthognathus*.

Fiber zibethicus (L.) Muskrat. 9 specimens.

Exceedingly abundant on all the marshy shores of the lakes and rivers. We set a line of sixteen traps one afternoon and on visiting them next morning found fourteen muskrats. One trap I set on a floating log that lay across a little brook where it emptied into Lake Edward and caught a muskrat in it every night during our stay.

Evotomys gapperi (Vig.). Red-backed Mouse. 36 specimens.

The commonest small mammal at Lake Edward. The red-backed mouse of this region is the small, dark-colored form of the spruce belt, true *gapperi*.

Evotomys fuscodorsalis Allen. Dusky-backed mouse. 4 specimens.

Apparently this little known *Evotomys* was rare, four examples being all we caught. These were taken in two localities about three miles apart and two in each place. In both places they were caught among loose boulders on side hills covered by moss and overgrown by spruce, fir, and white birch.

Peromyscus canadensis abietorum subsp. nov. Hudsonian White-footed Mouse. 4 specimens.

Type No. 2205, coll. of E. A. and O. Bangs, female adult, from James river, Nova Scotia. Coll. by C. H. Goldthwaite, August 8, 1894. Total length, 200; tail, 103; hind foot, 20 (measured in flesh by collector).

General characters.—Similar to *Peromyscus canadensis* (Miller), from which it differs in being a uniform dark gray above in both young and adult, never showing the russet and yellowish shades of old examples of *P. canadensis*.

Color.—Old adult: upper parts dark smoke gray, slightly darker along the middle of the back, causing an indistinct median band; under parts white, the hairs plumbeous at their base; feet and hands white; tail bicolored, black above, white below, hairy, and longer than the head and body; pencil long.

The size, proportions, and skull are the same as in true *canadensis*.

This white-footed mouse is the Northern representative of *P. canadensis*, which it resembles very closely in everything but color. When a large series of each is laid out side by side the difference in color is very striking, the uniform gray of the adults of *abietorum* being in marked contrast to the russet and yellow shades of the adults of *canadensis*. *P. abietorum* has a wide range in the spruce and fir forests of the north. It was not common at Lake Edward, and, as all we caught were immature, I have taken for the type a fine old adult from James river, Nova Scotia, from whence I have a good series, collected by Mr. C. H. Goldthwaite in the summer of 1894.

Zapus insignis Miller. Woodland Jumping Mouse. 1 specimen.

Either *Zapus insignis* was very rare at Lake Edward or they had already hibernated, the weather being quite cold, with a heavy frost nearly every night during our stay. This species is very easy to catch and we set many traps in its favorite haunts along the little brooks in the forest. The only one caught was exceedingly fat.

Lepus americanus Erxl. American Hare. 4 specimens.

Very abundant. We caught a number in steel traps baited with salt pork. These traps were set after the Indian fashion, a semicircle of slabs cut from the spruces being set up and the top covered over with spruce boughs. The bait was put inside and the trap in the opening. One morning I shot a hare asleep on top of a board fence three feet high, beside the railroad in the settlement. How he could have jumped onto this fence and balanced himself there is a mystery.

Vespertilio subulatus Say. Bat. 1 specimen.

Two bats of this species flew into the house on different evenings.

Blarina brevicauda (Say). Short-tailed Shrew. 5 specimens.

Common everywhere.

Sorex (Microsorex) hoyi Baird. Hoy's Shrew. 1 specimen.

Apparently rare.

Sorex (Neosorex) albibarbis (Cope). Water Shrew. 1 specimen.

Apparently rare.

Sorex personatus Geoff. St. Hilaire. Common Shrew. 18 specimens.

Extremely abundant and inhabiting every variety of country.

Condylura cristata (L.) Star-nosed Mole. 1 specimen.

No work of this mole was seen anywhere. The one taken was caught in a cyclone trap set under an old log. Probably the animal lives below the deep layer of moss with which everything is covered, and therefore gives no sign of its presence.

Mephitis mephitica (Shaw). Hudsonian Skunk. 5 specimens.

Skunks were common about the settlement. We trapped four and took another skull from an animal that had been killed some months previously. These skunks are highly interesting, being extreme examples of the Northern short-tailed form to which I have restricted Shaw's name *mephitica*.* They measure as follows:

No.	Sex and age.	Total length.	Tail.	Hind foot.
3801	♂ old ad.	585	193	75
3803	♂ ad.	617	202	79
3804	♂ ad.	592	202	76
3802	♀ old ad.	565	159	75

The skulls of all lack the median palatal spine usually seen in the skulls of Southern skunks.

Putorius (Lutreola) vison (Schreber). Little Black Mink. 6 specimens.

Mink were abundant in spite of the fact that great numbers are trapped every winter. All we took are very small and dark-colored and are extreme examples of the beautiful northern form, true *vison*.

Putorius (Gale) richardsoni cicognani (Bp.) Small Brown Weasel. 3 specimens.

We caught four of these little weasels, but one was partly eaten and ruined by some animal. All were caught in traps set for marten and baited with salt pork.

Mustela americana Turton. Marten or Sable. 1 specimen.

We set many traps for this elusive pirate of the forest, but succeeded in catching only one, a very dark-colored old female.

It is of interest that the trappers here never get the fisher (*M. pennanti*) and say that it does not occur at all in this whole region.

* Proc. Bost. Soc. Nat. Hist., vol. XXVI. Author's edition, July 31, 1895, p. 5.

Cranial Measurements of Synaptomys fatuus, S. cooperi, and Microtus fontigenus.

Number.	Sex and age.	Locality.	Basilar length (basion to front of prenaxillary).	Basilar length of Hensel.	Occipito-nasal length.	Zygomatic breadth.	Mastoid breadth.	Interorbital breadth.	Greatest height of cranium above palate.	Greatest height of cranium above lip of foramen magnum.	Length of upper molar series on alveoli.	Greatest length of single half of mandible.	Breadth of muzzle at root of zygoma.
Synaptomys fatuus Bangs.													
3857	{ Type } { ♀ ad. }	Quebec, Lake Edward	24.0	23.0	26.0	15.2	11.8	3.0	8.2	6.2	6.6	15.8	5.2
3854	♂ ad	" " "	23.4	22.0	25.0	15.8	12.0	3.2	8.4	6.2	6.8	16.0	5.0
3855	♂ ad	" " "	23.6	21.8	25.0	15.6	11.8	3.2	7.8	6.0	6.2	15.4	5.0
3856	♀ yg. ad	" " "	22.6	21.4	24.2	14.4	11.4	3.0	7.8	6.2	6.8	15.2	4.8
3858	♀ yg. ad	" " "	22.0	20.2	23.0	14.2	11.4	3.0	7.6	6.0	6.2	15.2	4.4
Synaptomys cooperi Baird.													
1037	♂ ad	Massachusetts, Wareham	24.0	22.2	25.0	16.6	12.2	3.2	8.4	7.0	7.0	16.0	5.2
215	♀ ad	" "	24.2	22.8	25.8	16.8	13.0	3.2	8.6	7.0	6.8	16.0	5.4
Microtus fontigenus Bangs.													
3837	{ Type } { ♀ ad. }	Quebec, Lake Edward	24.4	23.2	25.6	14.0	11.2	3.8	8.4	7.0	6.2	15.6	4.2
3840	♂ ad	" " "	23.4	22.4	24.4	14.2	11.6	3.4	7.8	7.0	6.2	15.8	4.8
3839	♂ ad	" " "	23.4	22.0	24.8	14.2	11.6	3.6	7.8	6.8	6.2	15.0	4.4
3841	♂ ad	" " "	23.2	22.0	.....	13.8	11.0	3.8	8.0	7.0	6.2	15.2	4.4
3838	♀ ad	" " "	24.0	23.0	25.0	14.2	11.4	.....	8.2	7.0	6.4	15.8	4.6

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PROCEEDINGS

OF THE

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DESCRIPTION OF A NEW SPECIES OF PLOVER FROM THE EAST COAST OF MADAGASCAR.

BY CHARLES W. RICHMOND.

The apparently new species of plover here described is represented in the United States National Museum series by five specimens. Three of these were in a collection of birds lately received from Dr. W. L. Abbott; the other two were obtained by exchange some years ago from the Paris Museum.

Ægialitis thoracica sp. nov.

Type No. 151,174, U. S. National Museum, ♀ adult, Loholoka, east coast of Madagascar, June 3, 1895. Dr. W. L. Abbott, collector.

Crown, back, scapulars, tertials, and wing-coverts hair brown, the feathers edged with pale or deep buff, those of the greater wing-coverts edged and tipped with white; primaries, secondaries, rump, median upper tail-coverts, and middle rectrices dark clove brown; shafts of primaries (including the third) with white on terminal half; primary coverts brownish black, tipped with white; lateral upper tail-coverts white; inner primaries narrowly bordered on inner web and tipped with white; base of outer webs white; secondaries tipped with white, which become broader toward the innermost. Forehead, lores, cheeks, throat, axillars, under wing-coverts, sides of body, and flanks white; a line from upper mandible to lower anterior border of eye, continued posteriorly through and including ear-coverts black, connecting with a narrower black band extending across lower border of nape, and with a broad black pectoral band, the latter more extensive on sides of chest; an interocular crescent-shaped black band borders the white forehead and separates it from a white line over eyes, ear-coverts, and passing across nape as a conspicuous ruchal band (leaving the black crown patch entirely surrounded by a white band and the latter isolated from other white markings); a white band below the black pectoral band passes abruptly into cinnamon buff on the abdomen and under tail-coverts, that of the abdomen extends up on sides of body to the black band across breast, intercepting the white. Three outer tail feathers white, with more or less dusky markings,

especially on the two inner ones; next inner pair (4th) dusky, with white tips; 5th pair hair brown, becoming black subterminally, with a deep buff tip. Bill, legs, and feet black in dried skin. Wing, 4.00; tail, 1.72; tarsus, 1.20; culmen (exposed), .69 inches.

In another female (No. 151,169) the wing measures 4.20 inches; the other measurements of the five specimens are very much the same.

This species seems to be most nearly related to *Egialitis varia* (Vieillot) of Africa, and also found in Madagascar, but differs from it mainly in the presence of the black pectoral band and the absence of a wholly black shaft in the third primary; the white line posterior to the black crescent between eyes is more pronounced and the lesser wing-coverts and primary coverts are not decidedly blackish. There is also a slight difference in size, particularly noticeable in the bills.

The two specimens received from the Paris Museum are sexed as males, and are precisely similar to those collected by Dr. Abbott. They were collected by M. Lantz, in 1882, on the southeast coast of Madagascar. In addition to this information the labels bear the names '*Charadrius tenellus*,' and, in a later handwriting, '*pecuarius*' [= *varia*].

From an examination of the specimens in the National Museum and a careful comparison of descriptions, it appears that no described plumages of either *Egialitis tenella* or *E. varia* possess black pectoral bands.

I was rather loth to consider the species unnamed after examining the two specimens from the Paris Museum, as the bird must be well known to the French authors, particularly Milne-Edwards and Grandidier, whose great work on Madagascar birds I have had no opportunity to consult. Thinking there might be some reference to the black pectoral band in the account of *E. varia* in this work, I wrote to Mr. Witmer Stone, of the Philadelphia Academy, who has access to it, and he has very kindly furnished me with the following extract* under *Charadrius pecuarius* Temm. (as they prefer to write it):

"Ce Pluvier africain se trouve aussi à Madagascar, sur les côtes de l'est comme sur celles de l'ouest. Il est en dessus d'un brun roussâtre clair avec une couronne blanche autour de la tête qu'un diademe noirâtre separe du front, qui est également blanc ainsi que les joues; la gorge, la poitrine, que traverse, chez les adultes, une large bande noire, et les sous-caudales, sont blanches; le ventre est roussâtre. Cette bande noire qui traverse la poitrine chez les adultes n'a pas encore été signalée chez les individus Africains."

It is very remarkable that the black pectoral band should be present in adults from Madagascar and absent in those from Africa, where the species is said to be common in many places and breeds and from whence it was originally described.

The two species, *varia* and *thoracica*, are apparently found together on the east coast of Madagascar, where Dr. Abbott collected a specimen of each at Loholoka on June 3. It was probably this association of the species that led the authors of the above-mentioned work to consider them adult and young of one species.

* Hist. Phys. Nat. et Polit. de Madagascar, XII, Ois. tome I, pp. 511–512.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

REVISION OF THE LEMMINGS OF THE GENUS *SYNAPTOMYS*, WITH DESCRIPTIONS OF NEW SPECIES.

BY DR. C. HART MERRIAM.

The genus *Synaptomys* has an interesting history. It was described by Professor Baird about forty years ago from a specimen received from William Cooper, of Hoboken, New Jersey, for whom the species was named *Synaptomys cooperi*.[1] The locality at which it was collected is unknown. For many years the species continued to elude the notice of naturalists, and it was not until 1874 that additional information was published concerning it. In this year Coues recorded specimens from Indiana, Illinois, Minnesota, and Kansas. He also mentioned specimens from Oregon [= Washington] and Alaska; but these, as will be shown later, do not belong to the present species.[2]

In 1881 Dr. F. W. Langdon recorded its occurrence "in numbers" at Brookville, Indiana, and described the locality at which it had been found by E. R. Quick.[4]

In 1885 Edgar R. Quick and Amos W. Butler described its habits as observed at Brookville, Indiana.[5]

In December, 1892, I published a notice of the occurrence of the species on Roan Mountain, North Carolina, and of the discovery of its remains in 'pellets' of the long-eared owl found in Virginia, near Washington, D. C., by Dr. A. K. Fisher, and of others taken from the stomachs of hawks and owls killed at Sandy Spring, Maryland, and Alfred Center, New York.[6] At the close of this paper I suggested that mammal collectors would "do well to keep a sharp lookout for this species in the cooler parts of Pennsylvania and New Jersey."

In January, 1893, S. N. Rhoads recorded the species from May

[1] The numeral references in the present paper refer to titles in the bibliography at the end of the article.

Landing, New Jersey, but unfortunately gave it a new name, *Synaptomys stonei*.*[7] In the same year (1893) J. B. Steere recorded it from Ann Arbor, Michigan.[8]

In April, 1894, Outram Bangs recorded specimens from Wareham and Plymouth, Massachusetts, and showed that *S. stonei* is the same as *S. cooperi* Baird.[9]

In December, 1894, J. A. Allen recorded the northward extension of *Synaptomys* to Andover and Gulquac Lake, New Brunswick.[12]

Early in January, 1895, S. N. Rhoads published a record of the capture of a specimen of *S. cooperi* on Big Bushkill creek, Monroe county, Pennsylvania.[13] This completes, so far as I am aware, the published records of the type species.

Although remains of the species had been found both in 'pellets' and stomachs of hawks and owls from the vicinity of Washington, D. C., and although the species had been persistently trapped for by a number of experienced mammal collectors, still no specimen 'in the flesh' was actually obtained until February of the present year (1896), when Vernon Bailey captured several in a sphagnum bog at Hyattsville, Maryland, only seven miles from Washington. Mr. Bailey has also secured a number at Elk River, Minnesota, and I have a specimen from Knoxville, Iowa.

During recent explorations in the great Dismal Swamp in southern Virginia, Dr. A. K. Fisher secured specimens of a new *Synaptomys*, which is here described under the name *S. helaletes*.

Specimens collected at Neosho, Kansas, many years ago by the late Captain B. F. Goss, and labeled *S. gossii* by Baird, are here described as a subspecies under that name.

A few months ago Napoleon A. Comeau, of Godbout, on the north shore of the St. Lawrence, near the Gulf, sent me a specimen of *Synaptomys* which differs materially from *S. cooperi*. This animal has just been described by Outram Bangs under the name *S. fatuus*, from specimens collected by him at Lake Edward, Quebec.[14] Dr. Allen's New Brunswick specimens, which he has kindly loaned me for examination, also belong to this northern form. It is not improbable that all of the four forms here recognized will be found to intergrade.

In 1894 F. W. True described a new lemming mouse collected by Lucien M. Turner at Fort Chimo, Ungava, and named it *Mic-*

* In the same paper Mr. Rhoads stated that the species "had previously been detected by the U. S. Department of Agriculture in the rejects of a barn owl living in the tower of the Smithsonian Institution" (Am. Nat., Jan., 1893, 53). This statement was unauthorized and incorrect.

tomys innuitus.[10] The characters that separate it from *Synaptomys* proper seem of subgeneric rather than generic weight, and in the present paper *Mictomys* is treated as a subgenus of *Synaptomys*.

In 1874,[2] and again in 1877,[3] Coues referred to *Synaptomys cooperi*, a specimen from Skagit valley, Washington, collected in 1859 by C. B. Kennerly, and one from Nulato, Alaska, collected in 1867 by William H. Dall. These specimens are still in the U. S. National Museum, and through the courtesy of Mr. True I have been enabled to compare them with his type of *Mictomys innuitus*, which they closely resemble. Both belong to the subgenus *Mictomys*, but differ sufficiently from *innuitus* and from each other to warrant separation. They are here described under the names *truei* and *dalli*.

In September, 1895, Clark P. Streator collected, at Wrangel, Alaska, still another member of the same group, which is here named *wrangeli*.

Summary.—The material now available shows that the genus *Synaptomys*, instead of being monotypic, as until recently supposed, comprises 2 well marked subgeneric groups—*Synaptomys* proper and *Mictomys;* that *Synaptomys* proper inhabits eastern Canada and the northeastern United States from Minnesota to New Brunswick and New England, and contains 4 fairly well defined forms; that *Mictomys* has a transcontinental distribution from Labrador to Alaska, and contains at least 4 species.

Synaptomys, like the other genera of lemmings, is a distinctly boreal group. Of the two subgenera, *Mictomys* is decidedly the more boreal, being strictly confined, in the east at least, to the Hudsonian zone. The subgenus *Synaptomys* pushes southward to the northern edge of the Austroriparian zone, but after it leaves the Boreal zone it occurs only, so far as known, in cool swamps.

Genus SYNAPTOMYS Baird.

Subgenus *Synaptomys* Baird, 1857.

Inferior molars with well defined closed enamel loops on outer side; upper incisors very broad and heavy, with enamel face deep orange throughout; posterior end of palate without median azygos ridge or projection.

Subgenus *Mictomys* True, 1894.

Inferior molars with no closed enamel loops on outer side; upper incisors relatively narrow and weak, with enamel face pale yellow and part on outer side of sulcus nearly white; posterior end of palate with a strongly marked median azygos ridge and projection.

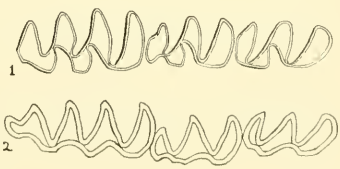

FIG. 1.—Enamel pattern of lower molars.
1. *Synaptomys* 2. *Mictomys*.

Subgenus SYNAPTOMYS Baird.

Synaptomys cooperi Baird.

Synaptomys cooperi Baird, Mammals N. Am., pp. 556–558, 1857.
Coues, Proc. Acad. Nat. Sci., Phila., p. 194, 1874; Monog. N. Am. Rodentia, pp. 235–236, 1877.
Quick and Butler, Am. Naturalist, XIX, 113–115, Feb., 1885.
Merriam, Proc. Biol. Soc. Wash., VII, 175–177, Dec., 1892.
Bangs, Proc. Biol. Soc. Wash., IX, 99–104, April, 1894.
Synaptomys stonei Rhoads, Am. Naturalist, XXVII, pp. 53–54, Jan. 11, 1893.

Type locality unknown; probably northern New Jersey or southern New York.

Geographic distribution.—Boreal and parts of Transition zones from Minnesota eastward to eastern Massachusetts and south to Iowa, Indiana, and Maryland, and in the mountains to North Carolina and Tennessee. South of the Boreal zone it appears to be confined to cold sphagnum swamps, which give it a boreal atmosphere.

General characters.—Similar in size and general appearance to *Microtus pennsylvanicus*, but tail very much shorter. Contrasted with *Synaptomys helaletes* the feet are smaller and the rostrum, mandible, and upper incisors are much narrower and less massive.

Color.—Upper parts grizzled gray and yellowish brown abundantly mixed with black-tipped hairs; under parts soiled whitish, the plumbeous under fur showing through; tail bicolor; brownish above, whitish below. In the adult the color of the back varies from pale yellowish brown to almost rusty, always 'grizzled' by a bountiful admixture of black-tipped hairs. In the young the color is at first very dark, almost blackish slate; it then becomes grayish brown and approaches sepia before taking on the yellowish brown of the adult.

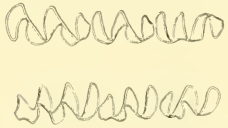

FIG. 2.—Enamel pattern of upper and lower molars in *Synaptomys cooperi*.

Cranial and dental characters.—Contrasted with *S. helaletes* from Dismal Swamp, the skull and teeth of *S. cooperi* are smaller and weaker, the zygomata more bowed outward, the rostrum and mandible very much narrower, the nasals narrower posteriorly, and the brain case shorter.

Measurements.—Average of 4 specimens from Ann Arbor, Michigan: total length, 118; tail vertebræ, 17.5; hind foot, 18. Average of 2 from Roan Mountain, North Carolina: Total length, 121; tail vertebræ, 20; hind foot, 19.5.

Synaptomys fatuus Bangs.

Synaptomys fatuus Bangs, Proc. Biol. Soc. Wash., X, 47–48, March 7, 1896.

Type locality.—Lake Edward, Quebec.

Geographic distribution.—Hudsonian zone from Lake Edward, Quebec (and probably much farther west), to Victoria county, New Brunswick, and Godbout, Quebec. Limits of range unknown.

General characters.—Similar to *S. cooperi*, but slightly smaller; skull decidedly smaller, with much narrower upper incisors.

Color.—Upper parts grizzled yellowish brown, abundantly mixed with black-tipped hairs; under parts varying from slate gray to whitish, washed with buff on the belly; tail nearly concolor, only slightly paler below than above.

Cranial and dental characters.—Skull similar to that of *S. cooperi*, but smaller and weaker; rostrum narrower; basisphenoid broader posteriorly. Upper incisors very much narrower than in *cooperi*.

Measurements.—Average of 2 adults from type locality (measured in flesh by O. Bangs): total length, 124; tail vertebræ, 18; hind foot, 18.7. Measurements of an alcoholic specimen (♀) from Godbout, Quebec: total length, 106; tail vertebræ, 19; hind foot, 18.

Synaptomys helaletes sp. nov.

Type from Dismal Swamp, Virginia, No. 75172, ♀ adult, U. S. National Museum, Department of Agriculture collection. Collected October 14, 1895, by Dr. A. K. Fisher. Original number 1818.

General characters.—Similar to *S. cooperi*, but with larger head and feet, longer tail, much broader rostrum and mandible, and larger and more massive skull and teeth.

Color.—Upper parts grizzled gray and yellowish brown, abundantly mixed with black-tipped hairs; under parts plumbeous, washed with white; tail bicolor, brownish above, whitish below; toes usually partly white.

Cranial and dental characters.—Contrasted with *S. cooperi*, the skull and teeth are larger, heavier, and more massive; the zygomata less strongly bowed outward; the nasals broader posteriorly, and the brain case longer. The rostrum, upper incisors, and under jaw are remarkable for breadth and massiveness.

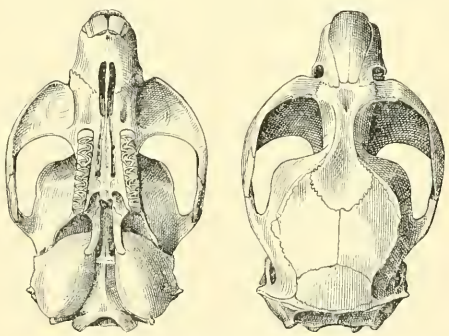

FIG. 3.—Skull of *Synaptomys helaletes* ♀ (type) × 1½.

Measurements.—Type specimen: total length, 125; tail vertebræ, 22; hind foot, 20. Average of four adults from type locality: total length, 118.5; tail vertebræ, 21; hind foot, 20.2.

General remarks.—*Synaptomys helaletes*, while of essentially the same size as *S. cooperi*, has very much larger fore and hind feet and a longer tail. The difference in the breadth and massiveness of the rostrum, mandible, and upper incisors is so great that skulls of the two require no comparison. Still, specimens recently collected by Vernon Bailey in a sphagnum swamp near Washington, D. C., are somewhat intermediate and indicate that intergradation may exist.

Synaptomys helaletes gossii subsp. nov.

Arvicola (Synaptomys) gossii Baird MS., Coues, Monog. N. Am. Rodentia, p. 235, 1877 (*nomen nudum*).

Type locality.—Neosho Falls, Kansas, No. 6915, ♂ old, U. S. National Museum. Collected by B. F. Goss, 1866.

General characters.—Similar to *S. helaletes*, but color probably redder; rostrum longer; audital bullæ smaller.

Color.—Not positively known; probably more reddish brown than in *cooperi* or *helaletes*. The mounted specimen in the National Museum has been skinned out of alcohol, and the skins originally collected by Captain Goss cannot be found.

Cranial and dental characters.—Skull as a whole similar to that of *S. helaletes*, but even larger, with rostrum and nasals longer; zygomata more bowed outward in the middle; orbital fossæ larger; audital bullæ smaller; postpalatal pits deeper, defining a distinct median ridge between them, which ridge projects slightly into the postpalatal notch. Viewed from below, the rostrum and incisive foramina are conspicuously longer. Owing to the small size of the audital bullæ, the sides of the basioccipital are less deeply excavated, and the vacuity on each side of the basisphenoid is much larger than in *helaletes*; the incisors are very broad and heavy, as in *helaletes*, and the molars nearly as large (the upper series measuring 7 mm.).

Measurements.—Average of 6 specimens from type locality: total length, 120; tail vertebræ, 20.5; hind foot, 19.*

Subgenus MICTOMYS True.

A new and exceedingly interesting lemming-vole from Ungava, Labrador, was described by Mr. F. W. True, in 1894, under the name *Mictomys innuitus*. On comparing the type specimen of this species and specimens of the two related species here described, with *Synaptomys cooperi*, it appears that the most important character separating *Mictomys* from *Synaptomys* is the absence of closed triangles or enamel loops on the outer side of the lower molars (Fig. 1). In addition, the upper incisors in *Mictomys* are more slender and much paler in color, and the part exterior to the sulcus is nearly white, while in *Synaptomys* the whole enamel face is deep orange. The chief cranial differences are in the post-palatal region. In *Mictomys* there is a distinct median azygos ridge not present in *Synaptomys*,† where the

* Hind foot from alcoholics; the other measurements taken in flesh by Captain Goss and converted from Coues' table, N. Am. Rodentia, p. 236, 1877.

† Except in *S. gossii* in which the post-palatal pits are so deep that the median part of the palate between them is left as a nearly vertical projection comparable to, but much shorter than, that of *Mictomys*.

palate breaks down to the interpterygoid notch. This ridge separates the post-palatal pits and projects backward into the post-palatal notch. In *Mictomys* the supraorbital ridges unite in a single median ridge; in *Synaptomys* they are normally separated by a sulcus.

The differences in enamel pattern of the molar teeth in the four species of *Mictomys* now known are shown in the accompanying illustration (Fig. 4). The teeth are large and broad in *M. innuitus* and *dalli;* smaller and much narrower in *wrangeli* and *trucі*. The reëntrant angles on the outer side of the lower molars are deepest in *trucі* (*d'*); shallowest in *wrangeli* (*b'*).

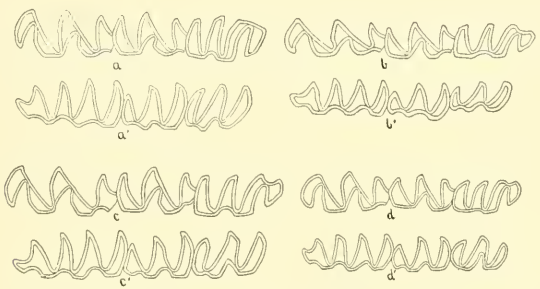

FIG. 4.—Enamel pattern of molar teeth in type specimens of *Mictomys*. × 5.

a, *b*, *c*, *d*, upper series; *a'*, *b'*, *c'*, *d'*, lower series.
a. *Mictomys innuitus*, Ft. Chimo, Ungava.
b. *Mictomys wrangeli*, Wrangel, Alaska.
c. *Mictomys dalli*, Nulato, Alaska.
d. *Mictomys trucі*, Skagit Valley, Washington.

Synaptomys (Mictomys) innuitus True.

Mictomys innuitus True, Proc. U. S. Nat. Mus., XVII, 243, April 26, 1894.

Type locality.—Fort Chimo, Ungava, Labrador.

General characters.—Size and general appearance similar to *Synaptomys cooperi;* ear slightly longer than in *Synaptomys;* tail shortest of the four known species of *Mictomys*.

Color (of alcoholic).—"Upper surfaces grayish brown, as in *Synaptomys;* under surfaces gray; face pale brown; lips, end of nose, and chin white; feet pale brown; tail bicolored, pale brown above, white below." From continued immersion in alcohol the color of the upper parts has now changed to reddish brown.

Cranial and dental characters.—Skull as a whole very broad and flat; brain case strongly depressed; zygomata broadly spreading and standing out squarely from rostrum; audital bullæ strongly inflated anteriorly, the anterior border strongly convex forward. Contrasted with *M. wrangeli*,

the posterior loop of the last upper molar is longer transversely, and the reëntrant angles of the middle and last lower molars are deeper.

Measurements of type specimen (alcoholic, measured by C. H. M.).—Total length, 115; tail vertebræ, 17; hind foot, 17.5.

Synaptomys (Mictomys) dalli sp. nov.

Type locality.—Nulato, Alaska, No. 10957, ♂ adult [skeleton from alcohol], U. S. National Museum. Collected February, 1867, by Wm. H. Dall.

General characters.—Similar to *M. wrangeli*, but differing in cranial characters.

Color.—Unknown.

Cranial and dental characters.—Skull similar to that of *wrangeli*, but differing in the following particulars: nasals emarginate instead of truncate posteriorly; interparietal much narrower anteroposteriorly and acute at both ends; brain case broader; interorbital constriction broader; zygomatic expansion slightly larger; *audital bullæ much larger* and more fully inflated, with corresponding reduction in breadth of basioccipital and basisphenoid; *mandible conspicuously larger, broader, and heavier*, particularly as seen from below; upper and lower molars conspicuously larger; middle and last lower molars with reëntrant angle on outer side decidedly deeper than in *wrangeli*, and thus resembling *truei;* posterior loop of last upper molar as in *wrangeli*.

Measurements (estimated from skeleton).—Total length, 115; tail vertebræ, 22; hind foot, 19.

General remarks.—In looking at the skull of *M. dalli* from above and comparing it with the type of *M. wrangeli*, the only conspicuous differences are the greater breadth of the brain case and interorbital constriction. Looked at from below, the large size of the audital bullæ and molar teeth is striking. On comparing the under jaws, one is also impressed by the disproportionally large size of the mandible and molars of *dalli*. I have named the species in honor of Dr. William H. Dall, who collected it at Nulato, Alaska, nearly thirty years ago.

Synaptomys (Mictomys) truei sp. nov.

Type from Skagit Valley, Washington, No. $\frac{37998}{12101}$, yg. ad., U. S. National Museum. Collected August 6, 1859, by Dr. C. B. Kennerly (probably in mountains bordering Skagit valley).

General characters.—Size and general appearance as in *S. wrangeli*, but ears slightly longer and color of upper parts more reddish brown. Last lower molar with a deep reëntrant angle on outer side.

Color.—Upper parts dull umber brown fading gradually to plumbeous of under parts; belly hairs tipped with whitish. Tail bicolor, dark above, whitish below. The type and only known specimen is in the molt and in very poor condition; hence the colors may not be as in the living animal.

Cranial and dental characters.—The skull of the type is nearly destroyed, leaving only the teeth in the broken jaws. The molar loops, both above and below, are much fuller and more bluntly rounded than in *innuitus* and

wrangeli, and the reëntrant angle on the outer side of the last lower molar is much deeper and nearly forms a closed loop on the outer side of that tooth. The upper incisor is narrower and the sulcus shallower than in the other known species.

Measurements (from dry skin).—Total length, about 112; tail vertebræ, 22; hind foot, 18.

General remarks.—*Mictomys truei* differs markedly from the two other species now known in the fullness of the molar loops and the depth of the reëntrant angle on the outer side of the last lower molar. I have named the species in honor of Mr. F. W. True, curator of mammals in the U. S. National Museum.

Synaptomys (Mictomys) wrangeli sp. nov.

Type from Wrangel, Alaska, No. 74720, ♂ ad., U. S. National Museum, Department of Agriculture collection. Collected September 6, 1895, by Clark P. Streator. Original number 4871.

General characters.—Similar to *S. innuitus*, but larger; tail and hind foot longer; skull narrower.

Color.—Upper parts grizzled grayish brown, with a yellowish cast; under parts plumbeous, tippid with whitish; tail bicolor, brownish above, whitish below, darker at tip.

Cranial and dental characters.—The skull of *Mictomys wrangeli*, contrasted with that of *M. innuitus*, is narrower and higher; the zygomata narrower and less spreading anteriorly; brain case narrower and less depressed; audital bullæ less inflated anteriorly. The posterior loop of the last upper molar is much shorter; the reëntrant angle on outer side of last lower molar shallower, and the enamel folds of all the teeth more loosely spaced.

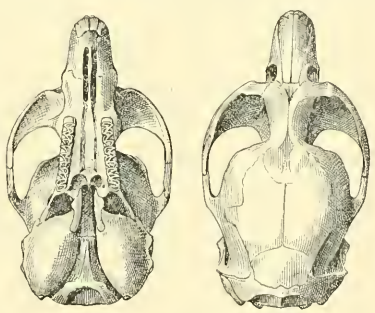

Fig. 5.—Skull of *Mictomys wrangeli* ♂ (type) × 1½.

Measurements (taken in flesh).—Type specimen: total length, 122; tail vertebræ, 23; hind foot, 19. Average of two specimens from type locality: total length, 119.5; tail vertebræ, 22.5; hind foot, 19.

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PRELIMINARY SYNOPSIS OF THE AMERICAN BEARS.

BY DR. C. HART MERRIAM.

Heretofore it has been customary to class the North American bears in three groups—Blacks, Grizzlies, and the Polar bear. The study of a series of more than 200 skulls, including about 35 skulls of the huge bears of the Alaska coast region, shows this classification to be inadequate and adds four strongly marked species to our fauna. The new species are: (1) the gigantic fish-eating bear of Kadiak Island and the Alaska Peninsula, *Ursus middendorffi* nob.; (2) the large brown bear of Yakutat Bay and the coastal slope of the St. Elias Alps, *Ursus dalli* nob.; (3) the large brown bear of Sitka and the neighboring islands (and perhaps the adjacent mainland also), *Ursus sitkensis* nob.; and (4) the Florida Black bear, *Ursus floridanus* nob.

In view of the remarkable characters presented by these new forms it becomes necessary to rearrange our bears. They may be classed in five well marked superspecific groups or types, as follows:

1. The Polar bear type, genus *Thalarctos* Gray.
2. The Black bear type, subgenus *Euarctos* Gray.
3. The Grizzly bear type, *Ursus horribilis* and its allies, subgenus *Danis* Gray.
4. The Sitka bear type, *Ursus sitkensis* nob. and *U. dalli* nob.
5. The Kadiak or Alaska Peninsula bear, *Ursus middendorffi* nob.

The five groups are unequally related: the Polar bear belongs to an independent genus; the Black bears are more different from the others, taken collectively, than the latter are from one

another, and seem to be the only ones whose distinctive characters are of sufficient weight to entitle them to subgeneric recognition.

1. The Polar or Ice bear, *Thalarctos maritimus* (Linn.), inhabits the Arctic shores and islands of both continents and has not been subdivided.

2. The Black bears may be separated into at least 4 species having more or less circumscribed geographic ranges: (*a*) the common Black bear, *Ursus americanus* Pallas; (*b*) the Louisiana bear, *Ursus luteolus* Griffith; (*c*) the Florida bear, *Ursus floridanus* nob.; and (*d*) the St. Elias bear, *Ursus emmonsi* Dall. Some of these may be found to intergrade, and *Ursus americanus* may be still further split into subspecies. *Ursus emmonsi*, recently described by Dr. Dall as a 'variety' of *americanus*,* I have not seen. From the description it appears to be a distinct species.

3. The Grizzly bears (including the Barren Ground bear) may be separated into 4 more or less well-marked forms, as follows: (*a*) the true Grizzly, *Ursus horribilis* Ord, from the northern Rocky Mountains; (*b*) the Sonoran Grizzly, 'var. *horriæus*' Baird, probably only a subspecies; (*c*) the Norton Sound, Alaska, Grizzly, probably another subspecies; (*d*) the very distinct Barren Ground bear, *Ursus richardsoni* Mayne Reid. Whether or not the large Grizzly from southern California deserves subspecific separation from the Sonoran animal (*horriæus*) has not been determined.

4. The Sitka bear, *Ursus sitkensis* nob., and the allied Yakutat bear, *Ursus dalli* nob., are the representatives of a very distinct type. They resemble the Grizzlies in the flatness of their skulls, but are much larger, are different in color, have more curved foreclaws, and the Sitka bear has a different type of sectorial tooth. The Yakutat bear is much larger than the Sitka bear and has very different teeth. It may represent an independent section.

5. The Kadiak and Alaska Peninsula bear, *Ursus middendorffi* nob., is the largest of living bears and differs markedly from all other American species. It closely resembles the Great Brown bear of Kamschatka, *Ursus beringiana* Middendorff,† which it only slightly exceeds in size. The extraordinary elevation and narrowness of the forehead suffice to distinguish this bear from all other known species (Pl. IV, fig. 2).

The number of full species of North American bears here recog-

* Science, NS., vol. II, No. 30, p. 87, July 26, 1895.

† *Ursus beringiana* Middendorff, 1851 = *Ursus piscator* Pucheran, 1855. Both are from Kamschatka.

nized is ten: 4 of the Black Bear group; 2 of the Grizzly group; 3 of the big Brown bears of Alaska, and the Polar bear.

In addition to the splendid series of skulls of big bears in our National Collection and those in my private collection, I have been fortunate in having a number of others loaned me for study. For these I am indebted to the courtesy of Mr. Archibald Rogers, of Hyde Park, N. Y., Mr. W. Hallett Phillips, of Washington, D. C., and Mr. John Fannin, Curator of the Provincial Museum at Victoria, British Columbia. I wish further to express my appreciation of the efforts of Mr. Charles H. Townsend and Mr. J. Stanley-Brown, and also of Mr. Rudolph Neumann, of the Alaska Commercial Company, in securing skulls of big bears from various points in Alaska.

The present paper, which is intended merely as a preliminary announcement of results, to be followed later by a more comprehensive treatise on our bears, is based almost wholly on a study of skulls and teeth. Much additional material is desired, particularly from northern British Columbia and the coast region of Alaska south of the Alaska peninsula.

The external characters—color, length and curvature of claws, length of tail and ears, proportions of feet, and so on—are doubtless of great importance and probably afford many excellent landmarks in differentiating the several species, but unfortunately no series of skins is available for comparison. No museum in the world contains such a series, and any person who will aid in collecting and preserving the necessary material will advance the science of mammalogy. It is known in a general way that the Grizzlies have longer and straighter claws than the big Brown bears of Alaska, and that the animals differ materially in color, but the nature and extent of these differences are unknown.

The Bears present a surprisingly wide range of individual variation in cranial and dental characters, and the sexes differ greatly in size, the males being much the larger and possessing heavier teeth. The material at my command comprises upwards of 200 skulls, covering all known and several previously unrecognized North American species, and has the rare advantage of containing large series from single localities, one such series consisting of no less than 95 skulls. These series show that, in addition to sexual variation and the changes in form and size resulting from difference in age, there is a large range of individual variation in the size, shape, and proportions of the cranium and teeth. They show also that this variation, great as it is, has

definite limits beyond which it does not pass, and that excellent and constant characters exist by which the several species and subspecies may be recognized.

Sexual difference in size is most conspicuous in the Grizzlies, though it is marked in the Black bears also. In the latter the disproportion is greater in the teeth than in the skull; in the female the molar teeth are much smaller, narrower, and less massive than in the male.

Individual variation in the teeth is the rule, and the amount of this variation is surprising, affecting the number and relations of the accessory cusps, and also the form and proportions of the fourth upper and lower premolars, and the great posterior 'heel' of the last upper molar.

As is well known, the bears normally have 42 teeth, the dental formula being $i\frac{3}{3}$, $c\frac{1}{1}$, $pm\frac{4}{4}$, $m\ \frac{2}{3} = \frac{20}{22} = 42$. The first three premolars above and below, however, are small and nearly functionless, and several of them usually fall out before the animal attains maturity, so that adult skulls rarely contain more than 36 or 38 teeth.

FIG. 6.—Lower carnassial tooth (m_1) and last premolar.

1. Black bear (*Ursus americanus*).
2. Sitka bear (*Ursus sitkensis*).
3. Grizzly bear (*Ursus horribilis*).

In the Grizzlies, Barren Ground, Yakutat, and Kadiak bears the first lower molar (m_1) has one or more cusps or tubercles on the inner side between the middle and posterior cusps (fig. 6,[3]), no trace of which exists in the Black bears (fig. 6,[1]). These intermediary cusps are absent also in the Sitka bear (fig. 6,[2].) In the Grizzlies and their allies the posterior cusps (inner and outer) are nearly opposite; in the Blacks they are more oblique.

Examination of the molar teeth in several hundred bear skulls shows beyond question not only that the last upper molar decreases in size markedly (and probably rapidly) after the wearing down of the crown has passed a certain plane, but also that the length of the molariform series as a whole in both jaws shortens materially. No gaps are left between the teeth, the wear being compensated by a movement from behind forward which keeps the crowns continually in contact.

KEY TO THE BIG BEARS OF AMERICA.

Molars small and weak; pm ^{4} with inner cusp obsolete or small; m ^{2} without decided heel . . . . . genus THALARCTOS.
Color, white . . . . . *Thalarctos maritimus.*

Molars large and powerful; pm ^{4} with inner cusp strongly developed; m ^{2} with enormous heel . . . . . genus URSUS.

Size huge.
Size largest (skull reaching 440 mm. in greatest length); frontal region enormously elevated above and behind orbits . . . . . *Ursus middendorffi.*
Size somewhat smaller (skull less than 425 in greatest length); frontal region nearly flat.
pm ^{4} very large and quadrituberculate; pm $_4$ large and high without heel; m $_1$ without clear interspace on inner side . . . . . *Ursus dalli.*
pm ^{4} normal; pm $_4$ moderate, normally with cusp on cingulum in front of main cusp; m $_1$ with clear interspace on inner side . . . . *Ursus sitkensis.*

Size medium or relatively small.
Temporal impressions turning in abruptly from postorbital processes, nearly at right angle to cranial axis; skull short . . . . . *Ursus richardsoni.*
Temporal impressions not turning in abruptly from postorbital processes; skull longer.
Frontal elevated and usually convex between postorbital processes . . . . . *Ursus horribilis.*
Frontal flattened and concave between postorbital processes . . . . . *Ursus horriæus.*

Ursus middendorffi sp. nov. Kadiak Bear.

Pl. IV, figs. 2, 3; pl. V, fig. 2; pl. VI, fig. 2.

Type from Kadiak Island, Alaska, No. 54793, ♂ ad., U. S. Nat. Mus., Dept. Agric. coll. Collected July 3, 1893, by B. J. Bretherton. (Original No. 176.)

Characters.—Size huge; largest of living bears, though only slightly larger than *Ursus beringiana* Middendorff, from Kamschatka; frontal region in male enormously elevated, highly arched, and relatively narrow; zygomata bowed outward to an extraordinary degree; postzygomatic part of skull very short.

The bear of Kadiak Island needs comparison with only a single species—*Ursus beringiana*, of Kamschatka. It requires no comparison with the American Grizzlies (*Ursus horribilis* Ord) or with the Barren Ground bear (*Ursus richardsoni* Mayne Reid). Contrasted with the Kamschatka bear the forehead of the male is very much higher, more swollen above and behind the postorbital processes, narrower, and more rounded;

the zygomatic arches are more strongly bowed outward and their posterior roots stand out at nearly a right angle to the cranial axis; the interpterygoid fossa is longer; the ascending arms of the premaxillæ are shorter; the jugal is more extended anteriorly, reaching up in front of the lachrymal foramen [in *beringiana* it falls considerably short of this foramen]. The audital bullæ differ strongly in young skulls of the two species, though they come to resemble one another more in old age. In the young of the Kadiak animal they are very much heavier, more convex inferiorly, and broader at the outer or meatus end. In the adult female the skull is relatively more elongated than in the male, and the frontal region is less elevated.

FIG. 7. - Kadiak Bear.
Ursus middendorffi.

The first upper and last lower molars (particularly the latter) are decidedly smaller in the Kadiak animal, while the middle lower molar is nearly the same size in both species. The lower carnassial has strong intermediary cusps or tubercles, as in the Grizzlies.

Measurements of skull of type.—Greatest length of cranium (front of premaxillary to end of occipital crest), 440; greatest basal length (gnathion to occipital condyles), 392; basal length (gnathion to basion), 377; basilar length of Hensel, 370; zygomatic breadth, 277; occipito-sphenoid length (basion to suture between basi- and presphenoid), 105; postpalatal length, 167; basion to plane of front of last upper molar, 238; interorbital breadth, 98; distance between postorbital processes, 132.5; occipito-nasal length, 358; height of brain case above pterygoid, 160; height of brain case above basisphenoid, 123.

Remarks.—Compared with *Ursus beringiana*.* skulls of adult *U. middendorffi* can be distinguished at a glance by the difference in the breadth of the frontal and the degree of elevation of the supraorbital region. Skulls of any age may be distinguished by the peculiarity of the anterior end of the jugal, which in the Kadiak animal reaches upward to articulate with the lachrymal,

* *Ursus arctos* var. *beringiana* Middendorff, Untersuchungen an Schädeln des gemeinen Landbären, p. 74, 1851.

and also by the smaller size of the first upper and last lower molars. The difference in the posterior ending of the ascending arm of the premaxilla also furnishes a good average character. In the Kadiak bear the premaxillæ rarely reach more than half way up the vertical height of the orbit, while in the Kamschatka animal they usually reach considerably more than half way. The shape of the zygomatic arch as seen from the side differs in the two. In the Kadiak bear it is more highly arched and broader, especially posteriorly. The difference is more marked in the young than in adults.

The claws of the fore feet of *Ursus middendorffi* are long and rather strongly decurved on the distal third. Those of the Grizzly (*Ursus horribilis*) are still longer and much straighter. The longest claw of an old male *middendorffi* killed at Kadiak Island, June 18, 1894, and measured for me by Mr. B. J. Bretherton, measured over the convexity of the claw 96 mm., while the distance in a straight line from base to tip on the under side was only 74 mm.

I have named this bear in honor of the celebrated Russian naturalist, Dr. A. Th. von Middendorff, in recognition of his early struggles with the large bears of the shores of Bering Sea. Middendorff named the big bear of Kamschatka *Ursus beringiana*,* and stated that he was particularly struck with a skull from Kadiak which was distinguished by its superior size. It seems fit that the great Kadiak bear, proving distinct from the Kamschatka animal, should perpetuate Middendorff's name. I have examined 16 skulls of this bear.

Ursus dalli sp. nov. Yakutat Bear.

Pl. V, fig. 1; pl. VI, fig. 5.

Type from Yakutat Bay, Alaska, No. 75048, ♂ old, U. S. Nat. Museum, Dept. Agriculture coll. Collected Sept. 8, 1895, by the chief of the Yakutat Indians. (Procured through Albin Johnson. Original No. 2.)

Characters.—Size huge, only slightly less than the Kadiak bear; skull long and massive; frontals rather flat and only slightly elevated above orbits; postorbital processes strongly developed and decurved in old age; paroccipital processes very large and heavy, but relatively short. Molariform teeth large and heavy; pm^4 extraordinarily large and high, nearly as broad as long, quadritubercular (an accessory cusp on inner side in front of postero-internal cusp); m_1 much as in the Grizzlies, the inter-

**Ursus arctos* var. *beringiana* Middendorff, Untersuchungen an Schädeln des gemeinen Landbären, p. 74, 1851.

space between anterior and posterior parts of tooth on inner side filled by one or more cusplets; m^2 large and broad, with heel elongate and broadly rounded posteriorly in male; shorter and more obliquely truncated in

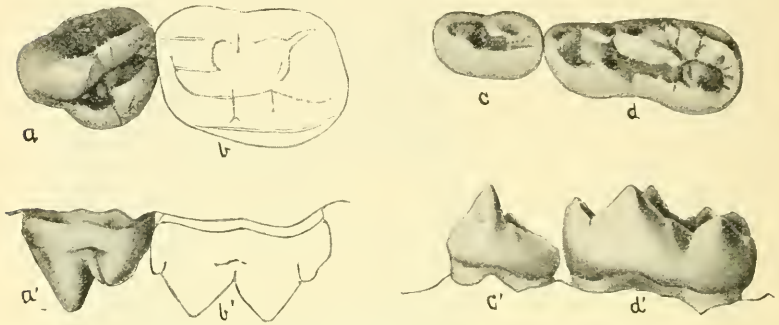


FIG. 8.—Teeth of Yakutat Bear (*Ursus dalli*), natural size.

a. Last upper premolar. *c*. Last lower premolar.
b. First upper molar. *d*. First lower molar.

female; pm_4 large and high, without distinct heel, the main cusp occupying nearly the whole crown of the tooth; a strongly developed peg-like accessory cusp usually present on inner side of main cusp a little behind the middle.

Measurements of skull of type.—Greatest length of cranium (front of premaxillary to end of occipital crest), 424; greatest basal length (gnathion to occipital condyles), 400; basal length (gnathion to basion), 366; basilar length of Hensel, 360; zygomatic breadth, 269; occipito-sphenoid length (basion to suture between basi- and presphenoid), 107; postpalatal length, 172; basion to plane of front of last upper molar, 242; interorbital breadth, 92; distance between postorbital processes, 134; occipito-nasal length, 360; height of brain case above pterygoid, 148; height of brain-case above basisphenoid, 117.

FIG. 9.—Yakutat Bear (*Ursus dalli*).

Remarks.—The Yakutat bear is almost as large as the Great bear of Kadiak and the Alaska peninsula. In fact the total length of the skull from the occipital condyles to front of in-

cisors and the length of the top of the skull (occipito-nasal length) are both slightly greater in *Ursus dalli*. Adult skulls may be distinguished at a glance by the general form, the frontal region of *dalli* being flattened, while that of *middendorffi* is highly arched, and young skulls by the dental characters above mentioned. I have examined five skulls from Yakutat bay.

It gives me pleasure to name this splendid bear in honor of Dr. Wm. H. Dall, whose name must ever be associated with the natural history of Alaska.

Ursus sitkensis sp. nov. Sitka Bear.

Pl. IV, Fig. 1; pl. V, fig. 3.

Type from coast near Sitka, Alaska, No. 6543, Merriam coll. Collected by an Indian; purchased at Sitka and presented to me by Mr. J. Stanley-Brown.

Characters.—Size large, but smaller than *Ursus dalli;* claws long; skull long and heavy, similar to that of *dalli*, but less massive; frontals flat; postorbital processes well developed, but shorter and less decurved than in *dalli;* paroccipital processes much longer and more slender than in *dalli;* incisors, canines, and last premolar large; molars relatively small; pm^4 normal (tritubercular) and very much longer than broad; m_1 with an open interspace on inner side between anterior and posterior cusps (fig. 6^2), much as in subgenus *Euarctos*, thus differing widely from all other big bears of America; m^2 decidedly smaller than in *dalli*; pm_4 with normally a distinct and rather large cusp on cingulum in front and slightly on inner side of main cusp.

Measurements of skull of type.—Greatest length of cranium (front of premaxillary to end of occipital crest), 395; greatest basal length (gnathion to occipital condyles), 345; basal length (gnathion to basion), 329; basilar length of Hensel, 322; zygomatic breadth, 243; occipito-sphenoid length (basion to suture between basi- and presphenoid), 73; postpalatal length, 129; basion to plane of front of last upper molar, 211; interorbital breadth, 85; distance between postorbital processes, 123; occipito-nasal length, 340; height of brain case above pterygoids, 140; height of brain case above basisphenoid, 105.

Remarks.—The Sitka bear resembles the Yakutat bear in general appearance, but is decidedly smaller and differs widely in dental characters. It lacks the excessive development of the last upper premolar which characterizes *Ursus dalli*, and the first lower molar is unique among the large bears, lacking the tubercles that are present in all the others between the anterior and posterior parts of the tooth. In this respect the tooth approaches, though it does not really resemble, that of the Black bears.

A skull purchased from an Indian at Sitka in 1889 by Mr. Charles H. Townsend differs from the other Sitka skulls. It is larger and longer and has decidedly smaller molar teeth. The exact locality where this bear was killed is uncertain, but Mr. Townsend was told that it came from the mainland a little north of Sitka. I have examined 7 skulls of the Sitka bear.

Ursus horribilis Ord. Grizzly Bear.

Pl. IV, fig. 4; pl. V, fig. 4; pl. VI, fig. 1.

Ursus horribilis Ord, Guthrie's Geography, 2d Am. edition, vol. II, pp. 291, 299–300, 1815. [Rhoads' reprint, 1894.] Based on the Grizzly bear of Lewis and Clarke.

Type locality.—Montana.

Geographic distribution.—Northern Rocky Mountains from Wyoming and northern Utah northward; also whole of interior British Columbia and thence northwestward in the interior to Norton Sound, Alaska.

Characters.—Size large (larger than *Ursus richardsoni*, but smaller than any of the Alaska bears); fore claws nearly straight, larger than in any other species, and whitish; hairs elongated over the shoulders, giving almost the effect of a 'hump'; skull and teeth large and massive; frontal region elevated above orbits and highest behind postorbital processes; temporal impressions strongly curved, usually meeting over hinder end of frontals, and not elevated anteriorly to form ridges. Looked at from in front the frontals are normally elevated and convex between the postorbital processes, hiding the sagittal crest (fig. 12), while in the California and Sonora Grizzlies this part of the skull is flattened and depressed, and the temporal ridges and beginning of the sagittal crest may be seen (figs. 11 and 15).

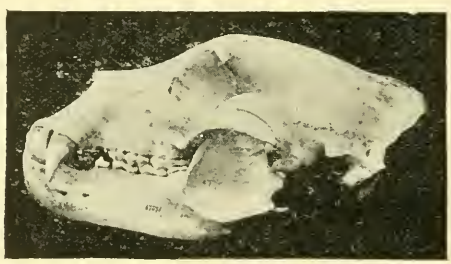


FIG. 10.—Grizzly Bear (*Ursus horribilis*). From Wyoming.

Remarks.—The Norton Sound, Alaska, Grizzly, compared with true *Ursus horribilis* from the Rocky Mountains, differs slightly in cranial and dental characters and will probably merit subspecific separation as *Ursus horribilis alascensis*. It is somewhat larger, the frontal region is furrowed antero-posteriorly between the orbits, the palate averages longer, and the blade of the coronoid process of the mandible is narrower; the first lower molar is broader posteriorly and is much more abruptly and deeply

narrowed on the outer side immediately in front of the posterior cusp. Except in a single skull (an old male from the Shaktolik River, No. 76470), the combined length of the basioccipital and basisphenoid along the median line is decidedly less than half the length of the palate. In the Rocky Mountain Grizzly the occipito-sphenoid length is decidedly greater than half the length of the palate.

Ursus horribilis horriæus Baird. Sonora Grizzly.

Pl. IV, fig. 5; pl. V, fig. 6; pl. VI, fig. 4.

Ursus horribilis var. *horriaeus* Baird, Rept. Mexican Boundary Survey, II, Mammals, pp. 24–29, 1859.

Type locality.—Coppermines, southwestern New Mexico.

Geographic distribution.—Southern Rocky Mountains and outlying peaks and ranges in Colorado, New Mexico, Arizona (and probably southern Utah), northern Mexico, and southern California. The type locality is the old Coppermines, near the Rio Mimbres, in Grant Co., New Mex.

FIG. 11.—Sonora Grizzly from the Coppermines, New Mexico. Baird's type.

FIG. 12.—Rocky Mountain Grizzly from Wyoming.

Characters.—Size large; skull and teeth large and massive; frontal region not elevated above or behind orbits, highest at, and flattened and concave between, postorbital processes; temporal impressions straight or nearly straight, meeting considerably anterior to hinder end of frontals, and elevated anteriorly to form well-defined ridges or crests (Pl. 6, fig. 4).

Remarks.—Professor Baird in his original description of *horriæus* had three specimens—an adult skin and skull from Nogales, Sonora, and both adult and young skulls from the Coppermines, New Mexico. The adult from the latter locality (No. 990) is here chosen as the type because it is the one used by Baird in his comparisons, and the only one of which he gave a

table of measurements. The Nogales skull is higher with reference to its length and differs in other particulars, as shown in the accompanying illustrations (figs. 13 and 14).

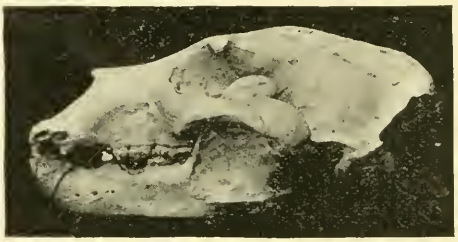


FIG. 13.—Baird's type of *horriæus* from the Coppermines, New Mexico.

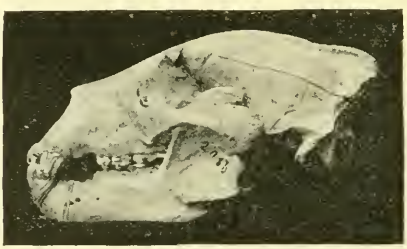


FIG. 14.—Baird's Nogales specimen.

The huge Grizzly of southern California, which unfortunately is rapidly approaching extinction, differs in some respects from the typical Sonora Grizzly and may be entitled to stand as subspecies *californicus*. It is larger, the skull averages longer, and the teeth are of greater size. I have not been able to compare skins of the two forms, but Prof. Baird states that there are color differences; that the Sonora animal lacks the stripes of the California bear, and that the ears and tail are both short and essentially of the same length, while in the California bear the

FIG. 15.—California Grizzly from Monterey.

ears are twice as long as the tail. The average basilar length of six skulls from Monterey and old Fort Tejon, California, is 336 mm., while the average of two adult males from New Mexico is only 310. The average of four adult male *horribilis* from the northern Rocky Mountains is 316 mm. But the numbers here averaged are too small to afford reliable results.

Ursus richardsoni Mayne Reid. Barren Ground Bear.

Pl. IV, fig. 6; pl. V, fig. 5; pl. VI, fig. 3.

Ursus richardsonii Mayne Reid, Bruin: The Grand Bear Hunt. London, 1860. Am. ed., pp. 260–261, 1864.

Type locality—Great Slave Lake, Arctic America.

Geographic distribution.—Barren grounds between Hudson Bay and the Mackenzie River.

Characters.—Size smallest of the American big bears; skull short; zygomata broadly spreading; temporal ridges conspicuous and turning abruptly inward from postorbital processes (fig. 17); teeth large and broad. Adult skulls of the Barren Ground bear may be known from all other species by the form of the frontal shield, which is truncated posteriorly by the temporal crests (figs. 16 and 17). The temporal crests, beginning on the posterior edge of the largely developed postorbital processes, run toward the median line, forming

Fig. 16.

Fig. 17.

Barren Ground Bear (*Ursus richardsoni*), showing high sagittal crest and abruptly spreading temporal ridges.

nearly a right angle with the cranial axis, as shown in the accompanying illustrations. The postorbital processes are long and peg-like and flattened on top. The sagittal crest is correspondingly elongated, reaching forward beyond the middle of the frontals and measuring more than half as much as the upper surface of the skull. The muzzle is short and

slightly upturned, giving the animal a 'pug-nosed' appearance (pl. V, fig. 5). Contrasted with the Grizzlies, the skull as a whole is much shorter and relatively broader, the ratio of zygomatic breadth to basilar length being very much greater. The shortening is chiefly in the brain case, bringing the broad posterior part of the zygomatic arches much nearer the hinder end of the skull. The skull of the young animal is flat on top; that of the adult rises abruptly at the orbits and is convex over the brain case. The angular process of the mandible curves strongly upward at the tip, so that the notch is nearly a complete circle; it is more open in the other bears.

The dentition is distinctly of the Grizzly type. The molars are as large as in the Grizzly. The fourth upper premolar is large and high and has a strong single internal cusp, without accessory cusps in the specimens examined. The fourth lower premolar lacks the antero-internal cusplet of the Grizzlies, and the main cusp slopes back to the posterior margin, where it is rounded off without developing a posterior cusplet. The last upper molar has the inner tubercles flatter than in the Grizzly.

Remarks.—The Barren Ground bear is an excellent species, differing widely from its nearest relative and neighbor, the Grizzly of Alaska, which latter animal is represented in the collection by a number of skulls from the Norton Sound region. All the skulls of the Barren Ground bear I have examined are from the region north of Great Bear Lake, and were collected by R. McFarlane. They are labeled as coming from Anderson River, Franklin Bay, and 'Arctic coast.' Whether the species ranges west of the Mackenzie River I have been unable to ascertain.

The Black Bears. Subgenus *Euarctos* Gray.

The subgenus *Euarctos*, proposed by Gray in 1864 * for the common Black bear of North America (*Ursus americanus* Pallas), is well worthy of recognition. It was characterized as follows: "Fur short, uniform. Front claws moderate, not much longer than the hind ones. Hind feet Short. Upper tubercular moderately long, narrowed behind."

In addition to the peculiarities pointed out by Gray, it differs constantly in several excellent dental characters from the large Brown and Grizzly bears of America, and also from *Ursus arctos* Linnæus, of Scandinavia, which is the type of the genus *Ursus*. The most important character, and one which alone is sufficient to warrant the establishment of the subgenus, is the form of the lower carnassial tooth (m_1). This tooth has a broad, open, flat space or step on the inner side between the middle and posterior cusps (metaconid and entoconid), which is never present in the Brown and Grizzly bears (fig. 6). In the restricted genus *Ursus* the metaconid and entoconid are joined together, and the notch between is

* Proc. Zoöl. Soc. Lond., 692, 1864.

occupied by one or more accessory cusps. The posterior cusps of the talon (hypoconid and entoconid) are nearly opposite in the Grizzlies and very oblique in the Black bears. The Black bears agree further among themselves and differ from the Grizzlies in the last lower premolar (pm_4), which lacks the accessory cusps on the inner side, lacks the median sulcus behind and the inner limiting ridge, and is uniformly much smaller; in the last upper premolar (pm^4), which lacks all traces of the posterior accessory cusp; in the shape of the last upper molar (m^2), which is considerably broadest in the middle and is cut away posteriorly on the outer side, with the heel shorter than in the Grizzlies. In *Euarctos* the coronoid process of the mandible rises at nearly a right angle from the horizontal ramus; in *Ursus* proper by a gradual slope.

Ursus americanus Pallas. Black Bear.

Ursus americanus Pallas, Spicilegia Zoölogica, fasc. XIV, pp. 5–7, 1780.

Type locality.—Eastern North America.

Geographic distribution.—Forest-covered parts of North America north of the Lower Austral zone.

Characters.—Size small; frontal region usually moderately elevated; zygomata spreading; molar teeth small.

The characters of the subgenus suffice to distinguish *Ursus americanus* from all other American bears except *luteolus* and *floridanus*. From these it differs in the shortness of the skull as a whole, in the smaller size of the molar teeth, and in other particulars pointed out under the latter species.

Measurements of skulls.—Average of 4 adult males from New York State: Basilar length of Hensel, 254; postpalatal length, 118; basion to plane of front m^2, 168; zygomatic breadth, 184; ratio of zygomatic breadth to basilar length, 75.

Ursus luteolus Griffith. Louisiana Bear.

Ursus luteolus Griffith, Carnivorous Animals, pp. 236–237 (with col. pl.), 1821.
Merriam: Proc. Biol. Soc. Wash., VIII, pp. 147–152, Dec. 29, 1893.

Type locality.—Louisiana.

Geographic distribution.—Louisiana and Texas and probably other parts of Austroriparian Zone.

Characters.—Size large; skull long and flat; fronto-parietal region depressed; profile of top of skull (including crest) nearly a straight line; sagittal crest long and high, about half the length of upper side of skull in old age. Contrasted with old skulls of male Black bears from the Adirondacks, in northern New York, the three old male skulls from Mer Rouge, Louisiana, differ uniformly in the following particulars: They are longer and flatter; the occipito-sphenoid length is greater; the distance from foramen magnum to plane of front of last upper molar is greater; the ratio of zygomatic breadth to basilar length is less (average, 64.6 instead of 75 percent); the ratio of postpalatal length to occipito-sphenoid length is considerably greater.

The molars are very large, much larger than in any known species of the Black bear group. The last upper molar in particular is notable for its great breadth as well as length, averaging 29 to 30 mm. in length and 17 mm. in breadth in three old males from Prairie Mer Rouge.

Measurements of skulls.—Skull of type specimen (No. 1155, U. S. Nat. Mus., from Mer Rouge, La.): Greatest length (gnathion to end of occipital crest), 326; basal length (gnathion to basion), 292; basilar length of Hensel, 288; zygomatic breadth, 187; occipito-sphenoid length, 89; postpalatal length, 134; basion to plane of front of last upper molar, 193; interorbital breadth, 68; distance between postorbital processes, 97; occipito-nasal length, 276. Average of three adult males from type locality: Basilar length of Hensel, 280; postpalatal length, 131; basion to plane of front of m^2, 185; zygomatic breadth, 188. Ratio of zygomatic breadth to basilar length, 64.6.

Remarks.—The Louisiana bear resembles the Florida bear in the elongation and narrowness of the skull, but differs in having the frontal region remarkably flattened instead of highly arched, and in having the upper molars much larger.

In my original article on '*The Yellow Bear of Louisiana*'* I made the mistake of referring to this species a bear described by Mr. Arthur Erwin Brown and considered by him to be the *Ursus cinnamomeus* of Audubon and Bachman,† which latter animal is commonly regarded as a color phase of the Black bear. Mr. Brown's bear died in the Philadelphia Zoölogical Garden. It was procured in November, 1891, "at some point on the Union Pacific railway, in Wyoming," "by the late James E. Cooper, a well-known showman of Philadelphia." Mr. Brown afterward kindly sent me the skull for examination (No. 3380 ♂ old, Mus. Phila. Acad. Sci.). To my surprise, it does not belong to either of the two groups of bears inhabiting the United States—the Blacks and Grizzlies—but, in my judgment, is the Carrion bear of the Ural Mountains of Russia, described by Eversmann in 1840 under the name *Ursus cadaverinus*.‡ Although it has short fore claws like the Black bears, as pointed out by Mr. Brown, it does not belong to the subgenus *Euarctos*. The first lower molar is much worn, but instead of the open space or 'step' of the Black bears it shows on both sides the worn-down base of the connecting cusp or tubercle of the large bears, and the last upper molar has the enormous, broadly rounded heel of *Ursus arctos*

* Proc. Biol. Soc. Washington, VIII, 147–152, Dec., 1893.

† Forest and Stream, Dec. 16, 1893, 518-519. Also a subsequent paper in Proc. Acad. Nat. Sci. Phila., June, 1894, 119–129.

‡ Bull. Soc. Imp. Nat. Moscow, 1840, 11–13.

and its allies. The last upper premolar is exceedingly narrow and the postero-internal cusp is greatly reduced, in which respects it differs from all American bears except the Polar bear, which belongs to another genus.

The peculiar cranial characters of Mr. Brown's bear are very well covered by Eversmann's original description. Eversmann states that the skull is thickly built, comparatively short and high, the frontal is arched above the orbits and then slopes abruptly and forms a step with the nasals, which curve up to meet it. The elliptical orbits stand more vertical than in the other species. Eversmann states further that even in the living animal the species can be distinguished. In the Carrion bear the head is short and the prominent forehead does not slope gradually down to the snout, but with an abrupt step. The skin is generally brown, and is lighter on the neck and shoulders, where it is soiled yellow or yellowish brown.

In view of the facts that the early history of Mr. Brown's bear is involved in hopeless obscurity; that the animal differs radically and irreconcilably from all known American species and seems to agree perfectly with the Carrion bear of western Russia, and that numbers of living bears are shipped from western Russia to America for exhibition purposes, it seems more reasonable to regard the specimen in question as an exotic rather than as an American species, of which, up to the year 1896, only a single specimen has come to the notice of naturalists.

Ursus floridanus sp. nov. Everglade Bear.

Type from Key Biscayne, Florida. Skull No. 3484, ♂ old, U. S. National Museum.

Geographic distribution.—The everglades and probably other parts of peninsular Florida.

Characters.—(Type specimen.) Skull very long, high, and narrow; frontal region remarkably elevated, highest immediately behind postorbital processes (more than 100 mm. above hinder part of palate); brain case very long and narrow; interpterygoid fossa very long (71 mm. in type specimen); basisphenoid and palate deeply excavated, the latter strongly arched both antero-posteriorly and transversely.

Measurements of type skull (♂ old).—Basal length (basion to gnathion), 282; basilar length of Hensel (basion to middle incisor), 277; zygomatic breadth, 190; occipito-sphenoid length (basioccipital + basisphenoid), 91; basion to hinder edge of palate, 133; basion to plane of front of last molar, 186; interorbital breadth, 68; distance across postorbital processes, 109; occipito-nasal length, 290; greatest length of skull, 330; ratio of zygomatic breadth to basilar length, 68.5.

Remarks.—The bear of the everglades seems to differ specifically from both the common Black bear of the eastern United States (*Ursus americanus* Pallas) and the Louisiana bear (*Ursus luteolus* Griffith). I have not had an opportunity to compare the skin of the Florida bear with that of other species, but have examined several skulls. The cranial characters are marked, particularly in the adult male. The skull resembles that of the Louisiana bear in great length and narrowness, but differs in the form of the palate and vault of the cranium. The frontal region is highly arched, while that of the Louisiana bear is flattened, and the molar teeth are much smaller than in *luteolus*.

Ursus emmonsi Dall. Glacier Bear.

Ursus americanus var. *emmonsii* Dall, Science, NS., II, No. 30, p. 87, July 26, 1895.

Type locality.—St. Elias Alps, Alaska (near Yakutat Bay).

Geographic distribution.—Glacier region of the St. Elias Alps and thence southeasterly along the mountains to the neighborhood of Juneau; limits of range unknown.

Characters.—Size small; claws short and strongly curved; skull not seen; pelage peculiar: "The general color of the animal resembles that of a Silver fox. The fur is not very long, but remarkably soft and with a rich under fur of a bluish black shade, numbers of the longer hairs being white or having the distal half white and the basal part slaty. The dorsal line from the tip of the nose to the rump, the back of the very short ears, and the outer faces of the limbs are jet black. Numerous long white hairs issue from the ears; black and silver is the prevalent pelage of the sides, neck and rump; the under surface of the belly and the sinuses behind the limbs are grayish white, or even nearly pure white, I am told, in some cases. The sides of the muzzle and the lower anterior part of the cheeks are of a bright tan color, a character I have not seen in any other American bear; and this character is said to be invariable. There is no tint of brown elsewhere in the pelage. There is no tail visible on the pelts. The claws are small, very much curved, sharp, black above and lighter below; the animal evidently can climb trees, which the Brown bear cannot do."*

* Dall: Science, July 26, 1895, p. 87.

EXPLANATION OF PLATES.

PLATE IV.

Fig. 1. *Ursus sitkensis* ♂ ad. Mainland north of Sitka. Coll. C. H. Townsend.

2. *Ursus middendorffi* ♂ yg. ad. Kadiak Island, Alaska. No. 67401, U. S. Nat. Mus.

3. *Ursus middendorffi* ♂ old. Kadiak Island, Alaska. No. 55493, U. S. Nat. Mus.

4. *Ursus horribilis* ♂ ad. Bighorn Mountains, Wyoming. No 67391, U. S. Nat. Mus.

5. *Ursus horriæus* ♂ old. Coppermines, New Mexico. No. 990, U. S. Nat. Mus.

6. *Ursus richardsoni* ♂ old. Anderson River. No. 6255, U. S. Nat. Mus.

PLATE V.

Fig. 1. *Ursus dalli* ♂ old. Yakutat, Alaska. No. 75048, U. S. Nat. Mus.

2. *Ursus middendorffi* ♂ yg. ad. Kadiak Island, Alaska. No. 67401, U. S. Nat. Mus.

3. *Ursus sitkensis* ♂ ad. Sitka, Alaska. No. 6543, Merriam Coll.

4. *Ursus horribilis* ♂ ad. Bighorn Mountains, Wyoming. No. 67391, U. S. Nat. Mus.

5. *Ursus richardsoni* ♂ old. Anderson River. No. 6255, U. S. Nat. Mus.

6. *Ursus horriæus* ♂ old. Coppermines, New Mexico. No. 990, U. S. Nat. Mus.

PLATE VI.

Fig. 1. *Ursus horribilis* ♂ ad. Bighorn Mountains, Wyoming. No. 67391, U. S. Nat. Mus.

2. *Ursus middendorffi* ♂ old. Kadiak Island, Alaska. No. 55493, U. S. Nat. Mus.

3. *Ursus richardsoni* ♂ ad. Anderson River. No. 6255, U. S. Nat. Mus.

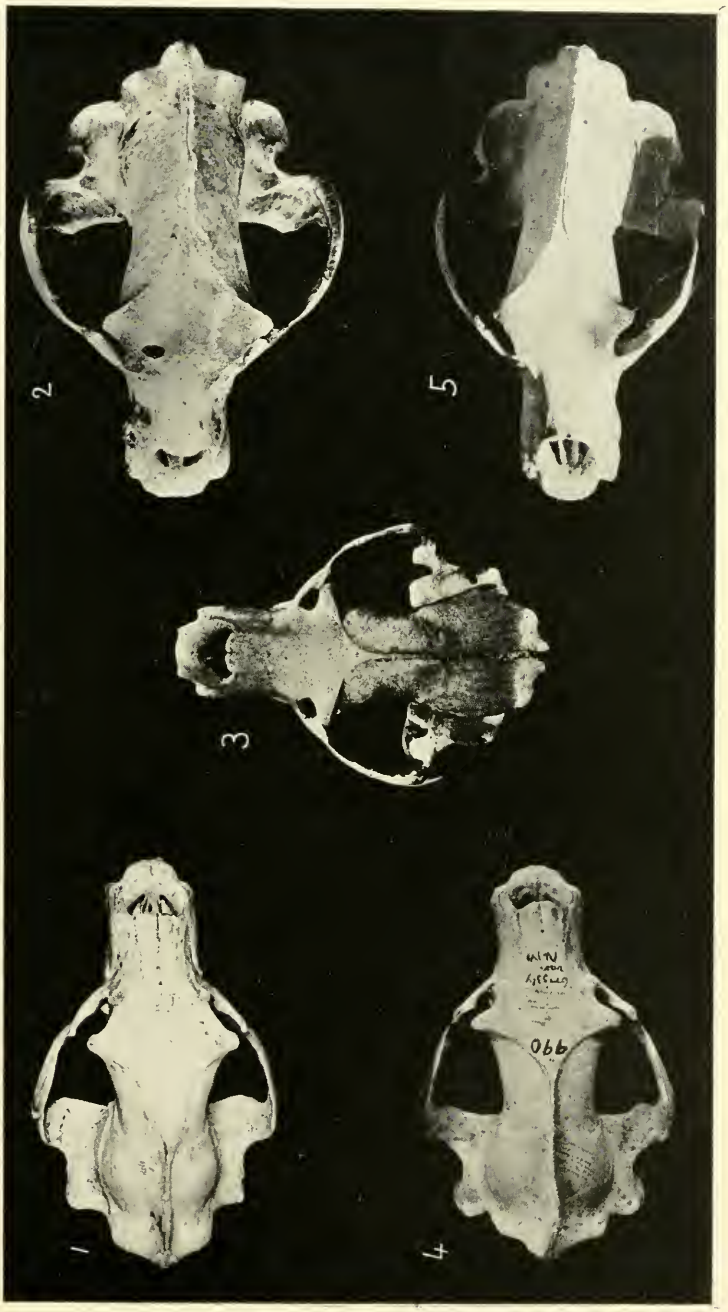
4. *Ursus horriæus* ♂ old. Coppermines, New Mexico. No. 990, U. S. Nat. Mus.

5. *Ursus dalli* ♂ old. Yakutat, Alaska. No. 75048, U. S. Nat. Mus.

[NOTE.—The photographs from which the accompanying illustrations were made belong to the Division of Ornithology and Mammalogy of the U. S. Department of Agriculture. They are here used by courtesy of Dr. Charles W. Dabney, Jr., Assistant Secretary of Agriculture.]

1 *Ursus sitkensis* ♂ ad. 2 *U. middendorffi* ♂ yg. ad. 3 *U. middendorffi* ♂ old. 4 *U. horribilis* ♂ ad. 5 *U. horriæus* ♂ old. 6 *U. richardsoni* ♂ ad.

1 *Ursus dalli* ♂ old. 2 *U. middendorffi* ♂ yg. ad. 3 *U. sitkensis* ♂ ad. 4 *U. horribilis* ♂ ad. 5 *U. richardsoni* ♂ ad. 6 *U. horriæus* ♂ old.



1 *Ursus horribilis* ♂ 2 *U. middendorffi* ♂ 3 *U. richardsoni* ♂ *U. horribeus* ♂ 5 *U. dalli* ♂

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PROCEEDINGS

OF THE

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THE PURPLE-FLOWERED, STEMLESS VIOLETS OF THE ATLANTIC COAST.*

BY CHARLES LOUIS POLLARD.

The acaulescent species of the genus *Viola* constitute a most perplexing natural group, and are very baffling to one who attempts, as I have attempted during the last five years, to discover satisfactory and constant characters on which to base a specific arrangement. While herbarium specimens of these plants are quite adequate for morphological study, it has been found that habit and habitat are of the utmost importance in respect to specific relationship, as is also the degree of variation under changed conditions of environment. I have therefore supplemented a close and searching series of field observations during the past few seasons by a study of many different forms under cultivation, noting the behavior, for example, of two plants from the same patch, one grown in sandy soil, with full exposure to the sun, and the other in damp, rich soil in a shaded situation. A residence of several successive seasons in one neighborhood afforded an opportunity of observing whether a given specimen set out in one summer presented marked leaf variation in the next.

The result of these investigations proves, I think, conclusively, that while several of these violets are extremely polymorphous, the species themselves do not intergrade to the extent generally believed. The difficulty has arisen in some cases by a confusion of the earlier types by writers at the beginning of this century;

* Read before a meeting of the Society held May 2, 1896.

in other instances it is due to an over-conservative view of what constitutes a species. It is a well-known fact in botany, and I presume also in other branches of biology, that the species of one genus differ *inter se* to a much less extent than those of another genus. In *Lechea*, for example, we are forced to depend almost solely on the appearance and structure of the radical shoots springing up after the close of the flowering season, while in the nearly allied genus *Polygala*, we have usually not only well-marked floral characters, but habit and leaf arrangment to guide us in making determinations. I believe that wholesale reduction to a single species of a number of so-called polymorphous types is a most unphilosophical and evasive method of treatment and productive of immense difficulty to the critical monographer. As an illustration of the simple solution presented when one of these aggregate types is reduced to its component forms, I may refer to the two Eastern species of *Sanicula*, which for many years were sources of despair to most botanists, since they presented remarkable variability in habit and phyllotaxy. Mr. E. P. Bicknell, after an extended series of field observations, discovered that there were altogether four very distinct species confused under the two originals, affording not only constant characters with respect to habit of growth and geographical range, but also in the fruit, which is of paramount importance in the study of all Umbelliferæ.* The same author has recently shed light on the Eastern forms of *Sisyrinchium*, no satisfactory disposal of which has heretofore been accomplished.† A similar condition exists among the violets of the Atlantic coast, and, while I by no means wish to imply that we can obtain an absolutely correct systematic treatment of this or any other genus, I do contend that it is possible to so arrange the species that any given plant may be determined with comparative ease. The conspectus of the group, which will be found at the close of this paper, is merely tentative, and is offered simply as the outgrowth of the field and herbarium study already referred to.

In taking up the discussion of individual species I wish to embrace the opportunity of extending thanks to Dr. N. L. Britton, of New York, for the loan of numerous specimens from the Columbia University herbarium, and also to Messrs. H. W. Olds and D. Leroy Topping, of Washington, for abundant field-notes and living plants.

* Bull. Torr. Club, 22, 351–361, 1895. † Ibid., 23, 130–137, 1896.

Passing over for the present the consideration of the Linnæan species, *Viola pedata*, which differs in root-structure from the other members of the group, we shall find that *V. palmata*, also described by Linnæus, may be fairly regarded as the type of its class, since it is the aggregate from which most of the remaining species have been separated. With *sagittata* and possibly *dentata*, *V. palmata* constitutes what we may call the heterophyllous type of stemless violets, or those in which the earliest leaves differ in shape from the later appearing ones. In *palmata* only the first two or three leaves, which are cordate in outline and rather small, are entire, the remainder being usually lobed to a greater or less extent. In the majority of forms there are three main divisions, of which the central one is the largest, the lateral lobes being occasionally cut-toothed or still more deeply divided. The general contour of the leaf is ovate or oblong, the length somewhat exceeding the breadth, the base never cucullate or inrolled as in *obliqua*, our common round-leaved violet. With a view to ascertaining how closely these two species might approach each other in leaf-forms, I set out several specimens in close proximity one fall. The following summer the leaves of *palmata* were scarcely at all lobed, but they preserved their characteristic outline, and were quite clearly distinguishable from the allied species. Similar observations have been made by others who have had the plants under cultivation. But this is not the only distinguishing character of *V. palmata*; it grows almost invariably in rich, shaded woodlands, and, as Schweinitz has observed,* never occurs in swamps or bogs, where *obliqua* is most common. Dr. Gray once reduced *palmata* to varietal rank in the fifth edition of the Manual,† but he afterward restored it to its former place,‡ a conclusion in which every other botanist of the century has concurred. The species of Muhlenberg and Schweinitz here referred to *palmata* are merely forms exhibiting slightly unusual degrees of lobation. Le Conte's *V. septemloba*, however, belongs to a different category. It is apparently confined to brackish meadows along the coast from Staten Island to the Gulf States, and I had always considered it a good illustration of varietal differences induced by local influences, but on a recent excursion with Dr. Britton to the home of the plant I became thoroughly convinced as to its specific validity. The leaves are quite gla-

*Am. Journ. Sci., 5, 54, 1822. †Gray, Man. Ed., 5, 78, 1867.
‡Coult., Bot. Gaz., 11, 254, 1886.

brous and succulent, chiefly remarkable for the constancy exhibited in the shape of their lobes, which in every one of the numerous plants examined consisted of a large central lobe and three lateral pairs, having a pinnate instead of a palmate arrangement, the large lobe serving as a rachis. Minor characters are presented also in the shape of the rootstock.

Our commonest violet has passed under a very varied assortment of names. In Hill's Hortus Kewensis *Viola obliqua* is first described and so well figured as to leave not the slightest doubt concerning the plant to which it refers.* Twenty years later Aiton in a similar work describes *V. obliqua* and *V. cucullata*, assigning the former name to a plant with pale flowers ("petala straminea"), which may have been an albino of the same species, or else something quite distinct.† At all events, Aiton's *cucullata* is Hill's *obliqua*, and the former name, though promulgated twenty years later, has been accepted by all our botanists up to the present time, *obliqua*, if retained at all, being based on Aiton's and not on Hill's plant. Dr. Gray admits the applicability of the name *obliqua* to our common violet in his revision of the genus published in the Botanical Gazette for 1886,‡ where he says "The name *cucullata* would have to give way to the much earlier-published *V. obliqua* Hill, well figured and unmistakable in his Hortus Kewensis." The calamity that would attend the taking up of an older name Dr. Gray averted by retaining the plant in question as a variety of *palmata*. The characters have been chiefly pointed out in connection with the latter; it only remains to say that *obliqua* has the earlier leaves reniform, the later ones cordate and cucullate, usually glabrate or subpubescent, and grows in wet or damp situations.

The history of Walter's *V. villosa* affords a further illustration of the differences in opinion between early and late botanists. Before 1850 it was recognized as a good species in nearly every published work, including the monographs of Schweinitz and Le Conte, Nuttall's Genera, and Torrey and Gray's Flora. It is not mentioned in the first edition of Gray's Manual, but is treated as a species in the second and third editions of the same work, and depressed to varietal rank in the fifth, under the name of *cordata*. In the first fascicle of the Synoptical Flora of North America, part I, Dr. Robinson transfers this variety to *palmata*,

* Hill, Hort. Kew., 316, t. 12, 1769. † Aiton, Hort. Kew., 3, 288, 1789.
‡ Coult. Bot. Gaz., l. c.

applying to it the original specific name *villosa*, to which he appends the abbreviation "n. var." It is certainly one of the marvels of systematic botany that a plant described by Walter in 1788 as *Viola villosa* should be able to reappear, first as *V. cucullata* var. *cordata* in 1867, and then as *V. palmata* var. *villosa*, "n. var." in 1895!

The species has an early blooming period, and may be found on dry hillsides, usually in rich soil, always distinguishable on account of its leaves, which are round-cordate, almost orbicular in outline, and lie closely impressed on the ground; they are variegated with purple veins beneath, and exhibit a delicate, silvery pubescence. The flowers are rather small, reddish-purple in hue, and the plant sends up but few leaves and flowers from a simple rootstock.

Viola sagittata, another of Aiton's species, has received universal acceptance, but it has also been made to include some forms for which we can find no warrant in the original description. The leaves are there referred to as "unequally and remotely serrate, incised-sinuate below the middle, subpubescent, cordate-sagittate, oblong."* This seems sufficiently clear for all practical purposes, and yet in one of our botanical text-books *V. sagittata* is described as follows: "Smoothish or hairy; leaves on short and margined, or the later often on long and naked petioles, varying from oblong-heart-shaped to halberd-shaped, arrow-shaped, oblong-lanceolate or ovate, denticulate, sometimes cut-toothed near the base."

Such a description is not merely faulty but false. The author of the species states distinctly that the leaves are "incised-sinuate below the middle;" yet when a student learns that they are "sometimes cut-toothed near the base," as stated above, he is apt to mistake type for variation, gaining, accordingly, an incorrect conception of the species; and this is precisely what has happened in the case of *V. sagittata*. The plant which Aiton had in mind is far less common than is generally supposed. It has rather obtuse sagittate or hastate glabrous leaves, which although at first borne on petioles scarcely exceeding the scapes, soon become greatly elongated, the petiole attaining a length of twice or thrice that of the blade, the base of which is always sharply dentate or deeply incised. Even at the early vernal stage the smooth leaf with its peculiar base serves to differentiate

*A literal translation. See Aiton, l. c.

the plant from *V. ovata* Nutt., with which it is always confounded. Both species have the first three or four leaves oval and entire or merely crenate, but before flowering, *V. ovata* puts forth its characteristic strongly pubescent or even villous foliage, the regularly shaped, almost entire, ovate-elliptical leaves never becoming so elongated as to exceed either flowering or fruiting scape.

Viola ovata Nuttall is *V. ciliata* of Muhlenberg's Catalogue,* well described and differentiated afterward by Darlington and other writers and retained by Torrey and Gray as a variety of *sagittata*. The plant which I last year described as another variety of *sagittata*, under the name of *Hicksii*,† is much closer to *ovata* than to the true *sagittata* as now understood, and I take this opportunity of indicating its transfer, retaining it under the varietal name. Dr. Robinson, in the Synoptical Flora above quoted,‡ remarks in connection with this form that the recurved fruiting peduncles and distinctly mottled seeds "are not infrequently associated with quite different foliage." However this may be, specimens have been sent to Prof. C. F. Wheeler, of Michigan, and to Dr. T. J. W. Burgess, of Canada, both of whom have admitted it to be distinct from what they are accustomed to regard as typical *sagittata*. We have it in the National Herbarium from Pennsylvania and from Sussex county, New Jersey, in addition to the original locality near Pierce's Mill, in the District of Columbia.

Pursh's *Viola dentata*, here reinstated, is a plant to which my attention was called by Dr. Britton some time ago as a species of marked validity. The leaves in this plant are glabrous and somewhat flaccid, deltoid-cordate, or even panduriform in outline, irregularly crenate, and in general so unlike those of the ordinary violets with which it is associated that it has been considered a hybrid. Le Conte pointed out these characters, under his name of *emarginata*, sixteen years after Pursh's original publication. The plant is mainly of southern range. A typical specimen of it, collected by Dr. John K. Small in northern Georgia in 1895, is to be found in the herbarium of Columbia University. In the National Herbarium the species is represented by a plant found in the District of Columbia by Dr. Vasey.

It will be observed that eight species of the eastern acaulescent

* Muhl. Cat., 26, 1813, without synonymy or description.

† Coult. Bot. Gaz., 20:326, 1895.

‡ 1, 1:197, foot-note.

purple-flowered violets are here maintained as distinct. Pursh and Schweinitz, two of the earliest authorities in this century, recognized each ten species, Nuttall accepted six, Le Conte thirteen, and Torrey and Gray six. In the first edition of the Manual, Gray admits but four species, in the second five, and in the fifth and sixth editions three only. In the most recently published work, the Synoptical Flora, above referred to, there are included three species and four varieties. It seems obvious that the most logical course of procedure for a conservative botanist is the reduction of all possible forms to the Linnæan species *palmata*, for the differences between *palmata* and *sagittata*, the validity of both of which is everywhere admitted, are scarcely more than those between any others of this group selected for comparison.

Synopsis of Species.*

Leaves all pedately divided; rootstock short and abruptly perpendicular ..... *V. pedata.*

Leaves broadly lobed or undivided; rootstock ascending or horizontal.

Plants glabrous or with very slight pubescence:

Leaves somewhat pinnately 7-lobed ..... *V. septemloba.*
Leaves deltoid-cordate or panduriform ..... *V. dentata.*
Leaves hastate or sagittate, basally incised ... *V. sagittata.*
Leaves cordate-cucullate ..... *V. obliqua.*

Plants pubescent or villous:

Leaves palmately lobed ..... *V. palmata.*
Leaves ovate or oval ..... *V. ovata.*
Leaves cordate-orbicular ..... *V. villosa.*

Viola pedata L., Sp. Pl. 933, 1753.† Not of subsequent authors.

V. pedata bicolor Pursh, tide Raf. in D. C., Prodr. 1 : 291, 1824.

Viola pedata inornata Greene, Pitt. 3 : 35, 1896.

V. pedata of authors, not of L.

* In this connection it should be stated that *V. pedatifida* Don, which is closely related to *V. pedata*, is omitted as not belonging strictly to our coast.

† Prof. E. L. Greene has proved that the type of the Linnæan *pedata* must have been a plant of the bicolor variety rather than the monocolored form which we are accustomed to regard as *pedata*. This is conclusively shown by an examination of the plate of Plukenet to which Linnæus refers.

Viola palmata L., Sp. Pl. 933, 1753.

Viola heterophylla Muhl., Cat. 25, 1813.
Viola palmata var. *d. heterophylla* Ell., Bot. S. C. and Ga., 1:300, 1817.
Viola triloba Schwein., Am. Journ. Sci., 5:57, 1822, in part.
Viola cucullata var. *palmata* A. Gray, Man. Ed., 5:78, 1867.

Viola septemloba Le Conte, Ann. N. Y. Lyc., 2:141, 1828.

Viola obliqua Hill, Hort. Kew., 316, t. 12, 1769. Not Pursh, 1812.

Viola cucullata Ait., Hort. Kew., 3:288, 1789, in part.
Viola asarifolia Pursh, Fl. Am., Sept. Suppl., 732, 1812, in part.
Viola papilionacea Pursh, Fl. Am., Sept., 1:173, 1812, in part.
Viola affinis Le Conte, Ann. N. Y. Lyc., 2:138, 1828, in part.
Viola congener Le Conte, Ann. N. Y. Lyc., 2:140, 1828, in part.
Viola palmata var. *cucullata* A. Gray, Coult. Bot. Gaz., 11:254, 1886.
Viola palmata var. *obliqua* A. S. Hitchc., Trans. St. Louis Acad., 5:487, 1891.

Viola villosa Walt., Fl. Car., 219, 1788.

Viola sororia Willd., Hort. Berol., 1:72, 1809.
Viola villosa var. *b. cordifolia* Nutt., Gen. 148, 1818, in part.
Viola cucullata var. *cordata* A. Gray, Man. Ed., 5:78, 1867.
Viola palmata villosa Robinson, Syn. Fl. N. Am., I, 1:196, 1895.

Viola dentata Pursh, Fl. Am., Sept., 1:172, 1812.

Viola sagittata var. *b. emarginata* Nutt., Gen. 148, 1818.
Viola emarginata Le Conte, Ann. N. Y. Lyc., 2:142, 1828.

Viola sagittata Ait., Hort. Kew., 3:287, 1789.

Viola ovata Nutt., Gen. 148, 1818.

Viola primulifolia Pursh, Fl. Am., Sept., 1:173, 1812, not *V. primulæfolia* L., 1753.
Viola ciliata Muhl., Cat. 26, 1813, without description or synonymy.
Viola sagittata var. *b. ovata* T. and G., Fl. N. Am., 1:138, 1838.

Viola ovata Hicksii Pollard.

Viola sagittata Hicksii Pollard, Coult. Bot. Gaz., 20:326, 1895.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

LIST OF MAMMALS OF THE DISTRICT OF COLUMBIA.

BY VERNON BAILEY.

Useful lists of the plants and birds of the District of Columbia have long since been published, but no list of the mammals of the District has as yet appeared. Some species are known to have become locally extinct, and it is probable that others, of which we have no record, have vanished since the settlement of the country. The present list, imperfect as it is, may serve as a nucleus around which to gather additional data, and may prove useful as a guide in determining the changes that are constantly taking place in the relative abundance of species. Corrections and additional notes, with as exact data as possible, are requested.

To limit the list to species occurring within the present boundary of the District would throw out some that a few years ago were common where the city of Washington now stands; but by following the botanists and ornithologists in the use of a circular area with a radius of 20 miles and the Capitol as a center, all of the local species may be included. Probably this circle could be narrowed to half its diameter without leaving out a species.

In preparing this list my own observations have been supplemented by field-notes kindly placed at my disposal by several mammalogists who have done more or less field-work in the vicinity of Washington, mainly during the past 10 years. Each note is referred in the text to its proper authority; but I wish to express my thanks to Mr. Morris M. Green, Dr. C. Hart Merriam, Dr. A. K. Fisher, and Mr. E. A. Preble for assistance. During the years 1888 and 1889 Mr. Green collected 18 species

of mammals within a mile or two of the city. I do not know of a larger list of species taken in the District by one person.

As my own acquaintance with the bats of the District has been limited to early spring and late fall, most of the notes on this group are borrowed. Through the kindness of Mr. F. W. True I am able to include 2 species of bats from National Museum specimens collected in the prescribed area.

In regard to the larger mammals known to have once inhabited the region, but at present locally extinct, much valuable data is available; but for the present paper a brief list of extinct species will suffice. The following 7 species have disappeared from the region since the coming of white men: *Ursus americanus*, *Canis nubilis*, *Felis concolor*, *Castor canadensis*, *Cervus canadensis*, *Bison bison*, *Mus rattus*. The last-named species was introduced and then disappeared before its rival, *Mus decumanus*.

The following 38 species are known to occur at the present time within 20 miles from the Capitol and most of them within the District limits:

Didelphis virginianus. Opossums are common in the woods around Washington, where their tracks may be seen on the banks of every creek and pond. The stupid animals even wander into the city. In the spring of 1894 I found one sleeping on the branch of a tree near Connecticut Avenue, on the hill east of Rock Creek.

Sciuropterus volans. Flying Squirrels have been found in the woods on all sides of the city. Though strictly nocturnal and rarely seen, except when driven from their nests in hollow trees or caught in traps set over night on logs or stumps in the woods, they are not rare. In 1888 and 1889 Mr. Green found several pairs living in woodpecker holes in the trees along Rock Creek and others in the woods near the Soldiers' Home and along the Eastern Branch. Mr. Preble found them rather common at Mt. Vernon, where he secured 8 specimens one day by pounding on hol low trees and shooting the squirrels as they ran out of the holes. One was caught in a trap I had set for wood rats near the west end of Chain Bridge. But for the numerous cats that run wild in the woods, and to which flying squirrels fall an easy prey, these soft-furred, big-eyed, gentle little beauties would be much more common.

Sciurus hudsonicus. Red Squirrels are frequently seen among the trees in the Zoölogical Park, where they show their appreciation of the protection there offered by becoming unusually tame and unsuspicious. They cross Rock Creek and follow the trees to the top of the hill above High Bridge. In Woodley Park they are less frequently seen; in fact, the only one I saw there during the past winter had been shot and then shaken by a dog and left lying in the path with his bright winter coat torn and soiled. On the west side of the Potomac red squirrels live along the steep, wooded bluffs, but are so shy that lately while running a line

of traps among the rocks I did not see a live one. A few low *chr-r-r-r-s* were heard, chestnut shells were found on logs and rocks, and one unfortunate squirrel got his neck in a trap I had set under the rocks for a *Neotoma*. Mr. Preble tells me they are common at Marshall Hall, and I have several times heard them in the swamps near Hyattsville.

Sciurus carolinensis. Gray Squirrels range up to the edge of the city wherever there is timber, and sometimes wander into the city parks. Mr. Preble saw one in the Smithsonian grounds in 1894. I have seen them back of Mt. Pleasant and on the east side of Rock Creek, just above Connecticut Avenue bridge. They are not uncommon throughout the extensive forest area of the Zoölogical, Rock Creek, and Woodley parks. In the grounds of the Soldiers' Home they are abundant and unusually tame. They are common at Mt. Vernon and Marshall Hall and along the Virginia side of the Potomac above Georgetown, but except in the parks where protected from hunters they are exceedingly shy and rarely seen. The extensive areas of native forest, with old hollow walnut, butternut, hickory, chestnut, beech, and oak trees, offer a paradise of safe retreats and abundant food for squirrels, and as long as these forest areas remain, so will the furry-coats.

Sciurus cinereus. Fox Squirrels are not common in the immediate vicinity of Washington, but many are shipped to Center Market from points in Virginia 30 or 40 miles west of the city, and in Dr. Merriam's collection are several specimens from Laurel, Md.

Tamias striatus. Chipmunks are scarce in the immediate vicinity of the city, probably owing to the cats, dogs, and boys. I have seen a few in the Zoölogical Park and the Soldiers' Home grounds, and lately caught one and heard others on the west side of the Potomac, above Chain Bridge. Mr. Preble has found them rather common at Mt. Vernon. Dr. Fisher reports them from Munson Hill and Arlington, Va.; Sligo, Piney Branch, Silver Springs, and Sandy Springs, Md.

Arctomys monax. Woodchucks are still common on both sides of the Potomac River above Chain Bridge and on High Island and the little island just above, to which Dr. Merriam has given the appropriate name 'Woodchuck Island.' Six or seven years ago Dr. Fisher found them a couple of miles lower down on the cliffs on the west side of the river below Chain Bridge and on the flats on the east side between the river and canal. I have lately taken several on High Island and on the west side of the river opposite. Most of the burrows are located among rocks on the islands and on the steep slopes and cliffs of the river hills. On High Island there are several old breeding dens, regular strongholds, between and under the rocks. Woodchucks are said to be more common farther up the river, and I was told of a place where one lives near the east end of Chain Bridge.

Mus musculus. House Mice are numerous throughout the city and about buildings in the surrounding country. Some have taken up their residence in the woods and fields and along old fences and stone walls.

I have frequently caught them along Rock Creek in traps set for white-footed mice, and Mr. Preble has caught a number on the Potomac flats below the city. That they are common outside of buildings is further proved by the presence of their skulls in owl pellets. In 675 pellets of barn owls taken in the Smithsonian tower Dr. Fisher found 452 skulls of *Mus musculus.**

Mus decumanus. The common Brown Rats are numerous in the city and in the scattered buildings of the surrounding country. They show less inclination to take to the woods than do the house mice, *M. musculus.* I have not found them at any considerable distance from buildings, but in the previously mentioned 675 pellets of barn owls taken from the Smithsonian tower were 134 skulls of this species.*

Peromyscus leucopus. The White-footed Mice are common throughout the woods in every part of the District. They are abundant along Rock Creek near the Massachusetts Avenue and Connecticut Avenue bridges, and on the west side of the Potomac and east side of Anacostia River. I caught one in a trap at a hole in a stone wall near Rock Creek, and the next night caught a house mouse at the same hole. I have also taken them at the same holes where *Blarina brevicauda*, *Microtus pennsylvanicus*, and *M. pinetorum* were caught on the preceding or following nights, and many of my specimens have been eaten in the traps by blarinas that visited the traps before me.

Neotoma pennsylvanica. Wood Rats are fairly common among the rocks on the west side of the Potomac River a mile above Chain Bridge, and it is probable that they occur all along the river cliffs up to the Blue Ridge. No doubt they extend down to the end of the rocky bluff opposite Georgetown, or did before extensive quarrying disturbed their homes. They are rock-dwellers, and will probably not be found near the District away from the river cliffs. None have been taken on the east side of the Potomac.

Fiber zibethicus. Muskrats are common in all suitable localities near Washington. They are especially numerous along Rock Creek, where they have increased rapidly since receiving the protection of the Zoölogical Park. In favorite places the creek banks are perforated with their burrows, plants cut for food are strewn along the shores, and the animals may be seen swimming about in broad daylight. It will be interesting to see how far this increase will go and by what circumstances it will be limited. On the big marsh extending along both sides of Anacostia River muskrat houses are common, and a few may be seen in the ponds and marshes on the west side of the Potomac. Tracks and burrows are common along Beaver Dam Branch, on the east side of Anacostia River, and still more common along the arm of the Potomac that flows around the east side of High Island. Large numbers of skins are brought to market by negro trappers from lower down the river.

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*Science, N. S., III, p. 623, April 24, 1896.

Microtus pennsylvanicus. Meadow Mice are probably the most abundant mammals of the District. They press into the edge of the city on all sides and even into the parks and grassy vacant lots. Several have been caught in the Department of Agriculture grounds. Mr. Preble has caught a large number on the Potomac flats, and I have myself taken fully 100 close to the edges of the city. They are numerous along the Rock Creek flats from Massachusetts Avenue bridge up through the Zoölogical Park and fairly swarm along the Potomac and Anacostia marshes. They also range to the tops of the highest hills wherever a heavy growth of grass furnishes a good supply of food and sufficient cover for their runways. A few are found in the woods, especially along the edges of creeks, but open country, marshes, and grassy bottom lands are their favorite haunts.

Microtus pinetorum. Pine Mice are common, but less so and less frequently taken than the meadow mice, which often occupy the same ground. The generalization may be made (but it will not always hold) that the meadow mice live in the fields, meadows, and open country, while the pine mice live in the woods and brush. The pine mice are frequently caught in old fields and on open bottom land, but are found in greatest abundance in brushy bottoms along creek flats. The narrow flats along Rock Creek in the lower part of the Zoölogical Park are thickly marked with their ridges and the little round holes that lead into the burrows. Most of the traps that I set on this flat for moles caught only pine mice, a large number of which were also caught in traps set along the little creek in Woodley Park. A few were caught along Piney Branch and Broad Branch, and one near Fort Marcy, on the west side of the Potomac. Mr. Green caught them on the flats between the canal and Potomac, about a mile above Georgetown, and on a wooded knoll a quarter of a mile below the west end of Long Bridge.

Synaptomys cooperi. Cooper's Lemming-mouse. In 1888 Dr. Fisher examined some pellets of long-eared owls from Munson Hill, Virginia, and among 176 small mammal skulls in these pellets were 3 skulls of *Synaptomys.* Another skull was found in the stomach of a red-tailed hawk killed at Sandy Springs, Maryland, March 24, 1890.* It was, of course, impossible to know the exact localities where the hawks and owls procured these rare specimens. In February, 1896, I caught 4 *Synaptomys* in a sphagnum swamp near Hyattsville, 5 miles northeast of the Capitol, where their nests and runways are common in the damp, cool sphagnum. No doubt more careful trapping would have resulted in a greater number of specimens. As the animals have been so long suspected and so thoroughly trapped for in various places about the District, it is reasonable to infer that they are restricted to these cold swamps.

Zapus hudsonius. Jumping Mice have been taken on the west side of the Potomac close to the city. Morris M. Green caught several at a point a quarter of a mile below the west end of Long Bridge and about

*A. K. Fisher: Hawks and Owls of the United States. Bulletin 3, Div. of Ornithology and Mammalogy, 1893, pp. 59 and 141.

50 yards from the river. He writes me that they were found in brush heaps and beds of weeds and were caught in his hands in the daytime. Dr. Merriam caught one in 1886 at a point a short distance up the river from the west end of Aqueduct Bridge. Mr. Miller saw one near Forest Glen, Md., on May 10, 1896.

Lepus sylvaticus. The Cotton-tail Rabbit is the principal game mammal of the District and vicinity, and, in spite of the abundance of hunters and dogs, they are still fairly common. I have frequently seen them on both sides of Rock Creek near the Connecticut Avenue bridge and in the Rock Creek Park near Broad Branch. Every fresh snow shows a lot of rabbit tracks among the spruces in the Department of Agriculture grounds, and the rabbits are frequently seen running from bush to bush. They are common in the tall grass and among the brush on the river hills along the west side of the Potomac, where the rough country and rocks offer the best of protection. Part of the immense number of these rabbits exhibited for sale in the markets during fall and winter months are shipped in from beyond the 20-mile circle, but many are taken within a few miles of Washington. A negro hunter is frequently met coming in from the country with an old shotgun and a back-load of rabbits; but when questioned he usually avoids telling where his game was procured. Last February I watched a negro trapper from Westmoreland county, Virginia, selling his stock of furs to a dealer in Center Market, and among other skins 130 rabbits were sold at 1 cent each.

Felis domesticus. I am sorry to have to include the House Cat as an introduced species, but it seems thoroughly naturalized and of too great importance to be omitted. Its tracks are common in dusty wood paths and on every fresh snow in the wildest parts of the surrounding country.

Lynx rufus. Wildcats still inhabit the Blue Ridge Mountains, and it would be strange if they did not sometimes follow down the river cliffs on the west side of the Potomac to near the city. There is much wild country within a few miles of Washington where they could find plenty of small game and be fairly safe from enemies. Dr. Fisher caught one in October, 1895, at Lake Drummond, Virginia, where he reports them as very common.

Vulpes pennsylvanicus. The Red Fox is now fairly common in the country around Washington, though a century ago it was not known here. Dr. Fisher gives me the following interesting note: "Through the kindness of H. H. Miller we learn that the red fox first appeared in Montgomery County, Maryland, between the years 1798 and 1802. He obtained the facts from Mr. George E. Brooke, a gentleman of 80 years of age, who, like his father and grandfather, was an enthusiastic fox-hunter."

D. B. Warden, in writing of the District of Columbia in 1816, says: "The gray and red fox frequent this region, and sometimes carry off pigs, lambs, and poultry." *

Urocyon cinereoargenteus. Gray Fox. This species is still found in the vicinity of Washington, though not in abundance.

* Chorographical and Statistical Description of the District of Columbia, p. 159, Paris, 1816.

Procyon lotor. The Raccoon is not rare, even in the immediate vicinity of Washington. I have seen their tracks along Rock Creek in the lower end of the Zoölogical Park, on the bank of the Potomac near High Island, and along Beaver Dam Branch on the east side of Anacostia River. Skins are brought into the market by negro trappers from across the Potomac.

Mephitis mephitica. Skunk. In 1894 a skunk was found under a house in the middle of Georgetown. It was treated with carbon bisulphide, and its skin is now in the Department of Agriculture collection in the National Museum. They are fairly common along the Potomac River above Georgetown, where their tracks may be found in the dusty road along the canal almost every morning, and I have found both tracks and holes on the west side of the Potomac, above Chain Bridge. Tracks are less frequently seen in other localities near the city, and occasionally an unmistakable skunky odor blows into town.

Lutra hudsonica. Otters are scarce, but probably less so than is generally supposed. Dr. Coues mentions one brought into the National Museum in the flesh in 1874.* A man living near High Island tells me that an otter has been on the island during the past winter, and that one was caught near Great Falls. I cannot vouch for the truth of these reports, but see no reason to doubt them. The rapids of the Potomac and the rocky shores, with numerous drift-heaps and overhanging banks, offer the favorite environment for otter.

Lutreola vison. Mink are common along the Potomac, along Rock Creek, Anacostia River, Beaver Dam Branch, and probably on every small stream in the District. I have seen their tracks in all of the places mentioned, and the freshly killed animals have been brought to the Department of Agriculture from several points near Washington. One was brought in last February from College Station, Maryland, 8 miles northeast of the city.

Putorius noveboracensis. Weasels, while not plentiful, are by no means rare. Tracks are occasionally seen on the banks of streams. The National Museum contains a number of skins labeled Washington, and in the Department of Agriculture collection are two skins of weasels caught near the city. One of these I caught in April, 1896, a short distance above the west end of Chain Bridge. The spot was close to the old District line, but I could not tell on which side. Mr. C. W. Richmond tells me that a small weasel was caught a few years ago near the Central High School.

Sorex personatus. This tiny Long-tailed Shrew is one of the rarest mammals of the region. It has not yet been taken within the District of Columbia, though no doubt it occurs in very limited numbers in some of the swamps. In the mammal collection of Dr. Merriam there is a much-damaged specimen, picked up in a path near Sandy Springs, Maryland, some years ago. During February of the present year (1896) I succeeded in catching three of these shrews in a sphagnum swamp near Hyattsville,

* Fur-bearing Animals, p. 311, 1877.

5 miles northeast of the Capitol, but even in this semi-boreal swamp they seem to be scarce and are difficult to secure. Thorough and unsuccessful trapping for them in various localities about Washington proves to my own satisfaction that they do not inhabit the uplands.

Blarina brevicauda. Next to the meadow mouse, the Short-tailed Shrews are probably the most abundant mammals in the District of Columbia. They may be found anywhere in woods and brush and old fields and along creek banks and ditches. Under the cover of fallen leaves and grass and in burrows and covered runways they work their way safely into the very edges of the city. I have taken at least a hundred from traps set for more desirable species along the east side of Rock Creek near the Connecticut Avenue bridge and on the west side near the Massachusetts Avenue bridge, besides others along Piney Branch, Broad Branch, above Georgetown on the west side of the Potomac, and on the east side of Anacostia River near the mouth of Beaver Dam Branch and near Bladensburg. Other mammal collectors have had the same experience of catching more of these shrews than were wanted.

Blarina parva. The Little Short-tailed Shrew is common at Sandy Springs, Maryland, from which point Dr. Merriam has a large series of specimens, but there is not to my knowledge any record of specimens that have been taken nearer Washington. My own traps have not been set in the right kind of localities for this shrew, and probably for the same reason other trappers have not caught it. No doubt it will yet be found common within the limits of the District. Dr. Fisher took 21 skulls from pellets of barn owls found in the Smithsonian tower.

Scalops aquaticus. Moles are common about Washington, and sometimes their ridges are seen on unpaved ground in the city. The only visible sign of their presence is a little ridge pushed up along the surface of the ground and often extended in an interminable network. These ridges, however, are not always a sure sign of the presence of moles, for the pine mouse either makes similar ridges or occupies those abandoned by the moles, but enough moles have been caught in the near vicinity of the city to establish the fact that they are common. Morris M. Green caught them along Rock Creek and the Potomac; E. A. Preble caught one at Arlington; G. S. Miller, Jr., secured one at Forest Glen, Md., and Dr. Mearns tells me that half a dozen specimens have been brought to him at Fort Myer, Va.

Condylura cristata. Star-nosed Moles are either very rare or else their peculiar underground mode of life keeps them well out of the hands of collectors. The only record for the District of which I am aware is that of a family of five young found by Morris M. Green in a nest under an old log on the flats between the canal and river about a mile above Georgetown. As the animal has a general boreal range, it might be expected to occur in the vicinity of cold swamps. I have no doubt that thorough trapping may prove them to be common in certain localities.

Vesperugo georgianus. Morris M. Green, Dr. Fisher, and Dr. Merriam agree that this is the commonest bat in and around Washington.

In June and July of 1888 Mr. Green shot a large number of bats of this species in Rock Creek valley on the present site of the Zoo. In Dr. Merriam's collection are 16 specimens, taken May 14, 1887, under the roof of a barn near the Soldiers' Home, and also a nursing female, shot July 3, 1888.

Vesperugo fuscus. Brown Bat. This is the common large bat seen on summer evenings flying about the streets of Washington. It frequently enters houses through open windows. Specimens have been secured as early as March 8 and as late as December 25.

Vespertilio lucifugus. This is one of the common bats of the city. Mr. Green and Mr. Richmond have captured large numbers of them in the crevices between the timbers under Long Bridge. In Dr. Merriam's collection are 10 adults and 15 young taken June 16, 1889, and a nursing female taken July 3, 1888. Three specimens in the National Museum were collected in May, June, and August.

Vespertilio subulatus. Mr. Gerrit S. Miller, Jr., killed one of these bats at Forest Glen, Maryland, only 8 miles from Washington, May 10, 1896, and found another dead on May 26, 1896. In the National Museum there is one specimen collected at Alexandria, Va., in August, 1875, by P. L. Jouy. These dates may indicate that the bat is a summer resident, but if the species were not rare more specimens would certainly have found their way into collections.

Atalapha borealis. Dr. Fisher considers this next to *Vesperugo georgianus*, the commonest bat in the city. Mr. Green reports it as common in the country and in the city streets, and says he has seen it flying about in November. I have examined Washington specimens collected in May, June, September, and November. In the collection of Dr. Merriam there is a female taken June 22, 1889, with two young clinging to her.

Atalapha cinerea. Hoary Bat. A single skin in the National Museum collected at Laurel, Maryland, brings the species within the 20-mile circle. This specimen was taken October 2, 1892, and was probably a migrant. Other records from Baltimore, Maryland, New Jersey, South Carolina, Massachusetts, and Pennsylvania bring the range of the species on all sides of Washington.

Lasionycteris noctivagans. Dr. Fisher shot one of these bats November 12, 1885, between Arlington and Rosslyn, Va. In the National Museum collection are two skins, one labeled Washington, D. C., January, 1893, the other Smith Island, Va., September 3, 1893. These dates indicate that the species is a migrant or winter visitor.

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PROCEEDINGS

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THE EARLIEST RECORD OF ARCTIC PLANTS.

BY THEO. HOLM.

Through the courtesy of Dr. Edw. L. Greene my attention has been called to the fact that our knowledge of the Arctic flora is not of recent date. The invaluable botanical library which Dr. Greene has accumulated, and which is now located in the Catholic University in Washington, D. C., contains a vast number of old books, which are truly a great boon to the working botanist. It was in this library that Dr. Greene showed me a short chapter in Ray's Historia Plantarum,* wherein is enumerated and described some plants collected in Spitzbergen more than two hundred years ago.

The chapter referred to is headed "Plantæ Spitzbergenses a Frederico Martens Hamburgensi in itinerario suo observatæ delineatæ et descriptæ." When I examined the names "*Aloefolia florum capitulis rotundis*," etc., and the accompanying descriptions, which latter might just as well have represented almost any plant outside the Arctic, I felt discouraged. The title of the chapter, however, gave the clue—*i. e.*, the original record by Martens, who was said to have not only described these plants, but even to have figured them.

This is the work which Ray mentions in a letter to Dr. Hans Sloane,† where he expresses his great admiration of the careful observations made by Martens. Martens' own account appeared

* John Ray, vol. III, London, 1704, p. 226, Appendix.

† Correspondence of John Ray, edited by Edwin Lankester, London, 1848, p. 474.

in his famous little book "Spitzbergische oder Groenlandische Reisebeschreibung gethan im Jahr 1671."* Martens was the surgeon of the ship "Jonas im Wallfisch," which got as far north as the 81st degree of latitude. From here he visited the northwestern part of Spitzbergen, from whence he brought home several specimens of animals and plants.

Many of the observations in Martens' book show that he was possessed of unusual energy and skill as a scientific traveler. His voyage was made during a period when Spitzbergen was annually visited by a large number of whalers from various countries in Europe. So great was the traffic that from 1670 to 1710 not less than 2,289 ships visited this island, killing the vast number of nearly ten thousand whales. I have not been able to find any record of the Arctic flora prior to the period named, so that Martens is believed to have been the first writer on the Arctic flora.

His descriptions of Arctic plants are given in the third part of his book (page 41) "Von den Pflanzen so ich in Spitzbergen gefunden." The descriptions are accompanied by four plates, illustrating in all fourteen species. Although the diagnoses are somewhat puzzling, they certainly are much more accurate than those given by the learned English botanist, and his drawings, as a supplement, will enable the reader to identify the phanerogams and one of the two algæ.

The first plant which Martens describes is "Kraut mit Aloeblättern" (Table G, Fig. *a*), which Ray named "*Aloefolia florum capitulis rotundis.*" This plant, judging from the illustration, is undoubtedly *Saxifraga stellaris* L., forma *comosa* Poir. The statement that the flowers form small, flesh-colored heads ("nudo oculo vix discernendi") would seem to indicate that this plant is the Arctic forma *comosa*, the flowers of which are transformed into small bulblets. Besides this, the basal leaves of the drawing agree better with this than with *S. nivalis* L.

"Eingekerbtes Kleinhauswurtz" (Table F, Fig. *a*) is well drawn and represents *Saxifraga nivalis* L. The "Hauswurz" of the Germans is now the popular name for *Sempervivum tectorum*, so that the identification is not so far wrong. Ray has described this plant under the name "*Sedum minus dentatum, capitulis squamosis.*" The flowers are described in this species as having five petals, so that Martens would surely have seen the single

* Friderich Martens, Hamburg, 1675.

flowers of the foregoing species, if there had been any, instead of simply speaking about their forming small heads, a fact which seems to favor the supposition that he meant the bulblets, as I have mentioned above.

Four species of "Hanen-Füssen" ("Crowfoot") are also fully described and accurately figured. One of these, however, is *Saxifraga rivularis* L. (Table H, Fig. C). The others are: *Ranunculus hyperboreus* Rottb. (Table H, Fig. *c*), *R. pygmæus* Wahlbg. (Table G, Fig. *e*), and *R. sulphureus* Soland (Table I, Fig. *d*). The *Saxifraga* he describes as having white petals, and the figure given is a good illustration of this species. Ray has named these "*Ranunculi Spitzbergenses.*"

"Löffel-Kraut" is a species of *Cochlearia*, and this name is still the popular one for the plant. It was undoubtedly *C. fenestrata* R. Br., which is so far the only known species from Spitzbergen. Ray, it appears, accepted Martens' identification, but, although he did not find any difference between this and *C. Britanica*, he nevertheless called it *C. Spitzbergensis.*

The "Kraut als Mauerpfeffer" (Table F, Fig. *c*) is *Saxifraga oppositifolia* L. "Mauerpfeffer" is now the German name for some *Sedum*, to which the plant shows great resemblance. The flowers are described as purple, which agrees well with this species of *Saxifraga*. Ray called it "*Sedum minimum vermiculatum purpureum Spitzbergense.*"

"Natter-wurtz" (Table I, Fig. *a*) agrees well with *Polygonum viriparum* L., according to the description and illustration. This plant is very closely related to *Polygonum bistorta*, which is the proper "Natterwurz" of the Germans. Ray came to the same conclusion as Martens and named it "*Bistorta minor Spitzbergensis.*"

"Kraut als Maüse-Oehrlein" (Table G, Fig. *d*) is exceedingly well illustrated and described and represents *Cerastium alpinum* L., of which the German name is at present "Alpen-Hornkraut." "Mäuseochrchen" is now used for *Hieracium Pilosella* L., while "Mäusoehrlein," according to Lœselius,* is the name for some species of *Gnaphalium* and *Myosotis*. *Myosotis* is, so far as the name itself is concerned, the only plant to which this name "Mouse-ear" could be applied, as it was by Dioscorides, from the Greek μῦς, a mouse, and οὖς, ὠτός, an ear. The leaves of *Cerastium alpinum* very closely resemble those of a *Myosotis*, so that it can

* Johannes Lœselius: Flora Prussica, Regensburg, 1703.

easily be seen how the mistake occurred. "*Auriculæ muris affinis herba Spitzbergensis*" is the name given by Ray to this plant, but his diagnosis, "Supremo cauliculo Flos innascitur albus," is the only feature which is characteristic of this *Cerastium*. Martens has, indeed, pointed out the characteristics in a much clearer way.

"Kraut als Singrün" (Table G, Fig. *b*) represents *Salix polaris* Wahlbg. If it were not that the illustration is so good, it would hardly have been possible to identify this plant. "Singrün" is now the name for *Vinca*. The stem is described as knotted and woody and the leaves as occurring in pairs. The flowers were not seen, and Martens is therefore not certain that the plant belongs to *Pyrola minima*. It is called "*Vinca pervincæ similis herba Spitzbergensis*" by Ray. The leaves of this willow are very small and coriaceous, brilliant green. They occur in about two alternately on each branch, and to a certain extent resemble those of some species of *Pyrola*.

"Erdbeer-Kraut" (Table H, Fig. *b*) is *Potentilla fragiformis* Willd. The description is very good, and the statement that the leaves only had three leaflets shows that we have this species before us and not *P. maculata* Pourr., the leaves of which are quinate. The same statement is also given by Ray, "foliis tripartitis divisis . . . ," who has called it "*Fragariæ affinis Spitzbergensis*."

Two Algæ are enumerated under the name "Klippen-Kraütern," of which the figure *b* in Plate F represents *Fucus vesiculosus*. The vesicles are described very accurately, and Martens states that he did not observe whether these contained any seeds. His sailors informed him, however, that the small sea snails (Pteropoda), upon which the whales feed, originate from the seeds of this Alga. Martens does not seem to have shared this opinion, however, and says that he is inclined to believe that these snails have, like others, originated from eggs!

The large Alga (Fig. *c* in Plate I) is undoubtedly a species of *Laminaria*.

Several other plants were observed, but were not collected. Only two of these have been described, but these have not been figured. One of these, "*der weisse Mahn*," is evidently *Dryas octopetala* L. "Mahn" is undoubtedly a misprint for "Mohn," the common poppy (*Papaver dubium* or *Rhœas*). Since the only poppy that grows on Spitzbergen, *P. nudicaule* L., has yellow

flowers, it is not likely that Martens meant this plant, but rather the common white *Dryas*, which is not so very unlike a poppy. The other plant is "der rothe Sauerampffer," which probably was *Oxyria digyna* Campd., now called "Säuerling" by the Germans.

If the list of plants collected by Martens be compared with the most recent publication on the flora of Spitzbergen,* it will be seen that all the species named in the list have actually been rediscovered by later expeditions. As to the locality where they were collected, it appears that they were found in the neighborhood of Smeerenberg, on the northwestern shore of Spitzbergen, designated by Martens as "Harlinger Kocherey."

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* Nathorst, A. G., Nya Bidrag till Kännedomen om Spetsbergens Kärlväxter, Stockholm, 1883, Kgl. Sv. Vet. Akad. Hdlgr., vol. 20, No. 6, 88 pp.

Thyroptera discifera (Lichtenstein and Peters) ♀ ad. (Slightly enlarged)

VOL. X, PP. 109-112, PL. VII JULY 22, 1896

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

THE CENTRAL AMERICAN *THYROPTERA*.

BY GERRIT S. MILLER, JR.

Three specimens of *Thyroptera*, collected by G. E. Mitchell on the Escondido River at a point about fifty miles from Bluefields, Nicaragua, and now in the collection of the United States Department of Agriculture, are clearly referable to the species described by Lichtenstein and Peters in 1855 as *Hyonycteris discifera*.* This bat was recognized as a distinct species by Tomes in a paper published in the Proceedings of the Zoölogical Society of London for 1856 (p. 179), but Dobson, in 1878,† placed the name *Hyonycteris discifera*, together with *Hyonycteris albiventer* Tomes ‡ and *Thyroptera bicolor* Cantraine § among the synonyms of the Brazilian *Thyroptera tricolor* Spix. While no specimens of the three nominal and probably valid South American species || are available for comparison with the Nicaraguan bat, there can be no doubt that the latter differs widely from any of these. It may be redescribed as follows:

Thyroptera discifera (Lichtenstein and Peters).

Hyonycteris discifera Lichtenstein and Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin (1854), p. 335, 1855.
Tomes, Proc. Zoöl. Soc. London, 1856, p. 179.

* Monatsber. K. Preuss. Akademie Wiss., Berlin (1854), p. 335, 1855.

† Catalogue of the Chiroptera in the British Museum., p. 245, 1878.

‡ Proc. Zoöl. Soc. London, 1856, p. 179.

§ Bull. Acad. Roy. Sci. Bruxelles, VII, p. 489, 1845.

|| The type localities of these are: *Thyroptera tricolor*, Brazil; *T. bicolor*, Surinam; *T. albiventer*, Napo River, near Quito, Ecuador.

Thyroptera tricolor Dobson, Catalogue of the Chiroptera in the British Museum, p. 345, 1878 (in synonymy only; the description refers strictly to South American specimens).

Type locality.—Puerto Caballos, Honduras.

Geographic distribution.—Central America from Puerto Caballos, Honduras, south to Bluefields, Nicaragua.

General characters.—Size small; length about 45 mm.; tail, 26; forearm, 31. Calcar slender, distinct, slightly longer than free border of interfemoral membrane, terminating in an ill-defined lobule; the posterior edge with a well-formed keel supported by one strong cartilaginous process. Terminal 2 mm. of tail free. Free border of uropatagium with a few scattered hairs. Ears short, funnel-shaped, acutely pointed, when laid forward reaching barely to tip of nose. Wings from middle of claws. Third and fourth toes closely approximated and firmly bound together.

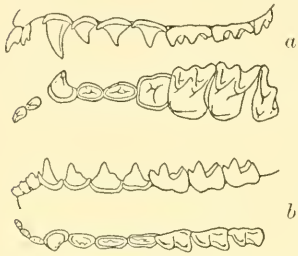

FIG. 1.—Teeth of *Thyroptera discifera*; *a*, upper; *b*, lower (× 5).

Teeth.—Dental formula as usual in the genus: $i\ \frac{2-2}{6}$, $c\ \frac{1-1}{1-1}$, $pm\ \frac{3-3}{3-3}$, $m\ \frac{3-3}{3-3} = 38$. The teeth (Fig. 1) are small and weak for the size of the skull. Upper incisors bifid,* in pairs, the outer tooth half as large as the inner and separated from the canine by a space about as wide as the crown of the larger incisor. Premolars all in the tooth row, not separated by spaces from each other or from the adjoining molar and canine, first slightly smaller than second, third slightly more than half as large as first molar. Crown of first molar broadest, crown of second longest. Lower incisors trifid, the crown of the outer as broad as that of the first and half of the second. First lower premolar smaller than second, but larger than canine. Middle lower molar largest.

FIG. 2.—Head of *Thyroptera discifera* (× 3).

Ears.—The ears are short, acutely pointed, funnel-shaped, and directed forward. The tips do not reach tip of nose when the ears are laid forward. The anterior border is strongly convex from base to small concavity just below very narrowly rounded off tip. Posterior border concave immediately below tip, then convex to basal notch. The basal notch is strongly developed and isolates a very large lobe which joins side of head below line of lips (Fig. 2).

Tragus short and broad, the tip thickened and bent abruptly forward; a large thickened basal lobe directed forward and outward, and a minute process directed backward just above posterior base.

* Dobson states that in *Thyroptera tricolor* the outer incisor is unicuspidate.

Membranes.—The membranes are thin and semitransparent, broad and ample. Wings attached at middle of claws, sparsely hairy from sides of body to line connecting elbow and knee. The free edge has also a narrow hairy border. Antebrachial membrane hairy near base and along humerus and fleshy part of forearm, which in turn are covered with hair. Uropatagium sparsely haired throughout on dorsal surface, otherwise naked, except at extreme base and along veins on ventral surface.

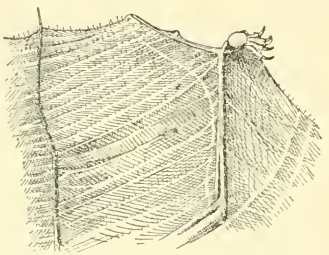

FIG. 3.—Foot and uropatagium of *Thyroptera discifera* (× 2).

Feet.—The feet are small, weak, and so turned outward as to be nearly in line with calcar (Fig. 3). Toes with two phalanges, of which the second is very small and serves merely to support the long claw. All the fingers are bound together by membrane to about the middle of the claws, while the third and fourth digits are firmly united, so that the two claws, although really separate, form what is apparently one strong nail, shorter and more abruptly curved than the others (Fig. 4). Calcar strong, distinct, longer than free border of uropatagium, terminating in a small lobule and bearing a well-formed keel, supported by one strong cartilaginous process. Sucking disk circular, the margin next the phalanges distinct, that toward the keel not sharply marked off from sole.

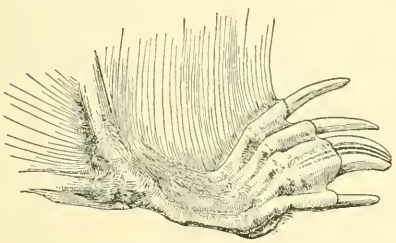

FIG. 4.—Right foot of *Thyroptera discifera* greatly enlarged to show syndactylism of third and fourth digits.

Fur and color.—In distribution, the fur is peculiar in its extension on the wings and dorsal surface of the interfemoral membrane. Color dull yellowish brown throughout, scarcely paler ventrally, the hairs without darker bases. Ears and membranes dusky brownish.

Measurements.—No. 51538, ♀ ad., Escondido River, Nicaragua; total length, 66 mm.; head and body, 37.6; tail, 26; free tip of tail, 2; femur, 13; tibia, 13.4; foot, 4; forearm, 31; third finger—metacarp., 29.8; first ph., 14; second ph., 7.8; fourth finger—metacarp., 28.6; first ph., 10; second ph., 4.6; fifth finger—metacarp., 26; first ph., 8; second ph., 5.6; ear, 11.6; width of ear, 12; tragus, 4; diameter of disk on thumb, 3; diameter of disk on foot, 2.

No. 51539, ♀ ad., same locality and date; total length, 65; head and body, 38; tail, 26; free tip of tail, 1.8; femur, 14; tibia, 14.8; foot, 4.8; forearm, 31.6; third finger—metacarp., 29; first ph., 13.4; second ph., 8.4; fourth finger—metacarp., 29; first ph., 9; second ph., 5.4; fifth finger—metacarp., 25.6; first ph., 7.4; second ph., 6; ear, 12; width of ear, 12; tragus, 3.6; diameter of disk on thumb, 3.4; diameter of disk on foot, 2.

General remarks.—Of the three South American species of *Thyroptera*, two (*T. bicolor* and *T. albiventer*) are described as sharply bicolor, brownish above and white beneath, while the third (*T. tricolor*) is said by Dobson to be reddish brown on the back and pale yellowish white on the abdomen, and also to have dental characters not found in the Nicaraguan animal. In *Thyroptera tricolor* and *T. bicolor* the free part of the tail equals one-fourth or one-third of its whole length. In *T. discifera*, on the other hand, only the terminal joint and part of the penultimate joint project beyond the edge of the interfemoral membrane. *T. albiventer* is said to have the terminal joint only of the tail free, but the type specimen of this species was so mutilated that no dependence can be placed on this character. In size the four forms apparently agree very closely—at least it is impossible to find any important differences in the measurements given in the original descriptions.

The characters of *Thyroptera discifera* and of the South American species as described may be thus contrasted:

Both upper incisors bifid.....*discifera*
Only the inner upper incisor bifid.....*tricolor*
Sharply bicolor, or color of back distinctly different from that of belly.....*albiventer, bicolor, tricolor*
Essentially unicolor.....*discifera*
One-fourth to one-third of tail free from inter-femoral femoral membrane.....*tricolor, bicolor*
Only tip of tail free.....*albiventer* (?) *discifera*

The syndactylism of the third and fourth digits of the foot may prove to be peculiar to *Thyroptera discifera*. It is mentioned by Lichtenstein and Peters in the original description of the species, but none of the authors who have described South American specimens make any allusion to such a condition, although in most cases they have mentioned the form of the feet and claws with considerable detail.

Another character of *Thyroptera discifera* not mentioned in descriptions of the South American species, but probably common to all, is the large and conspicuous clitoris (see pl. VII). In the adult female this measures 1.6 mm. in length and is about half as long as the penis of a nearly full grown male. The vulva opens longitudinally with the anterior commissure encroaching on the basal third of the clitoris.

VOL. X, PP. 113-114 JULY 22, 1896

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

NOTE ON THE MILK DENTITION OF *DESMODUS*.

BY GERRIT S. MILLER, JR.

Some immature specimens of *Desmodus rufus*, taken by Mr. E. W. Nelson, at Etzatlan, Jalisco, Mexico, in June, 1892, and now in the collection of the United States Department of Agriculture, retain the greater part of the milk dentition, though it is probable that none are young enough to present a complete set of deciduous molars. The extraordinary specialization of the teeth of this bat correlated with the animal's strictly sanguivorous habits make any facts relating to the early development of the teeth of special interest.

In the adult (Fig. 1, *e*, and 2, *c*) the dental formula is $i\ \frac{1-1}{2-2}$, $c\ \frac{1-1}{1-1}$, $pm\ \frac{2-2}{3-3}$, $= 20$. The milk dentition, so far as it can be determined, is as follows: $di\ \frac{2-2}{2-2}$, $dc\ \frac{1-1}{1-1}$, $dm\ \frac{1-1}{2-2} = 18$.

The largest of the deciduous teeth are the upper incisors (Fig. 1, *di* 1 and *di* 2). These cut the gums some time before the

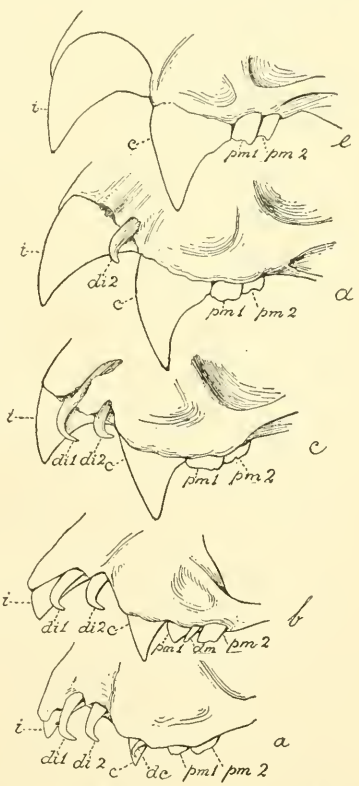

FIG. 1.—Maxillary teeth of *Desmodus rufus*, showing milk dentition and gradual change in form of permanent teeth from very young (*a*) to adult (*e*) (×5).

permanent incisors (Fig. 1, *i*), and even after the appearance of the tips of the latter remain for a considerable period the most conspicuous teeth in either jaw. Their strongly recurved tips are probably of great service to the young when clinging to the nipple of the female during flight. At first the anterior deciduous incisor lies on the outer side of the permanent incisor, while the posterior deciduous incisor occupies the space between the permanent incisor and canine (Fig. 1, *a*). As the permanent incisor increases in size, it gradually extends backward until both milk incisors appear closely appressed to its outer face. In this condition (Fig. 1, *c*) the teeth remain until the animal acquires a large size, while the second milk incisor often persists in nearly full-grown individuals (Fig. 1, *d*). The deciduous canine (Fig. 1, *a*, *dc*) lies imbedded in the gum on the outer side of the prominence caused by the growing permanent canine. It is shed at an early age, and never becomes in any way functional. A deciduous molar (Fig. 1, *b*, *dm*) was found occupying a position near the posterior outer border of the first permanent upper premolar in two specimens. This tooth lacks the recurved tip and must be wholly functionless.

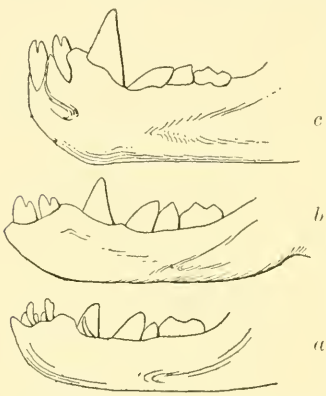

FIG 2.—Mandibular teeth of *Desmodus rufus*, showing part of milk dentition (*a*) and gradual change in form to adult (*c*) (× 5).

In the lower jaw (Fig. 2) the deciduous teeth are smaller and less conspicuous than those in the upper jaw. They are also shed at a much earlier period. On opening the mouth of one specimen (No. 52130) I found two deciduous molars lying loose on the gum over the permanent premolars. The exact position of these milk teeth could not be determined, and I failed to detect any trace of them in other individuals. The deciduous mandibular canine closely resembles its counterpart in the upper jaw, both in size, position, and history. Its tip is, however, less strongly hooked (Fig. 2, *dc*). The deciduous lower incisors (Fig. 2, *di*) are very small and loosely attached to the gum through which they scarcely pierce before they are shed. In form they are totally different from the corresponding upper teeth. Their tips are somewhat widened and faintly notched, thus suggesting the form presented by the permanent lower incisors of many bats.

VOL. X, PP. 115-118 NOVEMBER 3, 1896

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

A NEW FIR FROM ARIZONA, *ABIES ARIZONICA*.

BY C. HART MERRIAM.

In the summer of 1889, when making a biological survey of the San Francisco Mountain region in Arizona, I discovered a new fir with whitish corky bark. The scales of the cones were shed before the end of September, and no perfect cones were brought back. In my report on the 'Forest Trees of the San Francisco Mountain Region' I described this 'white cork-bark fir' under the head of *Abies subalpina* Engelm. [= *Abies lasiocarpa* Hooker], with the following explanation: "I believe this tree to be distinct from true *A. subalpina*, but in the absence of material for direct comparison I am unwilling to separate it." My original account of the species is as follows: "This beautiful fir, unique in the color and character of its bark, is one of the most conspicuous trees on San Francisco Mountain between the altitudes of 2,725 and 2,900 meters (8,950 to 9,500 feet). On the north side of a large butte, just south of Walker Lake crater, it descends to 2,600 meters (8,500 feet). The bark is a fine elastic cork of uniform texture, and free from hard particles. It averages about 6 millimeters in thickness and is very durable, frequently remaining intact while the wood rots away. Large pieces of it, still retaining their elasticity, may be stripped from dead trees and from logs upon the ground. It is sculptured by irregularly interrupted longitudinal depressions or grooves, and is ornamented by fine, parallel, wavy lines. Its color varies from creamy white to gray, and the surface has a velvety texture. The leaves are short, and the scales of the large cones are deciduous while still on the tree. In fact, it was almost impossible to secure a perfect cone as early as the latter part of September. * * *

"On Kendrick Peak it grows from the south rim of the crater (altitude about 2,800 meters, or 9,200 feet) to the summit (a little above 3,050 meters, or 10,000 feet)."*

FIG. 24.—Bark of *Abies arizonica* (natural size).

Early in July of the present year (1896) I again visited San Francisco Mountain and, in company with Dr. B. E. Fernow, had the satisfaction of obtaining upper and lower branches, fresh cones, and bark of the new tree, which may be defined as follows:

Abies arizonica sp. nov.

Type from west slope of San Francisco Mountain, Arizona. Altitude, about 3,000 meters (approximately 10,000 feet). Collected July 2, 1896. No. 270,604. U. S. National Herbarium.

Range.—Hudsonian Zone of San Francisco and Kendrick Mountains, Arizona; not reaching timber line.

Characters.—Size of tree, medium or rather small, averaging about 15 meters in height and rarely 300 millimeters in diameter at base; bark a highly elastic fine-grained cork, whitish or grayish in color, usually creamy white, with irregularly sinuous grayish ridges (Fig. 24); leaves of cone-bearing branches thick, subtriangular in transverse section, and sharp-pointed at apex (about 20 millimeters in length); leaves of lower branches much longer, flatter,

* North American Fauna, No. 3, pp. 120–121, September, 1890.

blunt, and notched at apex (about 25–30 millimeters in length); cones dark purple, slender, medium, or rather small, those of type specimen (not full grown) measuring about 50 x 20 millimeters; scales much broader than long, strongly convex laterally (Fig. 25, *c*), purple on both sides; bract (without awn) reaching to or past middle of scale; body of bract much broader than long.

Remarks.—The only tree with which the white cork-bark fir needs comparison is the subalpine fir (*Abies lasiocarpa* Hooker = *A. subalpina* Engelm.), from which it differs in leaves, bark, and cones. In *Abies lasiocarpa* the leaves of the lower branches average much shorter than in *A. arizonica;* the bark is hard instead of elastic-corky, and is variable in color, usually dark grayish brown blotched with whitish; the cones are larger, and the scales and bracts differ widely in shape and proportions. In *A. lasiocarpa* (Fig. 25, *a* and *b*) the scales are longer than broad, the body of the bract is less than one-third the length of the body of the scale, and the seed wings are about twice as long as broad; in *A. arizonica* (Fig. 25, *c*) the scales are much broader than long, the body of the bract is more than half the length of the scale, and the seed wings are about as broad as long.

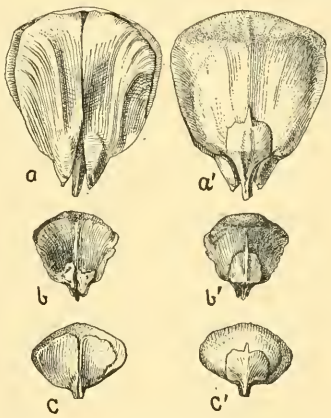

FIG. 25.—Scales of cones (natural size).

a. Abies lasiocarpa, mature.
b. Abies lasiocarpa, young.
c. Abies arizonica, young.
a, b, c. Upper side, showing seed wings.
a', b', c'. Under side, showing bracts.

The form of the scale and relative size of the bract probably change somewhat with age, but in the accompanying figures the immature scale of *Abies arizonica* (Fig. 25, *c*) is contrasted with a still younger scale of *A. lasiocarpa* (*b*), as well as with the mature scale of the latter (*a*). The young cone of *A. lasiocarpa*, from which the scale figured (*b*) is taken, is decidedly smaller than the cone of *A. arizonica*, from which figure *c* is taken, while the adult cone of *A. lasiocarpa* is more than twice as large. Both of the specimens figured of *A. lasiocarpa* came from Mount Hood, at the north end of the Cascade Range in Oregon, which is probably near the type locality of the species. I am indebted to Mr. F. V. Coville for the opportunity of figuring the young cone

of *lasiocarpa*. *Abies arizonica* is a much smaller tree than *A. lasiocarpa*.

Both are highly boreal species, belonging to the Hudsonian Zone, though *A. arizonica* fails to reach the upper or timber-line belt of this zone. *Abies lasiocarpa* ranges from southern Alaska and British Columbia southward, over the Rocky Mountains into Utah and Colorado, and over the Cascade Range to southern Oregon. *Abies arizonica*, on the other hand, is restricted, so far as known, to San Francisco Mountain and neighboring peaks on the summit of the plateau in northern Arizona.

VOL. X, PP. 119-125 NOVEMBER 5, 1896

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

THE COTTON MOUSE, *PEROMYSCUS GOSSYPINUS*.

BY OUTRAM BANGS.

The present revision of the subspecies of *Peromyscus gossypinus* is based on the study of several hundred specimens in the collection of E. A. and O. Bangs and the type and five topotypes of *Peromyscus gossypinus mississippiensis* kindly lent me by Mr. Samuel N. Rhoads.

LeConte, in 1853, bestowed the name *Hesperomys gossypinus* upon the large dark-colored, white-footed mouse of Georgia. Two years later the same author named what he supposed to be another species from the same general region, calling it *Hesperomys cognatus*. This last name has troubled subsequent mammalogists not a little, until Mr. Rhoads, in his 'Mammals of Tennessee,'* in 1896, relegated it to its proper place, and it became a synonym of *P. gossypinus*, based on the young in the pelage assumed after the plumbeous first coat has disappeared. There is, however, a name earlier than LeConte's *H. gossypinus* that must be considered. It is *Hesperomys polionotus* of Wagner, described in 1843.† This animal is said to have come

* Proc. Acad. Nat. Sci., Phila., 1896, p. 189.

† Archiv für Naturgeschichte von Wiegmann, 1843, 2ter. Bd., pp. 51–52. "Aus eben diesem Staate [Georgia] herrührend liess mir Prof. Schinz zwei Mäuse zur Ansicht zukommen, unter denen die eine mit M. Lecontii übereinstimmt. Der andern, die mir unbeschrieben scheint, habe ich den Namen *Mus polionotus* beigelegt: M. supra flavido-plumbeus subtus pedibusque albidus; auriculis mediocribus, dent. prim. integris, cauda pilosa abbreviata. Körper 2″ 4‴, Schwanz 1″ 2‴, Ohren 4‴, Hinterfuss 7‴. Wie schon erwähnt, werden beide nicht zu Mus gehoren, doch ist mir ihr Gebiss unbekannt."

from Georgia. The measurements and description of the colors of Wagner's specimen show it to have been a very young individual, and now impossible to identify. Wagner gives no definite locality in the State of Georgia, and as *P. aureolus* is found generally distributed throughout that State and as *P. leucopus* undoubtedly occurs in the mountains, it would be unwise to assume that the specimen in question was certainly the young of *P. gossypinus*, and thus allow Wagner's name to stand for that species.

Two names have been given lately to subspecies of *gossypinus* by Mr. Samuel N. Rhoads. One of these, the so-called *Sitomys megacephalus*, from Woodville, Alabama,* becomes a synonym of *P. gossypinus*. I have not seen the type, which is in alcohol, but there are no characters attributed to it that can in any way separate it from true *gossypinus* of Georgia, an animal Mr. Rhoads was wholly unfamiliar with, he making his comparisons with the Florida form, which is subspecifically distinct. The cranial characters claimed for *megacephalus* are individual and in nowise diagnostic. The other is the *Peromyscus gossypinus mississippiensis* of the bottom lands of the Mississippi in Tennessee, and is a well-marked race. I now describe two more races, one from the peninsula of Florida, the other from the bayou region of Louisiana, thus dividing *P. gossypinus* into four subspecies.

Peromyscus gossypinus has been given by authors in recent years as a subspecies of *P. leucopus*, not because any intermediates were forthcoming, but on general principles, until Rhoads, in his 'Mammals of Tennessee,' in 1896, gave it full specific rank. Mr. Rhoads, in the summer of 1895, found *gossypinus* and *leucopus* in the Mississippi bottoms in Tennessee, where, he says, it was possible to catch both species in the same trap, and yet the two kept perfectly distinct. This undoubtedly will prove to be the case wherever the ranges of *P. leucopus* and *P. gossypinus* overlap.

Most of the closely related forms of white-footed mice look very different from each other when one is trapping and handling them in the flesh. This 'aspect difference,' as Professor Shaler aptly calls it, is subtle and hard to define, and may disappear almost entirely when the animals are made into the conventional museum skins or preserved in spirits, thus leaving the characters on which species and subspecies are based very

* Proc. Acad. Nat. Sci., Phila., 1894, p. 254.

slight in comparison with what they were in life. This is strikingly true of *P. gossypinus*, and I well remember, when I first trapped this beautiful mouse, being astonished to see a creature so wholly different from *P. leucopus*, of which I had previously supposed it merely a subspecies. Since the cranial characters presented by the members of the genus *Peromyscus* are so slight that it is often difficult to tell apart the skulls of very different species, they are naturally of little help in distinguishing closely related forms.

Peromyscus gossypinus has a wide range in the lower Austral Zone, extending north along the Atlantic coast to North Carolina, up the Mississippi Valley to Tennessee, and west along the Gulf coast to Louisiana; but it is not found on the higher land between the most northern, eastern, and western points of its range.* *Peromyscus gossypinus* inhabits a variety of situations, but my experience with the typical form in Georgia has been that it is rare. About St. Marys, Georgia, they lived in the hammocks and margins and around the edges of some of the cleared fields, but were not numerous anywhere. I could not find them in the pine woods at all, but their absence there may be due to the annual firing of these woods to make pasture. The Florida form is very abundant in many parts of peninsular Florida. At Oak Lodge, on the east peninsula opposite Micco, I trapped them by the hundred. Their favorite abodes there were the edges of the salt savannah, the piles of brush and rubbish around the cleared fields, and along the edge of the beach in the saw palmetto thickets. In these dense thickets and among the plants and grasses of the upper beach *Peromyscus gossypinus palmarius* and the exquisite little *Peromyscus niviventris* occurred together in great numbers, feeding largly on the seeds of the sea oats, *Uniola paniculata*.

Peromyscus gossypinus meets or overlaps the ranges of at least four and probably five other white-footed mice. All along its northern limits it must come in contact with *Peromyscus leucopus*, and judging from Mr. Rhoads' experience in Tennessee the two species overlap, but keep distinct. *P. gossypinus* can always be told from *P. leucopus* by its much larger size, stouter build, bigger hind foot, shorter tail, browner and less fulvous coloration of the upper parts, and the gray (not white) under parts. Major LeConte states in his description of *P. gossypinus* that it has

* Reelfoot Lake, Tennessee, and Bertie County, North Carolina.

longer front legs than *leucopus*, and consequently a different gait, progressing in an even run, while *leucopus* goes by little leaps. I regret to say that while I had the opportunity I never studied the movements of *P. gossypinus* in life. Major LeConte undoubtedly did, and I see no reason to doubt his statement. The skull of *P. gossypinus* averages larger than that of *P. leucopus* when individuals of the same age are compared, but apart from this difference in size the two are indistinguishable.

Peromyscus aureolus overlaps the greater part of the range of *P. gossypinus*, but reaches farther north and probably not so far south, the southernmost examples, so far as I know, coming from Enterprise, Florida. It can always be told from *gossypinus* by the bright ochraceous of the upper parts, the under parts being also extensively washed with this color, and its smaller size about that of *P. leucopus*.

In Florida two white-footed mice, very different from each other and equally different from *gossypinus*, occur in many places associated with *gossypinus*. The commoner of these is the most beautiful of all white-footed mice, the little, ghost-like *Peromyscus niveiventris*. This species is about half the size of *gossypinus*, with pale gray and fawn-colored upper parts and snowy white under parts. The other is *Peromyscus floridanus*, an animal very unlike *P. gossypinus* and belonging to a different group of the genus. It is a large mouse, with big, nearly naked ears, short tail, and very large hind foot. The sides are a bright ochraceous buff and the under parts white. The fur is very soft and silky.

In the west *Peromyscus gossypinus* may meet the range of *P. mearnsi* of the lower Rio Grande and coast of Texas. *P. mearnsi* is about the size and proportions of *P. leucopus*, and is dark gray (purplish gray in fresh pelage) above, without a marked darker dorsal band, and white below.

Peromyscus gossypinus (LeConte).

1831. *Hyp*[*udæus*] *gossipinus* LeConte, M'Murtrie's Cuvier's Animal Kingdom, I, 1831, app., p. 434 (nomen nudum).
1853. *Hesperomys gossypinus* LeConte, Proc. Acad. Nat. Sci. Phila., 1853, p. 411.
1855. *Hesperomys cognatus* LeConte, Proc. Acad. Nat. Sci. Phila., 1855, p. 442.
1874. *Hesperomys* (*Vesperimus*) *leucopus gossypinus* Coues, Proc. Acad. Nat. Sci. Phila., 1874, p. 179.
1877. *Hesperomys leucopus gossypinus* Coues, Monog. N. American Muridæ, p. 76.

1894. *Sitomys megacephalus* Rhoads, Proc. Acad. Nat. Sci. Phila., 1894, p. 254.
1896. *Peromyscus gossypinus* Rhoads, Proc. Acad. Nat. Sci. Phila., 1896, p. 189.

Type locality.—The LeConte plantation a few miles above Riceboro, Liberty County, Georgia.

Geographic distribution.—From northern Florida north along the coast at least to Bertie County, N. C.; west through the non-mountainous parts of Georgia to Alabama and perhaps Mississippi.

Subspecific characters.—A large heavily built mouse; hind foot large; tail shorter than head and body, bicolored; ears dusky, nearly naked, of moderate size; general color of upper parts dark brown, with broad darker dorsal band; under parts gray; feet and hands grayish white.

Color.—*Adult:* Upper parts dark brown, varying from Prouts brown to sepia, darkening along middle of back into a broad dorsal band, which ranges from clove brown to black; a black orbital ring. Under parts smoke gray, the hairs plumbeous at base; feet grayish white; ears dusky; tail bicolored, dusky above, grayish white below. *Nursing young:* Blackish slate above, slate gray below; tail and feet as in adult. *Young in second pelage:* General color of upper parts duller, more hair brown, often with a sooty cast; otherwise like adult, dorsal stripe well marked.*

Size.—Average measurements of twelve adult specimens from St. Marys, Ga.: total length, 177.66; tail vertebræ, 70.25; hind foot, 22.35. Maximum size (of largest old adult in above average): total length, 197; tail vertebræ, 82.5; hind foot, 22.

Specimens examined, 37, from the following localities:

Georgia: St. Marys, 35.

North Carolina: Bertie County, 2.

Peromyscus gossypinus mississippiensis Rhoads.

1896. *Peromyscus gossypinus mississippiensis* Rhoads, Proc. Acad. Nat. Sci. Phila., 1896, p. 189.

Type locality.—Samburg, Reelfoot Lake, Tennessee.

Geographic distribution.—The Mississippi bottoms in Tennessee; limits of range unknown.

Subspecific characters.—Size about that of typical *gossypinus;* tail a little longer; hind foot larger; colors paler and more yellowish; dorsal band less well defined, without black orbital ring.

Color.—*Adult:* Upper parts varying from cinnamon brown to russet, darkening on middle of back into an ill-defined dorsal band about mummy brown; no dark orbital ring; under parts grayish white, the hairs plumbeous at base; ears dusky; tail bicolored, dusky above, white below; feet grayish white.

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*The young in this pelage are much smaller than the adults, but as they frequently breed they have the appearance of full-grown animals, and gave rise to LeConte's species *Hesperomys cognatus.*

Size.—Average measurements of six adult specimens from type locality: total length, 183; tail vertebræ, 79.5; hind foot, 24.45. Maximum size (of largest old adult in above average): total length, 196; tail vertebræ, 84; hind foot, 25.

Specimens examined, 6, all from the type locality.

Peromyscus gossypinus palmarius subsp. nov.

Type from Oak Lodge, on east peninsula opposite Micco, Brevard County, Florida. No. 3224, ♀ old adult, collection of E. A. and O. Bangs. Collected by O. Bangs February 23, 1895. Total length, 183; tail vertebræ, 74; hind foot, 21.

Geographic distribution.—Peninsular Florida, north at least to Brevard County on the east and Citrus County on the west.

Subspecific characters.—About the size of typical *P. gossypinus;* hind foot shorter; colors much paler and more yellowish; no decided darker dorsal band; a black orbital ring.

Color.—*Adult:* Upper parts varying, according to freshness of pelage, from bright russet to wood brown, usually a few darker hairs scattered along middle of back, but not enough to form a dorsal band; a black orbital ring; under parts grayish white, the hairs plumbeous at base; ears dusky; tail bicolored, dusky above, white below; feet grayish white.

Size.—Average measurements of twenty adult specimens from type locality: total length, 181; tail vertebræ, 71.88; hind foot, 21.55. Maximum size (of largest old adult in above average): total length, 206; tail vertebræ, 83; hind foot, 22.

Remarks.—*Peromyscus gossypinus palmarius* often shows a pectoral spot of yellowish brown, sometimes of large size.

It is often difficult to tell the young in the second pelage of *palmarius* from the young of typical *gossypinus*, but as a rule they are lighter in color, more grayish, less sooty, and have the dorsal stripe much less well defined.

Specimens examined, 166, from the following localities in Florida: Oak Lodge, east peninsula opposite Micco, Brevard County, 111; Micco, 3; Flamingo, 19; Miami, 2; Jupiter Inlet, 3; Crystal River, 4; Citronelle, 3; Blitches Ferry, Citrus County, 21.

Peromyscus gossypinus nigriculus subsp. nov.

Type from Burbridge, Plaquemines Parish, Louisiana. No. 2731, ♀ adult, collection of E. A. and O. Bangs. Collected by F. L. Small January 30, 1895. Total length, 174; tail vertebræ, 79; hind foot, 24.

Geographic distribution.—Bayou region of the coast of Louisiana.

Subspecific characters.—Size smallest of the *gossypinus* series; hind foot about as in typical *gossypinus;* tail proportionally longer; colors very dark; a broad dorsal band nearly black; ears and upper surface of tail black; a black orbital ring.

Color.—*Adult:* upper parts varying from vandyke brown to sepia, often with a sooty cast; darkening along middle of back into a broad dorsal

band of nearly black; a black orbital ring; under parts grayish white; the hairs plumbeous at base; ears black; tail bicolored, black above, grayish white below; feet and hands grayish white.

Size.—Average measurements of three adult specimens from the type locality: total length, 168.33; tail vertebræ, 76.66; hind foot, 23.66. Average measurements of twenty adult specimens from Gibson, Terre Bonne Parish, Louisiana: total length, 169.85; tail vertebræ, 77.85; hind foot, 22. Maximum size (of largest old adult in above average): total length, 184; tail vertebræ, 86; hind foot, 22.

Remarks.—The young of *Peromyscus gossypinus nigriculus* are very dark colored, both in the nursing and the second pelage, and can usually be separated, both by their dark color and their smaller size, from the young of corresponding age of *gossypinus* or of *palmarius*.

This form appears to be confined to the heavy swamps of the bayou region, and probably does not occur farther from the coast than the limits of these swamps. Although Mr. Small trapped persistently in several localities in the prairie and pine regions of central Louisiana, he failed to get a single specimen of any *Peromyscus* in such places and concluded that none occur north of the bayous.

Specimens examined, 89, from the following localities in Louisiana: Burbridge, Plaquemines Parish, 5; Gibson, Terre Bonne Parish, 56; Powhatan Plantation (near Gibson), 28.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

JUNCUS CONFUSUS, A NEW RUSH FROM THE ROCKY MOUNTAIN REGION.

BY FREDERICK V. COVILLE.

In a collection of Juncaceae from Idaho, recently received for identification from Mr. A. A. Heller, were two specimens of an undescribed Juncus, which had long been confounded, even by Engelmann himself, with *Juncus tenuis congestus* Engelm. A description of the species, which was already well represented in the National Herbarium by specimens from other collectors, is given herewith.

Juncus confusus Coville, sp. nov.

Plant perennial, densely tufted, 15 to 60 cm. high, erect; stem 0.5 to 1.5 mm. thick at base, narrower above, striate, nearly terete; leaves all basal, the sheaths with well developed auricles, the blades erect, one-third to one-half or more the height of the stem, flat, usually involute in drying, narrow, 0.5 to 1 mm. in breadth; inflorescence congested into a turbinate cluster 2 cm. or less in height, much exceeded by its lowest bract; perianth 3 to 4 mm. long, its parts equal, ovate-lanceolate, acute, with green or at maturity stramineous midrib and a brown stripe on either side; stamens 6, about one-half as long as the perianth, the anthers shorter than their filaments; capsule oblong, equaling the perianth, retuse, completely 3-celled; seed light brown, obovoid or oblong, .45 to .6 mm. in length, with oblique white apiculations connected by a usually evident white raphe, finely reticulated in about 16 longitudinal rows, the areolæ smooth and 2 to 4 times broader than long.

Type specimen in the U. S. National Herbarium, collected September 6, 1890, in an irrigated meadow, North Park, Colorado, by C. S. Crandall.

Other specimens beside the type have been examined as follows:

Colorado: Grand Lake, George Vasey, 1868, No. 576.

Wyoming: Sherman, altitude 8,000 feet, G. W. Letterman, July 28, 1884.

Big Horn Mountains, B. C. Buffum, August 6, 1892.

Clarks Fork Valley, J. N. Rose, September 3, 1893, No. 530.

Steamboat Point, Yellowstone Lake, Robert Adams, August 19, 1871.

Montana: Spanish Creek, P. A. Rydberg, July 11, 1896, No. 3058.

In a meadow, Spanish Basin, altitude 1,800 meters, P. A. Rydberg, July 17, 1896, No. 3116.

In a wet meadow, Blackhawk, P. A. Rydberg, August 5, 1896, No. 3282.

Idaho: In the vicinity of Forest and about Lake Waha, Nez Perces County, Mr. and Mrs. A. A. Heller, June 25, 1896, No. 3319, and July 16, 1896, No. 3446.

Washington: Near Spangle, Spokane County, W. N. Suksdorf, June 30, 1884, No. 1042.

Juncus confusus is one of seven closely related species, all of which with the exception of *J. tenuis* occur only in America and with the additional exception of *J. dichotomus* only in North America. *Juncus tenuis* was formerly a very rare plant in Europe, but is now becoming widely disseminated there and in nearly all parts of the world, apparently by introduction from America. The following synopsis will be useful in distinguishing the species of the group:

Synopsis of *Juncus tenuis* and its Allies.

Leaf blade flat, but sometimes involute in drying.

Anthers much longer than their filaments.....*J. georgianus* Coville.

A densely tufted plant, with long leaves, reaching the unusually large inflorescence; brown-striped perianth 4 to 6 mm. long; and narrowly oblong-lanceolate completely 3-celled capsule. This species is known only from Georgia, where it occurs on Stone Mountain and adjacent knobs of similar geological structure. For full description see Bull. Torr. Club, **22**: 44. 1895.

Anthers not exceeding their filaments.

Perianth 2.5 to 4 mm. long, usually with some reddish or brownish coloration, equaling the completely 3-celled capsule; apex of the capsule distinctly triquetrous, truncate or retuse.

Inflorescence somewhat congested, much exceeded by its lowest involucral bract.....*J. confusus* Coville.

A plant of the Rocky Mountain region from Colorado northward to Montana, Idaho, and Washington.

Inflorescence not congested, the flowers secund on the somewhat incurved branches, seldom exceeded by the lowest involucral bract.....*J. secundus* Beauv.

A species of common occurrence in the coastal plain from New Jersey to North Carolina and occasional in Illinois and Missouri.

Perianth 3.5 to 5.5 mm. long, green or stramineous, without brown stripes along either side of the midrib (except in the variety); capsule obovate, broadly rounded, though sometimes retuse, incompletely 3-celled.....*J. tenuis* Willd.

Occurring almost throughout North America, especially as a weed along roadsides and paths, and now migrating to all parts of the world. Along the Pacific coast from middle California to Vancouver Island occurs a robust variety with congested inflorescence much exceeded, as is usually the case also in the type form of the species, by the lowest involucral bract; the perianth 4 to 5.5 mm. in length, about one-half longer than the capsule; its parts with a reddish brown stripe along either side of the midrib. This plant is here named **Junctus tenuis occidentalis** (*J. tenuis congestus* Engelm. Trans. St. Louis Acad. **2**: 450. 1866. Not *J. congestus* Thuill. 1799).

Leaf blade terete, channeled along the upper side.

Seed not caudate.

Perianth 3.5 to 5 mm. long, not exceeded by the capsule.

J. dichotomus Ell.

A species common to North and South America, occurring abundantly in the United States along the coast from Texas to New Jersey, and more rarely as far northward as Maine. The plant is often confounded with *J. tenuis* when not critically examined, but in addition to its leaf character it may be distinguished also by its darker green color and its fewer-ribbed (about 14 instead of 20 to 24) seeds.

Perianth 2.5 to 3 mm. long, conspicuously exceeded by the capsule.....*J. greenei* Oakes & Tuckerm.

Occurring near the coast from New Jersey northward to New Brunswick; in Michigan, Wisconsin, and Minnesota; and in the Canadian province of Ontario. The inflorescence is usually short, much exceeded by the lowest involucral bract, and the exposed portions of the completely 3-celled ovoid-lanceolate capsule are commonly brownish. The seeds are commonly but erroneously described as caudate.

Seed distinctly caudate ..... *J. vaseyi* Engelm.

Occurring from Michigan, Illinois, and Iowa northward to the plains of middle Canada; at Orono, Maine; in the Black Hills of South Dakota; and, on the authority of a label in the Canby Herbarium, in Middle Park, Colorado. *J. vaseyi* differs from the last, in addition to its important seed and perianth characters, in its inflorescence usually exceeding the lowest involucral bract, and the green, or, at maturity, stramineous capsule being little or not at all contracted toward the apex.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

RIBES ERYTHROCARPUM, A NEW CURRANT FROM THE VICINITY OF CRATER LAKE, OREGON.

BY FREDERICK V. COVILLE.

Crater Lake is a remarkable body of the purest water, nearly circular in form, about ten kilometers (6 miles) in diameter and 600 meters (2,000 feet) in depth, without a visible outlet, occupying the bowl of an extinct volcano in the southern part of the Cascade Mountains of Oregon, situated about latitude 43° and longitude 122°. The surface of the water has an altitude of 1,902 meters (6,239 feet) and the surrounding cliffs rise 300 to 450 meters (1,000 to 1,500 feet) higher, some of the neighboring peaks reaching 2,400 and 2,700 meters (8,000 and 9,000 feet). The mountain slopes are densely forested, except where the trees have been burned off by sheep herders, and no settlements occur nearer than the plains below. It was the writer's good fortune to visit the place in August of the present year, at the time of the excursion of the Mazamas to that point. The Mazamas are an organization of mountain climbers, which originated in Portland, Oregon, and are doing a great deal to popularize the natural sciences, to make known the wonderful scenery of the Northwest coast, and especially to create and maintain a public sentiment toward the preservation of the magnificent forests of that region.

Nothing seems to have been published on the botany of this part of the Cascades, and indeed no botanist appears heretofore to have made a collection of the plants of the Crater Lake region. The collection made by the writer and Mr. John B. Leiberg from August 13th to 20th of the present year is therefore of unusual

interest. Only a partial examination of the specimens has been made thus far, and a full report must be deferred, but an interesting species, apparently undescribed, is here presented to the public.

Ribes erythrocarpum Coville & Leiberg, sp. nov.

Shrub trailing upon the ground, devoid of prickles, the stems rooting and giving rise to ascending branches commonly 10 to 20 cm. in height, the herbage and inflorescence clothed with short glandular hairs; leaves angulate-orbicular in outline, rugose, commonly 2 to 3.5 cm. in diameter, on petioles nearly as long, 3 to 5-lobed, the sinuses extending one-half or two-thirds the way to the base, the lobes coarsely crenate and the crenatures unevenly but finely dentate-serrate; racemes erect, commonly 10 to 20-flowered, the bracts herbaceous, lanceolate to obovate, commonly 2 to 4 mm. long, persistent; flowers erect, contiguous, when expanded 6 to 8 mm. in diameter, on pedicels equaling the bracts; ovary beset with short glandular hairs; calyx not produced into a tube, the spreading lobes oblong, obtuse or broadly acute, yellow, minutely dotted with red, therefore appearing salmon-colored, sparingly and minutely pubescent without, glabrous within; petals broadly spatulate, glabrous, one-third to one-half the length of the calyx lobes and similar in color; filaments glabrous; style glabrous, 2-parted; fruiting racemes erect or sometimes declined by the weight of the berries; fruit on erect pedicels, scarlet, subpyriform to spherical, commonly 8 to 10 mm. in length, provided with short glandular hairs, the flesh white or translucent, insipid.

Type specimen in the United States National Herbarium, collected August 12, 1896, at an altitude of about 1,675 meters, in the canyon of Pole Bridge Creek, about 10 kilometers south of Crater Lake, Cascade Mountains, Oregon, by Frederick V. Coville and John B. Leiberg.

The plant appears from the structure of its flowers to be most nearly related to the *Ribes laxiflorum* of Pursh and the *Ribes howellii* of Greene (*R. acerifolium* Howell), from both of which it is at once distinguishable by its creeping habit and its glandular pubescence, in the latter of these characters and in its general appearance closely resembling Pursh's *Ribes viscosissimum*. Its herbage, however, possesses the rank odor of *Ribes prostratum* and *R. hudsonianum*, quite distinct from the citronella-like smell of *viscosissimum*. That species, too, has blue fruit and an elongated calyx tube. *Ribes erythrocarpum* grows in abundance about Crater Lake, in the forests of *Tsuga pattoniana*, to an altitude of at least 2,400 meters.

VOL. X, PP. 133-134 DECEMBER 8, 1896

PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

AN UNDESCRIBED SHREW OF THE GENUS *SOREX*.

BY CHARLES F. BATCHELDER.

On September 9, 1895, at Beede's, Essex county, New York, I obtained a Shrew unlike any species known to me. It was caught in one of several 'cyclone' traps, baited with rolled oatmeal, that were set among some large, angular rocks at the head of a wooded talus of loose rock. Just above, shading the spot and keeping it moist and cool, rise the low cliffs from whose fragments the talus has been formed.

Nearly a year later, on August 1, 1896, I caught a second specimen of this Shrew on Mount Marcy, the highest of the Adirondack Mountains. It, too, was caught with oatmeal in a 'cyclone' trap. It was taken in a crevice between some rocks, on the bare, open summit of the mountain, about 5300 feet above sea-level. The locality where the first one was captured is about eight miles distant, in an air line, and lies at an elevation of only 1300 feet above the sea.

I have compared this Shrew with other species of the genus *Sorex* (the material for comparison I owe in some cases to the unfailing kindness of Dr. C. Hart Merriam), and find it so different from them all that I am led to describe it as follows:

Sorex macrurus sp. nov.

Type from Beede's [sometimes called Keene Heights], in the township of Keene, Essex county, New York; taken September 9, 1895. The type is a young adult male, No. 1384, collection of C. F. Batchelder.

General characters.—Size large; tail long; body stout.

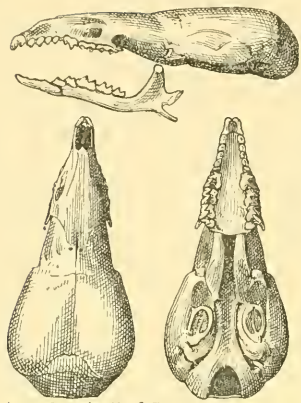

FIG. 26.—Skull of *Sorex macrurus* ♂ Type (× 2).

Colors (of type, noted in the flesh).—Upper parts between 'slate-color'[1] and 'blackish slate';[1] under parts dark 'smoke gray'[2] or brownish 'mouse-gray';[3] tail, above, browner than back; edge of lips and under side of tail, brownish flesh color; upper side of both hind and fore feet between 'fawn-color'[4] and 'ecru drab.'[4]

The specimen from Mt. Marcy (♂, ad. Aug. 1, 1896, No. 1386, coll. C. F. B.) differs in color from the type only in having a slightly more plumbeous tint, a difference due, apparently, merely to its pelage having been exposed to several weeks less wear.

Cranial and dental characters.—Skull long and slender; brain-case low, narrow, and little inflated; rostrum long, narrow, and low; palate rather narrow. Posterior border of infraorbital foramen lying over a point considerably behind the interspace between the first and second molars. Unicuspidate teeth slender; the first and second about equal in size; the third and fourth smaller, and subequal—if anything, the third slightly shorter than the fourth. Molariform teeth deeply excavated posteriorly.

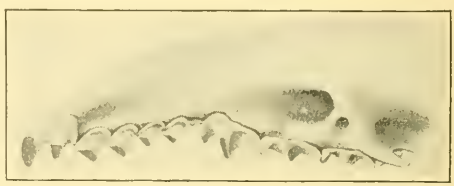

FIG. 27.—Left side of upper jaw showing teeth. Type (× 6).

FIG. 28.—Same tooth row, seen from below.

Measurements (of type, taken in the flesh).—Total length, 130 mm.; tail vertebræ, 60 mm.; hind foot, 15 mm.; fore foot, 8 mm.; height of ear, 10 mm. The Mount Marcy specimen measured: total length, 139 mm.; tail vertebræ, 61 mm.; hind foot, 15 mm.; ear, 10 mm. The extreme tip of its tail appears to have been lost by some accident.

This Shrew differs so widely from all others with which I am acquainted that comparisons with any other species are quite unnecessary. In color and size it bears a slight superficial resemblance to *Sorex fumeus* and to *S. trowbridgii*, but it is at once distinguishable from them by its long tail, even without reference to its cranial and dental characters, in which it is totally unlike these species. In the general shape of the skull there is a suggestion of *Sorex personatus*, but in this respect *macrurus* is even more remote from such species as *trowbridgii* or *fumeus* than is *personatus* itself.

[1] Ridgway: A nomenclature of colors for naturalists, etc., 1886, plate II, Figs. 4-3. [2] Ibid., Fig. 12. [3] Ibid., Fig. 11. [4] Ibid., pl. III, Figs. 22-21.

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

SOME NEW MAMMALS FROM INDIAN TERRITORY AND MISSOURI.

BY OUTRAM BANGS.

In the summer of 1896 Mr. Thaddeus Surber undertook a collecting trip to Indian Territory in the interests of the Bangs collection. After spending a short time in Missouri he went to Stilwell, in the Cherokee Nation, at the northwest part of the Boston Mountains. The country was suffering from an unprecedented drought and all mammals were extremely hard to find. Mr. Surber was also handicapped by the unfriendliness of the Indians, who absolutely refused to help him in any way. He had collected but a few days when he was taken ill with an extremely malignant form of malaria, which compelled him to abandon the work.

The Boston Mountains about Stilwell rise to a height of 2,500 feet (estimated), and are closed in by ranges of low lying hills, some 250 or 300 feet higher than the intervening narrow valleys of rich land. Beyond the hills west of Stilwell stretches a barren prairie that is said to have been formerly forest-covered. On the sides of the mountains are found black walnut, white oak, red oak, black jack, etc., but no pines. The mountains all top off in cliffs from five to fifty feet high, composed of sandstone or bastard limestone, in which there are many caves.

The material collected at Stilwell, while small in number of specimens, is of great interest. Besides the new forms here described, Mr. Surber got only three species of mammals—the raccoon, *Procyon lotor;* the southern gray squirrel, *Sciurus carolinensis*, and the plains wood rat, *Neotoma baileyi*.

My thanks are due to General Nelson A. Miles, who with great kindness secured for me the necessary permit allowing Mr. Surber to collect in Indian Territory. I am also indebted to Dr. J. A. Allen for presenting me with specimens of *Lepus sylvaticus bachmani*, *Peromyscus attwateri*, and *Scalops texanus* for comparison with the Indian Territory forms.

Lepus sylvaticus alacer subsp. nov.

Type from Stilwell, Indian Ter., No. 5480, ♀ young adult, collection of E. A. and O. Bangs. Collected by Thaddeus Surber August 14, 1896. Original No. 65.

Two specimens from Stilwell, Indian Ter.; 2 from Stotesbury, Vernon Co., Mo.

General characters.—About the size of *Lepus sylvaticus bachmani*, but differing from that form in being much darker and richer in color and in having much smaller audital bullæ.

Color.—Type in summer pelage: upper parts rich reddish brown (about hazel), many of the hairs with black tips; nuchal patch and upper surface of legs and arms cinnamon rufous; sides and rump paler, shading towards wood brown; band on under side of neck wood brown; rest of under parts, including chin and throat, white. A specimen from Stotesbury, Mo., in winter pelage (No. 1677, February 27, 1894): upper parts cinnamon rufous on back, wood brown on sides, very thickly mixed with black-tipped hairs, giving a dark and rich effect; ears wood brown broadly edged with black; no black mark between ears.

Cranial characters.—Skull small, about the size of that of *L. sylvaticus bachmani*, differing from other members of the *sylvaticus* series in having extremely small audital bullæ. Size of type skull: basilar length, 536; occipitonasal length, 67.2; zygomatic breadth, 34; greatest length of single half of mandible, 51.6.

Size.—Type: total length, 370; tail vertebræ, 50; hind foot, 95; ear, 73. Average measurements of two adult specimens from Stotesbury, Vernon Co., Mo.: total length, 398; tail vertebræ, 30.5; hind foot, 79.35; ear, 82.6.

General remarks.—When I was at work on the cotton-tails of eastern North America in 1894 I had the two specimens referred to above, collected at Stotesbury, Mo., in the winter of 1894, by Mr. Surber, and on account of their small size, peculiar coloration, and small audital bullæ was unable to refer them to any known subspecies. They clearly belong to the same form as the Indian Territory specimens, which appears to be unnamed. The two examples taken at Stilwell were both shot in the low, rich valleys, and Mr. Surber did not find the animal on the mountains. This form probably has an extensive range throughout the region where the wooded eastern country meets the great plains.

Lepus sylvaticus alacer probably merges into *L. sylvaticus bachmani* of Texas, but its smaller audital bullæ and dark color at once distinguish it from the gray *bachmani*.

Peromyscus bellus sp. nov.

Type from Stilwell, I. T. No. 5483, ♀ adult, collection of E. A. and O. Bangs. Collected by Thaddeus Surber August 15, 1896. Original No. 67. Two specimens from Stilwell, I. T.

General characters.—Compared with *P. attwateri* (apparently its nearest geographical ally) *P. bellus* differs in being much darker and browner; in having a larger hind foot, a pectoral band of fawn color, and a fawn-colored nose patch (white in *attwateri*). It belongs to the group of so-called brush mice.

Color.—Upper parts broccoli-brown much mixed with black along back, becoming fawn color on lower sides; patch at root of whiskers fawn color; ears large, nearly naked, dusky; tail large and long, bicolored, black above, white below, well haired and with a decided pencil; feet and hands white; under parts white, the hairs plumbeous at base; a band of fawn color extending across under side of neck in front of arms.

Cranial characters.—Skull of the same general appearance as that of *P. attwateri*, but larger and with deeper, broader brain case. Size of the type skull: basilar length, 24.2; occipitonasal length, 28; zygomatic breadth, 14; greatest length of single half of mandible, 15.

Size.—Type: total length, 190; tail vertebræ, 90; hind foot, 24; ear, 17. Average measurements of two adult specimens from Stilwell, I. T.: total length, 192.5; tail vertebræ, 93.5; hind foot, 24; ear, 16.

General remarks.—The two examples of this brush mouse were taken on one of the rocky hillsides at Stilwell. *P. bellus* differs from *P. attwateri* very materially, but *P. attwateri* seems very close, perhaps too close, to *P. rowleyi*, as I must confess I can hardly distinguish skins of the two species.

Tamias striatus venustus subsp. nov.

Type from Stilwell, I. T. No. 5478, ♂ old adult, collection of E. A. and O. Bangs. Collected by Thaddeus Surber August 13, 1896. Original No. 63. Two specimens from Stilwell, I. T.; 1 from Noel, Mo.

General characters.—Size and proportions about as in *T. striatus griseus*; colors very bright, especially on rump; all the black dorsal and lateral bands much shortened; hair, especially on rump, hispid, but this character may be seasonal.

Color.—Rump and upper surface of legs deep, rich, lustrous chestnut rufous, this color extending up back and sides, narrowly bordering the black bands; sides yellowish gray; back (between the black bands) and upper neck and shoulders dark gray; ears and face much suffused with chestnut rufous; facial markings not conspicuous; hairs of upper surface of tail yellowish at base, then black and slightly tipped with white; under parts yellowish white, somewhat washed on belly and under side of legs with cinnamon rufous; under side of tail cinnamon rufous.

Cranial characters.—The skull is large, about as in *T. striatus griseus*. Size of type skull: basilar length, 38.6; occipitonasal length, 43.6; zygomatic breadth, 24.4; greatest length of single half of mandible, 26.2.

Size.—The type: total length, 260; tail vertebræ, 100; hind foot, 37. Size of No. 5605, ♂ adult from Noel, Mo.: total length, 255; tail vertebræ, 105; hind foot, 36.5.

General remarks.—The two specimens of this fine chipmunk that Mr. Surber got at Stilwell were shot at the edge of an old field well up on a hillside. The specimen from Noel, Mo., was taken in a similar place.

Tamias striatus venustus is by far the handsomest of the *striatus* series and is easily distinguished from any of the other subspecies. Its large size and big hind foot place it nearest to *griseus*, but its bright, rich coloration will at once separate it from that form. With the pale yellow *lysteri* of the northeast it needs no comparison, and from the small, dull, dark-colored true *striatus* of the southeast it can always be told by its larger size, bigger hind foot, longer tail, and much brighter coloration.

Scalops texanus æreus subsp. nov.

Type from Stilwell, I. T. No. 5475, ♀ old adult, collection of E. A. and O. Bangs. Collected by Thaddeus Surber, August 13, 1896. One specimen from Stilwell, I. T.

General characters.—Size larger than typical *S. texanus*; hind foot larger; colors darker, without orange markings about nose and chest; skull slightly different.

Color.—Rich coppery chestnut all over, without golden or orange suffusions; slightly duller below than above, and grayer on chin and throat.

Cranial characters.—The skull of *S. texanus æreus* as compared with that of true *texanus* is larger and of a slightly different shape. The skull of *texanus* has a short rostrum and is much bulged between the orbits. The skull of *æreus* has a longer rostrum and does not present the bulged appearance between the orbits. Size of type skull: basilar length, 28.4; occipitonasal length, 33.4; zygomatic breadth, 15.2; greatest length of single half of mandible, 21.8.

Size.—The type: total length, 154; tail vertebræ, 24; hind foot, 19.

General remarks.—Mr. Surber caught the type specimen of *Scalops texanus æreus* while it was engaged in tunneling on a black-jack ridge at Stilwell.

Dr. J. A. Allen* gives the following measurements for *Scalops texanus* from Rockport, Texas: Average of twelve adult males, total length, 141; tail vertebræ, 25; hind foot, 17.8; and of eight adult females, total length, 137; tail vertebræ, 23; hind foot, 16.5. The largest male measured: total length, 147; tail vertebræ, 27; hind foot, 19; and the largest female: total length, 146; tail vertebræ, 25.5; hind foot, 18. Although Dr. Allen gives no cranial characters for the species, the two skulls of *texanus* that I have examined can be easily told from either the skulls of typical *Scalops aquaticus* or *S. aquaticus argentatus*, apart from the smaller size, by the much shorter rostrum and bulging interorbital region. The skull of *æreus* is much more like that of *aquaticus*.

Mr. Surber took a fine series of *Scalops aquaticus argentatus* at Stotesbury, Vernon County, Mo., which brings the range of that subspecies very near the range of *S. texanus æreus*. *Æreus*, however, does not approach *argentatus* in any way, its affinities lying wholly with *texanus*.

* Bull. Am. Mus. Nat. Hist., vol. vi, 1894, p. 186.

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THE SKUNKS OF THE GENUS *MEPHITIS* OF EASTERN NORTH AMERICA.

BY OUTRAM BANGS.

In 1895* I described a new skunk from Florida as a subspecies of the northern *Mephitis mephitica* (Shaw), and at the same time reviewed, in rather an informal way, the eastern members of the genus *Mephitis*. Since then I have learned more about the distribution of the eastern skunks and have seen many additional specimens, so that some of my former views have changed. I now consider the Florida *elongata* entitled to specific rank, and still another form from the Mississippi Valley entitled to recognition. The latter form, which I shall call *Mephitis mephitica scrutator*, is common in the pine and prairie region of central Louisiana, and extends northward up the Mississippi Valley and eastward through the Alleghany Mountains, gradually shading into true *mephitica*. Specimens from the central region from Virginia to Maine are typical of neither form. *M. mephitica typica* occurs only in high Canadian and Hudsonian regions. *M. elongata* is abundant, though locally distributed, over the greater part of peninsular Florida and extends up the Atlantic coast at least to southern South Carolina or northern Georgia, where it gradually ceases, and *no skunk* is found throughout eastern North Carolina,† thus leaving *elongata* and *mephitica*

*Notes on North American Mammals, Proc. Boston Soc. Nat. Hist., vol. xxvi, author's edition, July 31, 1895.

† Messrs. H. H. and C. S. Brimley, in fourteen years of constant collecting about Raleigh, N. C., have never seen a skunk there, and have only known one to be reported as having been killed. I have made many inquiries of farmers throughout eastern North Carolina and have always got the same answer, that there are no skunks there. Of course, *elongata* or *mephitica* might be expected to occur occasionally as stragglers.

separated by a wide area in the east. Just what forms the western limit of the range of *M. elongata* I am unable to say, but probably it is the heavy swamps of the lower Mississippi.

MEPHITIS MEPHITICA (Shaw).

1792. *Viverra mephitica* Shaw, Museum Leverianum, 1792, p. 172.
1857. *Mephitis mephitica* Baird, Mamm. N. Am., 1857, p. 195.

Geographic distribution.—Whole of eastern North America from Ontario, Quebec, and Nova Scotia to Louisiana, except Florida and the coast belt from thence to Virginia. Its range may overlap that of *M. elongata* in the lower Mississippi Valley, and undoubtedly does overlap the range of *M. hudsonica* * in the upper Mississippi Valley.

Description.—Size small to medium; tail short to medium, tapering to a pencil; color pattern variable, but usually black all over except frontal stripe, nuchal patch, two strips extending from nuchal patch to and down sides of tail, tip of tail and some scattered hairs in black part of tail, all of which are white.

Fully adult males vary in size according to locality: total length, 595–682; tail vertebræ, 171–241; hind foot, 64–83.

M. mephitica is distinguished from *M. hudsonica* by smaller size, shorter tail, tapering to a pencil, and smaller and less elongated skull. It is separated from *M. elongata* by heavier build, much shorter tail, and proportionally shorter and broader hind foot.

This species may be divided into two well-marked subspecies, *Mephitis mephitica mephitica* and *M. mephitica scratator*.

Mephitis mephitica mephitica (Shaw).

1792. *Viverra mephitica* Shaw, Museum Leverianum, 1792, p. 172.
1895. *Mephitis mephitica* Bangs, Proc. Boston Soc. Nat. Hist., Vol. XXVI. Author's edition, July 31, 1895. (Name restricted to the Hudsonian form.)

Type locality.—North America.

Geographic distribution.—Boreal eastern North America; Nova Scotia, Quebec, and Ontario south to about the northern limits of the United States. Western limit of range unknown.

General characters.—Size large; tail short, tapering off to a pencil; feet very broad and long; heel usually covered with hair, rest of sole naked;

* *Mephitis hudsonica* (Richardson) extends eastward to Minnesota and probably to western Ontario. It is a very big skunk, fully adult males measuring: total length, 690; tail vertebræ, 255; hind foot, 83, and larger. The skull is large and long and the dentition heavy. The palate ends in an even curve, without median spine. The color pattern varies but little. The tail is long, very heavily haired, and has a blunt brush-like end, around which the long hairs of the sides of the tail fall.

markings very constant, varying only in a trifling difference of length and width of the two lateral white stripes.

Color.—A narrow frontal stripe, nuchal patch, and two lateral bands extending from nuchal patch to and down sides of tail, white; tip of tail often white; many white or half white hairs mixed in tail; rest of head, body, tail, arms, and legs, black. Varies in a slight degree only. Occasionally the white stripes reach only to the middle of sides of back; the stripes vary in width but little.

Cranial characters.—Skull large and massive, the palate ending in an even curve, without median spine. Size of an old adult male skull (No. 3805, Bangs collection from Lake Edward, Quebec): basilar length, 71.6; occipitonasal length, 74.6; zygomatic breadth, 52; mastoid breadth, 43.8; greatest length of single half of mandible, 52.8. Size of an old adult female skull (No. 3802, Bangs coll. from Lake Edward, Quebec): basilar length, 65.2; occipitonasal length, 67.2; zygomatic breadth, 47.6; mastoid breadth, 40.8; greatest length of single half of mandible, 50.

Size.—Old adult ♂ (No. 2022, Bangs coll. from Digby, Nova Scotia): total length, 682; tail vertebræ, 171; hind foot, 83. Old adult ♀ (No. 3802, Bangs coll. from Lake Edward, Quebec): total length, 565; tail vertebræ, 159; hind foot, 75.

General remarks.—The constancy of the markings of *Mephitis mephitica typica* and the absence of the median spine of the palate are both characters it possesses in common with the big-tailed western species of the *hudsonica* group, from which it differs, however, in its shorter tail, tapering to a pencil, and its smaller size. Its range is very restricted. In its extreme form it occurs only in a narrow belt, including the upper edge of the Canadian and lower edge of the Hudsonian zones. Its exact northern limit is unknown to me, but the evidence seems to indicate that it does not reach very far north. A long line of intermediates extends southward from northern Maine until the other extreme, *M. m. scrutator*, is reached in the lower Mississippi Valley.

Mephitis mephitica scrutator subsp. nov.

Type from Cartville, Acadia Parish, Louisiana. No. 2889, ♂ old adult, collection of E. A. and O. Bangs. Collected by F. L. Small May 25, 1895. Original No. 1842.

Geographic distribution.—Pine and prairie regions of central Louisiana, extending up the Mississippi Valley to Indiana and eastward across the Alleghanies to Virginia, and thence northward, gradually becoming less typical, until it merges into true *mephitica*.

General characters.—Size small; tail medium (actually longer than in *mephitica typica*), tapering off to a pencil; feet very small; markings very variable.

Color.—Color and markings as in true *mephitica*, but much more variable. The two lateral white stripes are often so wide as to meet on the back for nearly their whole length, forming the predominating color of the upper parts. In other specimens the lateral stripes are reduced to

two small points of white projecting backward from the nuchal patch, the rest of the upper parts, except the frontal stripe and nuchal patch, being black.

Cranial characters.—Skull much smaller and lighter than that of *M. mephitica typica;* palate ending in a median spine, not always large, but even when much reduced giving a very different outline to end of palate from that of *mephitica typica.* Size of the type skull (an old adult ♂): basilar length, 60; occipitonasal length, 63.2; zygomatic breadth, 44; mastoid breadth, 35; greatest length of single half of mandible, 45.6. An old adult ♀ (No. 2886, Bangs collection from Point aux Loups Springs, Acadia Parish, La.): basilar length, 57.4; occipitonasal length, 62.2; zygomatic breadth, 38.8; mastoid breadth, 35; greatest length of single half of mandible, 43.

Size.—Old adult ♂ type: total length, 580; tail vertebræ, 208; hind foot, 64. Old adult ♀ (No. 2886, Bangs coll., from Point aux Loups Springs, Acadia Parish, La.): total length, 594; tail vertebræ, 233; hind foot, 67.

General remarks.—Among the intergrades between this form and *mephitica typica* that occur through the New England and Middle States, but especially northward, examples can be found both with and without the median spine at the end of the palate. No specimen that I have ever seen of *Mephitis mephitica typica*, however, has shown any approach to such a spine, not even the very young examples, while it is present, in a varying degree, in every skull of *scrutator* examined.

MEPHITIS ELONGATA Bangs.

1895. *Mephitis mephitica elongata* Bangs, Proc. Boston Soc. Nat. Hist., Vol. XXVI. Author's edition, July 31, 1895, p. 3.

Type locality.—Micco, Brevard Co., Florida.

Geographic distribution.—Peninsular Florida, north along the coast to southern South Carolina; western limit of range unknown. Rare in the northern part of its range; locally distributed everywhere.

General characters.—Size large, but of lighter build than *M. mephitica;* tail very long, tapering to a pencil; feet very long and slender; color and markings very variable.

Color.—Color and markings as in *Mephitis mephitica scrutator* and subject to the same range of individual variation. One specimen is all black except the tip of the tail and the nuchal patch, even the usual white frontal stripe being entirely wanting. Another has most of the tail and the whole back, except a narrow median line on the rump, white.

Cranial characters.—Skull large, about the size of that of *Mephitis mephitica typica*, always with a large median spine at end of palate.

Size of an old adult ♂ skull (No. 3052, Bangs coll., topotype): basilar length, 66.4; occipitonasal length, 71; zygomatic breadth, 49.2; mastoid breadth, 40; greatest length of single half of mandible, 50.8. An old adult ♀ skull (No. 2484, Bangs coll., from Blitches Ferry, Citrus Co.,

Fla.): basilar length, 59.6; occipitonasal length, 62.2; zygomatic breadth, 45.4; mastoid breadth, 35.8; greatest length of single half of mandible, 46.4.

Size.—Old adult ♂ (topotype, No. 3052, Bangs coll.): total length, 719; tail vertebræ, 321; hind foot, 76. An old adult ♀ (No. 2483, Bangs coll., from Blitches Ferry, Citrus Co., Fla.): total length, 673; tail vertebræ, 330; hind foot, 70.

General remarks.—*Mephitis elongata* is very different from *M. mephitica*, and its characters are constant throughout its range. Since I can find no indication of intergradation and the ranges of the two forms are separated, at least in the east, by a strip of neutral ground, where no skunk occurs, *M. elongata* seems entitled to rank as a full species.

(*Measurements on next page.*)

Individual Measurements of a Series of Eastern Skunks (genus Mephitis).

Number.	Locality.	Sex.	Age.	Total length.	Tail vertebræ.	Hind foot.	Measured by
Mephitis mephitica mephitica (Shaw).							
3801*	Quebec, Lake Edward	♂	Old adult	585.0	193.0	75.0	O. Bangs.
3803	" " "	♂	Adult	617.0	182.0	79.0	" "
3804	" " "	♂	Adult	592.0	182.0	76.0	" "
3802	" " "	♀	Old adult	565.0	159.0	75.0	" "
2022	Nova Scotia, Digby	♂	Old adult	682.0	171.0	83.0	" "
2249	Nova Scotia, Annapolis	♂	Adult	635.0	226.0	78.0	" "
3942†	Ontario, North Bay	♂	Old adult	600.0	170.0	80.0	G. S. Miller, Jr.
3941	" " "	♀	Old adult	590.0	170.0	65.0	" "
3945	Ontario, Little Pick River	♂	Old adult	580.0	190.0	75.0	" "
Intermediates.							
2684*	Maine, Upton	♂	Old adult	660.0	280.0	70.0	James Bernier.
2683	" "	♂	Old adult	612.0	217.0	68.0	" "
2685	" "	♂	Young adult	595.0	206.0	65.0	" "
2686	" "	♀	Young adult	625.0	209.0	70.0	" "
2433	Maine, Bucksport	♂	Old adult	544.0	169.0	62.0	O. Bangs.
5450	Massachusetts, Wareham	♂	Old adult	622.0	220.0	68.0	" "
1705	" "	♂	Old adult	599.0	200.0	68.5	" "
797	" "	♂	Adult	573.0	225.0	66.0	" "
5449	" "	♂	Adult	569.0	199.0	63.0	" "
1706	" "	♀	Old adult	595.0	251.0	61.0	" "
1709	" "	♀	Adult	623.0	248.0	64.0	" "
798	" "	♀	Adult	584.0	242.0	63.0	" "
1707	" "	♀	Adult	572.0	244.0	61.0	" "
2372	Connecticut, Liberty Hill	♂	Adult	591.0	239.0	63.0	" "
2370	" " "	♀	Old adult	632.0	278.0	67.0	" "
1050	" " "	♀	Adult	565.0	252.0	63.0	" "
2416	" " "	♀	Adult	564.0	253.0	60.5	" "
Mephitis mephitica scrutator nov.							
2892	Louisiana, Point aux Loups Springs	♂	Old adult	595.0	241.0	64.0	F. L. Small.
2891	" " " " "	♂	Old adult	567.0	224.0	62.0	" "
2890	" " " " "	♀	Old adult	563.0	219.0	62.0	" "
2889	Louisiana, Cartville	♂	Adult	580.0	208.0	64.0	" "
2886	Louisiana, Point aux Loups Springs	♀	Old adult	594.0	233.0	67.0	" "
2887	" " " " "	♀	Adult	585.0	228.0	62.0	" "
2888	Louisiana, Cartville	♀	Adult	518.0	210.0	56.0	" "
Mephitis elongata Bangs.							
3052	Florida, Micco	♂	Old adult	719.0	321.0	76.0	O. Bangs.
3051	" "	♂	Young adult	686.0	312.0	72.0	" "
2482	Florida, Blitches Ferry (Citrus County)	♂	Young adult	715.0	351.0	72.0	F. L. Small.
2483	" " " " "	♀	Old adult	673.0	330.0	70.0	" "
5036	Georgia, St. Marys	♂	Young adult	629.0	290.0	75.0	O. Bangs.
5038	" "	♀	Old adult	734.0	309.0	75.0	" "
5037	" "	♀	Adult	685.0	321.0	71.0	" "

* Collection of E. A. and O. Bangs, Boston, Massachusetts.
† Collection of Gerrit S. Miller, Jr., Peterboro, New York.

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A REVIEW OF THE SQUIRRELS OF EASTERN NORTH AMERICA.

BY OUTRAM BANGS.

The present paper is intended to review briefly all the squirrels of the genera *Sciurus* and *Sciuropterus* known to occur in North America east of the great plains. It is based principally on material in the collection of E. A. and O. Bangs, but in addition to this my friends, Dr. C. Hart Merriam, Mr. Gerrit S. Miller, Jr., and Mr. Samuel N. Rhoads, have kindly lent me specimens from many localities of special interest. I have also, through the kindness of Mr. William Brewster, examined all the skins in the Museum of Comparative Zoölogy at Cambridge.

The last important work on our squirrels was Dr. J. A. Allen's Monograph of the Sciuridæ published in 1877. As in the light of more modern material some of the conclusions reached in that work must be changed and a few new forms added, it seems well to review the whole group, mapping out so far as possible the geographic distribution of each species and subspecies.

While all our squirrels tend to break off very readily into geographic forms, the gray squirrel (*Sciurus carolinensis*) presents the most remarkable case, since it is impossible to recognize less than five races of this most protean species.

There is an immense range of individual color variation in some of the species, particularly in the fox squirrels. The northern gray squirrel varies much and is so subject to melanism in certain localities that the black phase is commoner than the gray. In such localities all sorts of strangely colored partially

melanistic individuals occur; on the other hand, over large areas of country the black phase is unknown. The red squirrel is not subject to melanism. I have heard of black individuals, but have never seen one. Local albinistic races or families are, however, not uncommon. One of these colonies is near Denver, Ind., from whence I have a curious series presenting every degree of albinism.

The flying squirrels do not vary individually to an extent worth notice.

The earlier writers were much troubled and confused by our squirrels, and as a consequence some of the species have an appalling array of synonyms. Professor Baird, in 1857, did a splendid piece of work, considering the scanty material he had, in doing away with most of the superfluous names, and Allen, twenty years later, put on a few finishing touches.

List of Species and Subspecies of Sciurus and Sciuropterus Inhabiting Eastern North America.

Name.	Type locality.
Sciurus niger Linn	Southern South Carolina.
ludovicianus Custis	Red River of Louisiana.
ludovicianus vicinus subsp. nov	White Sulphur Springs, W. Va.
carolinensis Gmelin	Carolina.
carolinensis leucotis (Gapper)	Region between York and Lake Simcoe, Ont.
carolinensis hypophæus Merriam	Elk River, Minn.
carolinensis fuliginosus (Bachman)	New Orleans, La.
carolinensis extimus subsp. nov.	Miami, Florida.
hudsonicus Erxl	Hudson Strait.
hudsonicus loquax subsp. nov	Liberty Hill, Conn.
Sciuropterus sabrinus (Shaw)	Severn River, James Bay.
silus sp. nov	Top of Katis Mtn., above White Sulphur Springs, W. Va.
volans (Linn.)	North America.
volans querceti subsp. nov	Citronelle, Citrus Co., Florida.

Genus SCIURUS Linnæus.

Tail long and bushy; ears well developed, sometimes slightly tufted; feet adapted for climbing, the anterior having four digits and a rudimentary pollex and the posterior five digits, all of which have long, curved, and sharp claws; mammæ from four to six; skull light built, with long postorbital processes; penultimate upper premolar, when present, minute; diurnal.*

*Substantially taken from Flower and Lydekker, Mammals Living and Extinct, London, 1891.

Sciurus niger (Linn.). Southern Fox Squirrel.

1758. *Sciurus niger* Linn., Syst. Nat., ed. 10, I, 1758, p. 64 (based on Catesby's black fox squirrel); Allen, Monog. N. Am. Sciuridæ, 1877, p. 719.
1758. *Sciurus cinereus* Linn., Syst. Nat., ed. 10, I, 1758, p. 64 (in part).
1788. *Sciurus vulpinus* Gmelin, Syst. Nat., I, 1788, p. 147; Baird, Mamm. N. Am., 1857, p. 246.
1802. *Sciurus capistratus* Bosc, Ann. du Muséum, I, 1802, p. 281; Bachman, Proc. Zoöl. Soc. London, 1835, p. 85; Aud. and Bach., Quad. N. Am., II, 1851, p. 132, pl. LXVIII.*

Type locality.—Probably southern South Carolina; based on Catesby's black fox squirrel.

Geographic distribution.—From the southern limit of the pine forest in Florida north to Virginia; west about to eastern Louisiana in the south, and to the foot of the Alleghany Mountains in the north.

Habitat.—Wholly confined to the great pine forest of the South Atlantic and Gulf States; breeding in trees, often building its nest in the little cypress ponds so common in this region, living principally on the ground, and climbing trees, even when pursued, with apparent reluctance and in a heavy and clumsy manner.†

S. niger is still common over the greater part of its range, but is very shy, and is seldom seen unless one has a dog trained to hunt it.

General characters.—Size, largest of the eastern squirrels; color very variable, but nose and ears always white. Feet and hands very large, the soles naked in the adult, sometimes partially covered with soft downy hair in the young. Pelage coarse and harsh.

Color.—Nose and ears always white, even in the black individuals; rest of the pelage varying individually from uniform glossy black to clay color

*I have refrained from giving any references to Gray's article on American squirrels entitled *Synopsis of the Species of American Squirrels in the Collection of the British Museum* (Annals and Magazine of Natural History, 3d series, vol. xx, 1867, p. 415), because the author seems to have had but a poor idea of the subject of which he treated, and any reference to his work must only lead to confusion. As an example, Gray puts *Sciurus niger* in F. Cuvier's genus *Macroxus*, under the name *Macroxus vulpinus* (in which genus he also puts the northern and southern gray squirrels), while he keeps the closely related species *S. cinereus* Linn. (= *S. ludovicianus vicinus* of the present paper) in the genus *Sciurus* with the red squirrels and *Sciurus aberti*, which he spells *alberti*. Gray fortunately only proposed three new names for eastern North American squirrels in this article. He renamed the northern and southern gray squirrels, calling the former *Sciurus carolinensis* var. *major* and the latter *Sciurus carolinensis* var. *minor*. The other name is *Macroxus neglectus*, from a specimen without locality, to which Gray assigns 'North America.' It is impossible to say from his description what this animal was, and it is very doubtful if it came from eastern North America.

† Its usual way of escape when chased is to run along the ground to some stump or log, upon which it climbs and waits until its pursuer comes too near, when it runs to another place of vantage, and so on. It takes to a tree only as a last resort, and then keeps to the trunk and large branches, trying to avoid detection by hiding. I believe it never jumps from tree to tree, as does its more agile and lightly built cousin, the gray squirrel.

mingled with black above (the hairs having either black tips or a black subapical band and clay-colored tips) and uniform clay color below. Tail usually mixed clay color and black (the hairs being clay color at base and tips and black in the middle) above and below. A few specimens have the under side of tail clear clay color. Top of head from white nose patch to ears usually black, even in the lightest examples. Occasional examples of a general ferruginous tone with the under side of tail rusty can be found in any large series.

Cranial characters.—Skull large and massive, developing with age conspicuous lateral ridges; rostrum long and well arched; ascending branches of premaxilla broad posteriorly, giving great breadth at the root of the zygomata; nasals broad and long, extending back of ascending branches of premaxilla; postorbital process of frontal heavy; ratio of occipitonasal length to nasal length, 30.78; penultimate upper premolar always absent in the adult. Size of an average adult skull: basilar length (basion to front of premaxilla), 64; occipitonasal length, 74.6; zygomatic breadth, 41; greatest height of cranium above palate, 22.6; greatest length of single half of mandible, 44.2.

Size.—Average measurements of fifteen adult specimens from Citronelle, Citrus Co., Fla.: total length, 638.46; tail, 304.13; hind foot, 87.81.

General remarks.—It does not seem probable that the black individuals of *Sciurus niger* are melanistic. They invariably retain the white ears and nose, and the commonest form has the back about half black, but the amount of black, as in the skunk, is very variable.

Sciurus niger retains its characters so constantly over the whole of its range and differs so markedly from the two smaller fox squirrels, *Sciurus ludovicianus* and *Sciurus ludovicianus vicinus*, that I treat it as a distinct species. Dr. Allen speaks of intermediate individuals from Virginia and Maryland, but I have never seen any such. The material at the time Dr. Allen's Monograph was written was of course very much inferior to that of today; consequently the differences between the species were not wholly apparent. Dr. Allen was, moreover, very badly off for skulls of any of the fox squirrels. I have but few specimens from localities where *S. niger* might be expected to actually interblend with either *S. ludovicianus* or *S. ludovicianus vicinus*, but such regions are small in extent, and it does not seem possible for animals as distinct as these to pass into each other suddenly.

Linnæus' *Sciurus niger*, as is well known, was based on the black fox squirrel of Catesby. Bachman applied this name to the melanistic variety of the northern gray squirrel, taking *Sciurus capistratus* Bosc for the fox squirrel. Professor Baird used the name *Sciurus vulpinus* Gmelin because Linnæus' name was given to the black variety only of the fox squirrel. Dr. Allen in 1877 restored *Sciurus niger* to its proper place, and the name has since then been generally used.

Specimens examined.—Total number, 44, from the following localities:

Florida: Hibernia, 1; Hawkinsville, 1; Citronelle, 37.

Georgia: St. Marys, 2; Columbus, 1.

North Carolina: Tarboro, 2.

Sciurus ludovicianus ludovicianus Custis. Western Fox Squirrel.

1806. *Sciurus ludovicianus* Custis, Barton's Med. and Phys. Journal, II, 1806, p. 43; Baird, Mamm. N. Am., 1857, p. 251.
1877. *Sciurus niger* var. *ludovicianus* Allen, Monog. N. Am. Sciuridæ, 1877, p. 720.
1822. *Sciurus rufiventer* "Geoff., Mus. Par.," Desmarest, Mamm., II, 1822, p. 332 (New Orleans); Harlan, Fauna Americana, 1825, p. 176; Schinz, Synop. Mamm., II, 1845–46. (Specimens from Missouri.)
1823. *Sciurus macroura* Say, Long's Expd. Rocky Mts., I, 1823, p. 115 (Kansas). Name preoccupied by Erxleben for a Ceylon species.
1825. *Sciurus magnicaudatus* Harlan, Fauna Amer., 1825, p. 178 (as a substitute for *S. macroura* Say).
1838. *Sciurus subauratus* Bach., Proc. Zoöl. Soc. London, 1838, p. 87.
1838. *Sciurus audubon*i Bach., Proc. Zoöl. Soc. London, 1838, p. 97.
1842. *Sciurus occidentalis* Aud. and Bach., Journ. Acad. Nat. Sciences, Phila., VIII, 1842, p. 317.
1851. *Sciurus rubicaudatus* Aud. and Bach., Quad. N. Am., II, 1851, p. 30, pl. LV.
1851. *Sciurus sayi* Aud. and Bach., Quad. N. Am., II, 1851, p. 274, pl. LXXXIX.

Type locality.—Red River of Louisiana.

Geographic distribution.—Mississippi Valley from Louisiana north to South Dakota; east probably to about the western edge of the Alleghany Mountains; west to the plains.*

Habitat.—Mixed forest and heavier woods, extending well into the prairies along the wooded streams. Still abundant over most of its range.

General characters.—Size much smaller than *Sciurus niger* (but little greater than the northern gray squirrel); ears and nose never white; colors very variable, but much deeper and more ferruginous than in the next subspecies, *S. ludovicianus vicinus;* feet of moderate size; soles often well clothed with hairs in winter; pelage in winter soft and full, with the ears well tufted.

Color.—Very variable, ranging from wholly black to a mixed black and rufous or ferruginous, the hairs being banded above, including the tail, and clear rufous or bright ferruginous below; most intense on ears, upper side of hands and feet, and on under side of tail. Some individuals have the under parts orange, some have the upper parts a pepper and salt mixture of yellowish and black and the under parts black.

Cranial characters.—Skull much smaller than that of *Sciurus niger,* which it resembles in general massiveness, but from which it differs in having proportionally a much shorter and blunter rostrum and shorter, broader nasals; ratio of occipitonasal to nasal length, 32.11; arrangement of teeth as in *S. niger.* Size of an average adult skull: basilar length, 55.2; occipitonasal length, 61.2; zygomatic breadth, 37.4; greatest height of cranium above palate, 20.4; greatest length of single half of mandible, 40.8.

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*Replaced in western Texas by a different subspecies, the small, pale *Sciurus ludovicianus limitis* (Baird). Type from Devils River, Texas.

Size.—Average measurements of fifteen adult specimens from Point aux Loups Springs, Acadia Parish, Louisiana: total length, 541.5; tail vertebræ, 252; hind foot, 73.7.

General remarks.—*Sciurus ludovicianus* is blessed with a greater number of synonyms than any other of our squirrels, owing to its enormous range of color variation, and to the fact that it occupies a large area of country. The so-called *Sciurus magnicaudatus* of Harlan, from the Missouri River region, will perhaps average a trifle smaller than Louisiana specimens, and, as a rule, is a little paler in color, but the differences are trifling and not worthy of subspecific recognition.

Specimens examined.—Total number, 44, from the following localities:

Louisiana: Point aux Loups Springs, Acadia Parish, 15; Grand Coteau, 2; Prairie Mer Rouge, 5.
Missouri: St. Louis, 3.
Indiana: Redfield,* 4; Denver, 1.
Illinois: Marion, 6; Jacksonville, 4; W. Northfield, 1.
Iowa: Sioux City, 1.
South Dakota: Richland, 2.

Sciurus ludovicianus vicinus subsp. nov. Northern Fox Squirrel.

1831. *Sciurus cinereus* Le Conte, Appendix to McMurtrie's Cuvier, 1831, p. 433; Bachman, Proc. Zoöl. Soc. London, 1838, p. 89; Aud. and Bach., Quad. N. Am., I, 1849, p. 145, pl. XVII; Baird, Mamm. N. Am., 1857, p. 248.
1877. *Sciurus niger* var. *cinereus* Allen, Monog. N. Am. Sciuridæ, 1877, p. 718.
1792. *Sciurus vulpinus* Schreber, Säugth., IV, 1792, p. 772. (Brought from Baltimore by Schoepf; name preoccupied by *S. vulpinus* Gmelin = *S. niger* Linn.). Not *Sciurus cinereus* Linn.

Type from White Sulphur Springs, W. Va. No. 5215, collection of E. A. and O. Bangs, ♀ old adult. Collected by Thaddeus Surber, January 29, 1896; total length, 582; tail, 282; hind foot, 75.

Geographic distribution.—From northern Virginia north, formerly to central New York and casually southern New England; west through West Virginia and Pennsylvania, probably extending some distance south in the Alleghany Mountains and higher land of Virginia and North Carolina. Now rare and local throughout its range.

Habitat.—The more heavily wooded and unsettled parts throughout its range, apparently fast becoming extirpated.†

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*Town not on modern maps; name appears on labels of specimens in Museum of Comparative Zoölogy.

†The Northern fox squirrel is one of the animals that cannot withstand persecution and the clearing and settlement of the country. It is already becoming very hard to get specimens of this subspecies. Dr. B. H. Warren, Zoölogist of the State of Pennsylvania, writes me that the northern fox squirrel is practically extinct in Pennsylvania except in the counties of Dauphin and Cumberland. I can get no information of any having been taken lately in New Jersey and fear it has met the same fate in that State. There seem to be a few left in the vicinity of the city of Washington. Mr. Vernon Bailey, in his 'List of the Mammals of the District of Colum-

General characters.—Size somewhat larger than *S. ludovicianus typicus.* General color usually less ferruginous, often yellowish gray; belly usually white and only under side of tail ferruginous; soles of feet naked in summer, partially covered with hair in winter; character of pelage the same as in true *ludovicianus.*

Color.—Ears never white; nose sometimes white; usual color of upper parts a mixed black and rusty, the hairs banded with black and pale ferruginous; under parts pale ferruginous to rusty white; under surface of tail ferruginous, the hairs with often a black subapical band. Ears ferruginous and in winter well tufted.

Some specimens are much lighter in color, being yellowish gray above, with the black banding of the hairs reduced to a minimum; the belly white, and the under surface of the tail pale ferruginous. Some others have a good deal of black on the head, belly, and legs, but I have never seen a wholly black individual.

Cranial characters.—Skull rather larger than that of *Sciurus ludovicianus;* otherwise similar. Ratio of occipitonasal length to nasal length, 32.3. Size of an average adult skull (the type): basilar length, 61; occipitonasal length, 68.8; zygomatic breadth, 40; greatest height of cranium above palate, 22.2; greatest length of single half of mandible, 42.2.

Size.—Average measurements of three adult specimens from White Sulphur Springs, W. Va.: total length, 587.7; tail vertebræ, 271.8; hind foot, 73.3.

General remarks.—It seems strange that among the multitude of names given our squirrels, and especially the fox squirrels, there should be none to apply to the present subspecies. Linnæus' name *Sciurus cinereus* has passed current for a long time for this animal, but cannot possibly apply to it. Linnæus based his name on three authorities, namely:

Ray's Quadrupeds, p. 215, "*Sciurus virginianus cinereus major.*"

Catesby's Natural History, II, p. 74, t. 74, "The Gray Fox Squirrel, *Sciurus cinereus.*"

Kalm, 2, p. 409.

Ray says of his *Sciurus virginianus cinereus major* that it is the size of the common rabbit (of Europe) and of the same color, and that it inhabits Virginia. This brief description can apply, on account of the very large size claimed for the species, to none other than the large southern fox squirrel, *Sciurus niger* Linn.

Catesby's gray fox squirrel has been supposed by subsequent authors, Baird excepted, to be the northern fox squirrel, but such a view seems to me wholly untenable and in direct contradiction to the evidence.

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bia,' records several specimens from Laurel, Md., in Dr. Merriam's collection, and states that many are shipped to Center Market from points in Virginia thirty or forty miles west of the city. The subspecies is, however, rare in most parts of northern Virginia. Lieut. Wirt Robinson has told me that in ten years' shooting in Buckingham County, Va., he got only two fox squirrels out of hundreds of squirrels killed. A few remain in the Alleghanies of West Virginia, where Mr. Thaddeus Surber got me three fine specimens in the last two years at White Sulphur Springs.

Catesby worked for the greater part of his stay in this country in a region in which the northern fox squirrel is unknown and in which the southern fox squirrel is abundant. Catesby spent one year on the coast, then went up the Savannah River to Fort Moore, about half way from the source of the river to the sea. It is true he made several expeditions into the mountains, and possibly may have seen the northern fox squirrel on some of these trips,* but if he did, he makes no mention of any such animal. He distinctly places his gray fox squirrel as an inhabitant of the coast region (a region wholly tenanted by the southern fox squirrel) by his remark that it, with the black fox squirrel, does great harm to the maize and pulse plantations of Virginia and Carolina (under descriptions of the two fox squirrels), he having previously stated that the inhabited portion of the country extended only sixty miles back from the coast (p. VIII, preface). Catesby's figure and description of the gray fox squirrel leave much to be desired, but one point upon which he was very careful in all his accounts of birds, mammals, and reptiles was size, and he distinctly states the gray and black fox squirrels to have been of about the same size (under description of black fox squirrel, Vol. II, p. 73). Judging by his work on other animals, Catesby would never have made such an assertion if he were describing the northern fox squirrel, an animal much smaller than the southern fox squirrel. Both on geographical and technical grounds it is impossible that Catesby's gray fox squirrel could have been intended for the northern fox squirrel, and his gray fox squirrel resolves itself into nothing more than the light colored phase of the southern fox squirrel, while his black fox squirrel is the black phase of the same species.

The black or nearly black individuals of the southern fox squirrel are much rarer than the light-colored ones, the proportion being about seven to one in favor of the light ones, and when the two extremes are compared they certainly look like very different animals, and are supposed so to be to this day by most southern squirrel-hunters. Catesby tells us that at first he judged the two to be one species, but finally yielded to the common notion and considered them distinct. (Under description of black fox squirrel.)

A point of some interest is that Catesby does not mention the gray squirrel (*Sciurus carolinensis* Gmelin) at all. It must certainly have been an abundant animal all about him, and it is probable that he confused it with the light-colored phase of the southern fox squirrel, perhaps thinking the ones he saw younger or smaller individuals of this kind.

Kalm gives a short but accurate description of the gray squirrel (*Sciurus carolinensis*), both as to size and color, as he saw it in Pennsylvania, and his long account of its habits, etc., refers to this species alone, he making no mention of any larger animal.

From the composite Linnæan species, *Sciurus cinereus*, Gmelin, in 1788, took out the southern gray squirrel and gave it the name *Sciurus caro-*

* It is by no means certain that the northern fox squirrel occurs in the southern Alleghanies.

linensis, thus restricting *Sciurus cinereus* Linn. to the light color phase of the southern fox squirrel, and it becomes a direct synonym of *Sciurus niger* Linn., based on the black phase of the same animal from the same locality.

The only other name that need be considered at all is *Sciurus virginianus* of Kerr's Linnæus, 1792. This name was based on the 'Cat Squirrel' of Pennant's Arctic Zoölogy, which is an indeterminable animal, said to have a very short tail and to inhabit Virginia, where the planters call it 'Cat Squirrel.' As the vernacular name 'Cat Squirrel' is invariably employed in the South for the gray squirrel, it seems likely that the animal in question was nothing more than that species. It may be well to add that Pennant's gray squirrel was a compound animal, including the gray, the southern fox, and perhaps the northern fox squirrels, but referring best to the gray squirrel, as pointed out by Professor Baird in his Mammals of North America in 1857. Professor Baird is the only author to question the standing of Linnæus' *Sciurus cinereus*. With his usual acuteness he saw that the name could not apply to the northern fox squirrel, but for some reason he retained it, probably because Le Conte, Bachman, and others had done so.

Specimens examined.—Total number, 10, from the following localities:

Pennsylvania: Carlisle, 1; Rothruck, 2; — 2.
Maryland: Prince George County, 1; — 1.
West Virginia: White Sulphur Springs, 3.

Sciurus carolinensis carolinensis Gmelin. Southern Gray Squirrel; Cat Squirrel.

1788. *Sciurus carolinensis* Gmelin, Syst. Nat., I, 1788, p. 148 (based on Pennant's Lesser Gray Squirrel from Carolina).
1877. *Sciurus carolinensis* var. *carolinensis* Allen, Monog. N. Am. Sciuridæ, 1877, p. 704.

Type locality.—Carolina.

Geographic distribution.—Austral Zone, from northern Florida north to about the lower Hudson Valley, west through the Alleghanies south of Pennsylvania to Indiana, Missouri, Indian Territory, and the edge of the plains.

Habitat.—In the South, where *Sciurus carolinensis* occurs in the same region with the southern fox squirrel, the two live in woods of very different character. The fox squirrel is exclusively an inhabitant of the flat, open 'piney woods.' The gray squirrel lives in the dense hammocks of live oak and water oak, and in the deep swamps of cypress, black gum, and great magnolia that border the streams. Farther north it is found in the forests and groves of oak, chestnut, and hickory.

Though they feed much on the ground, all the gray squirrels are highly arboreal and very active tree-climbers, springing, when occasion requires it, long distances from branch to branch.

The southern gray squirrel is in many places exceedingly abundant, but is much shot by the negroes for food, and where persecuted is very shy and seldom seen, passing the greater part of the day in hollows or

nests in the trees and feeding only in the early morning and after sunset in the evening. It is migratory to a certain extent, its migrations probably depending on the food supply.

General characters.—Size medium; colors quite constant, dark yellowish rusty above, white below; soles of feet usually naked, the heel covered with hair; ears sometimes slightly tufted in winter; pelage soft.

Color.—Upper parts dark yellowish rusty, the hairs annulated black and rusty yellow, with usually some gray-tipped hairs on upper surface of legs and arms, sides of neck, and sides of rump, giving a grayer tone to these parts, the yellowish rusty color predominating on head, middle of back, and along sides; hairs of tail dull yellow at base, then black and tipped with white; under parts white; ears yellowish white, sometimes a slight woolly tuft at base.

Cranial characters.—Skull light, developing with age only slight indications of lateral ridges; rostrum long and rather slender; nasals narrow and short, *not* extending back of ascending branch of premaxilla; zygomata slanting backward from root and lying close to skull (not so much bowed out as in the fox squirrels and not nearly so much so as in the red squirrels); postorbital processes long and slender; penultimate upper premolar normally present in the adult. Size of an average adult skull: basilar length, 50; occipitonasal length, 58.8; zygomatic breadth, 33.2; greatest height of cranium above palate, 19.2; greatest length of single half of mandible, 36.

Size.—Average measurements of two adult specimens from St. Marys, Ga.: total length, 450.5; tail vertebræ, 212; hind foot, 60.8. Average measurements of five adult specimens from Raleigh, N. C.: total length, 461.8; tail vertebræ, 205; hind foot, 63.2.

General remarks.—*Sciurus carolinensis* has escaped synonymy in a most remarkable way. It is rather a happy accident to have the specific name restricted to this form, since it occupies a central position and covers a larger area of country than any one of the four subspecies which surround it and shade directly into it.

The most typical specimens of *S. carolinensis* come from the coast region from northern Florida to Virginia. Specimens from the higher land of North Carolina and Virginia are shading both in color and size toward the northern subspecies (*leucotis*), while those from the lower Mississippi Valley begin to approach the form of the coast of Louisiana (*fuliginosus*). *S. carolinensis typicus* extends about half way down the Florida peninsula before it wholly breaks off into the subtropical form (*extimus*).

Specimens examined.—Total number, 20, from the following localities:

Florida: Rose Bluff, St. Marys River, 1.
Georgia: St. Marys, 4; McIntosh County, 1.
North Carolina: Raleigh, 7; Statesville, 2.
Missouri: Stotesbury, 2.
Indiana: Denver, 1.
Indian Territory: Stilwell, 2.

Sciurus carolinensis leucotis (Gapper). Northern Gray Squirrel.

1830. *Sciurus leucotis* Gapper, Zoöl. Journal, V, p. 206, 1830; Bachman, Proc. Zoöl. Soc. London, 1838, p. 96.
1792. *Sciurus cinereus* Schreber, Säugth., IV, 1792, p. 766, pl. CCXII; Harlan, Fauna Am., 1825, p. 173.
1815. *Sciurus pennsylvanicus* Ord, Guthrie's Geog., 2d Am. ed., II, 1815, p. 292 (*nomen nudum*).
1815. *Sciurus hiemalis* Ord, Guthrie's Geog., 2d Am. ed., II, 1815, p. 292; Rhoads, Appendix to reprint of Ord, 1894, p. 20. (Intermediate.)
1826. *Sciurus niger* Godman, Am. N. H., II, 1826, p. 133; Richardson, Fauna Bor.-Am., I, 1829, p. 191; Bachman, Proc. Zoöl. Soc. London, 1838, p. 96; Aud. and Bach., Quad. N. Am., I, 1849, p. 261, pl. XXXIV.
1842. *Sciurus vulpinus* DeKay, N. Y. Zoöl., I, 1842, p. 59.
1849. *Sciurus migratorius* Aud. and Bach., Quad. N. Am., I, 1849, p. 265, pl. XXXV.
1877. *Sciurus carolinensis* var. *leucotis* Allen, Monog. N. Am. Sciuridæ, 1877, p. 701.
1894. *Sciurus carolinensis pennsylvanicus* Rhoads, Appendix to reprint of Ord, 1894, p. 19.

Type locality.—Region between York and Lake Simcoe, Ontario.

Geographic distribution.—Transition Zone and locally, lower edge of Canadian Zone from the Alleghanies of Pennsylvania north through New York and New England to southern New Brunswick and southern Canada; west to Minnesota.

Habitat.—Hard-wood forests and groves of oak, chestnut, and hickory. Abundant over most of the country it occupies, but local in the north, and only occurring where there are large tracts of hard wood. Often very numerous and tame in the parks of the large cities, where it is carefully protected. The northern gray squirrel is highly migratory, but the migrations probably depend wholly on food supply and occur irregularly. Sometimes a large section of country will be deserted for several years, and at other times an unusually heavy crop of beech nuts or acorns will attract the gray squirrels in enormous numbers.

General characters.—Size large; tail long and bushy; much given to melanism locally, but especially northward. Color of normal examples much lighter above than in *carolinensis typicus*, being silvery gray. Feet large, the soles sometimes covered with hair between the pads in winter.

Color.—In winter pelage, upper parts silvery gray, the hairs banded yellowish brown and black, with long white tips; the yellowish brown color often predominating on head, center of back, and upper surface of hands and feet; under parts white (sometimes a specimen will be a little rusty between fore legs or on neck or chest); hairs of tail long, yellowish at base, then black and deeply tipped with white; ears yellowish white, sometimes with woolly tufts at base. In summer the white tips of the hairs wear off, giving a more yellowish appearance to the whole upper parts, with sometimes a good deal of rusty on the back, sides, neck, and legs. Wholly black (melanistic) individuals are common at some localities, and at such places every degree between the black and gray can be found.

Cranial characters.—Skull larger than that of typical *carolinensis*, but otherwise similar. Size of an average adult skull: basilar length, 54.4;

occipitonasal length, 65.2; zygomatic breadth, 35; greatest height of cranium above palate, 19.8; greatest length of single half of mandible, 37.2.

Size.—Average measurements of five adult specimens from Liberty Hill, Conn.: total length, 505.5; tail vertebræ, 230.6; hind foot, 71.7

General remarks.—Mr. Rhoads, in the appendix to his edition of Ord (1894, p. 19), tries to bring into use Ord's name *Sciurus pennsylvanicus* for the northern gray squirrel, calling it *Sciurus carolinensis pennsylvanicus* (Ord). Ord's name is a *nomen nudum*, and has no standing in nomenclature, even if we can guess the species he meant to apply it to. Gapper's name *leucotis* is well founded and has been in current use for nearly twenty years, ever since Allen reëstablished it in his Monograph of the American Sciuridæ in 1877.

About Ord's *Sciurus hiemalis* I feel some doubt. The name unquestionably was given to a gray squirrel in winter pelage, but from the locality attributed it, "Little Egg Harbor, New Jersey," the animal was probably intermediate between the southern and northern grays, and it therefore seems wiser to allow Gapper's name to stand for the northern gray squirrel.

Specimens examined.—Total number, 33, from the following localities:

Ontario: Mount Forest, 1.

Wisconsin: Madison, 1.

Minnesota: Elk River, 1.

Massachusetts: Belmont, 1; Brookline, 15; Wareham, 4; Marthas Vineyard, 2.

Connecticut: Liberty Hill, 8.

Sciurus carolinensis hypophæus Merriam. Merriam's Gray Squirrel.

1886. *Sciurus carolinensis hypophæus* Merriam, Science, Vol. VIII, p. 351, April 16, 1886; Allen, Bull. Am. Mus. Nat. Hist., Vol. VI, 1894, p. 171, foot-note.

Type locality.—Elk River, Minnesota.

Geographic distribution—The edge of the forest belt in Minnesota (a region having quite a distinctive mammalian fauna). Limits of range unknown.

General characters.—Size large, equaling that of *leucotis*. Color of upper parts rather darker than in *leucotis* and encroaching all round on under parts, leaving only a small central streak of white on belly. Soles of feet densely furred in winter between the pads, naked in summer. Ears well tufted in winter. Pelage in winter very long and full.

Color.—In winter upper parts dark iron gray, mixed with yellowish and rusty; the hairs banded, yellowish rusty and black, and somewhat tipped with white; a small irregular central streak of white on belly; rest of under parts like back; chest and under side of neck sometimes uniform yellowish brown; tail dark, the black band of hairs longer and the white tips shorter than in *leucotis;* ear tufts well developed in winter, yellowish white; in summer the general color is darker and more yellowish, owing to the wearing down of the hair.

Cranial characters.—Skull about the size of that of *leucotis*, showing no characters by which it can be separated from any of the *carolinensis* series. Size of an average adult skull: basilar length, 54.6; occipitonasal length, 63.2; zygomatic breadth, 34.6; greatest height of cranium above palate, 19; greatest length of single half of mandible, 35.4.

Size.—Average measurements of nine adult specimens from Elk River, Minn.: total length, 496.3; tail vertebræ, 220.4; hind foot, 67.2.

General remarks.—Little is known of this fine squirrel. My knowledge of it comes wholly from Dr. Merriam's description and from four specimens from the type locality, Elk River, Minn., kindly lent me by him, and ten topotypes in the Bangs collection.

One point of some interest is that the northern gray squirrel (*Sciurus carolinensis leucotis*) occasionally occurs at Elk River in considerable numbers with *hypophæus*, but has not been known to breed there, appearing only in migrations. This fact suggests the possibility of *hypophæus* proving to be a distinct species when more is known of it.

Specimens examined.—Total number, 14, from Elk River, Minn.

Sciurus carolinensis fuliginosus (Bachman). Bayou Gray Squirrel.

1838. *Sciurus fuliginosus* Bach., Proc. Zoöl. Soc. London, 1838, p. 96; Aud. and Bach., Quad. N. Am., III, 1853, p. 240, pl. CXLIX.
1895. *Sciurus carolinensis fuliginosus* Bangs, Proc. Bost. Soc. Nat. Hist., XXVI, p. 543, 1895; Rhoads, Proc. Acad. Nat. Sciences, Phila., 1896, p. 196.

Type locality.—Near New Orleans, La.

Geographic distribution.—The bayou region of the coast of Louisiana.

General characters.—Size larger than true *carolinensis;* colors rich and dark; under parts never pure white and often clear ferruginous; tail long and bushy, the hairs but slightly tipped with white; feet large, soles naked; ears with often a woolly tuft at base in winter.

Color.—Upper parts deep yellowish ferruginous, varied with black; the hairs banded, many of them having the black band extending to the tip; tail dark, the hairs yellowish ferruginous at base, then black and tipped with white, the black subapical band very broad and the white tips short; under parts varying from clear buffy ferruginous, the chin only gray, to smoky gray; line of demarkation between colors of upper and under parts always low down and irregular; ear tufts well developed, ferruginous in the examples with ferruginous under parts, grayish white in the examples with gray under parts.

Cranial characters.—Skull a little larger than that of true *carolinensis*, otherwise similar. Size of an average adult skull: basilar length, 50.6; occipitonasal length, 60; zygomatic breadth, 33.4; greatest height of cranium above palate, 19.8; greatest length of single half of mandible, 36.

Size.—Average measurements of ten adult specimens from Gibson, La.: total length, 467; tail vertebræ, 219.5; hind foot, 67.

General remarks.—*Sciurus carolinensis fuliginosus* is confined in its extreme form to the heavy swamps of the bayou region of the coast of Louisiana. Farther north in the 'prairie' regions of the same State it

begins gradually to approach *carolinensis typicus*, a large series from Acadia Parish, La., showing this tendency. Mr. Rhoads speaks of the living gray squirrels he saw in the park at Memphis, Tenn.,* and refers them to *fuliginosus*, on account of their large size and dark coloring. They are probably about like the examples from central Louisiana, which retain the large size and dark color above, but have pure white under parts, and can safely be called intermediates between *carolinensis* and *fuliginosus*, though perhaps nearer *fuliginosus*.

Specimens examined.—Total number, 37, from the following localities:

Louisiana: Gibson, Terre Bonne Parish, 13; Cartville, Acadia Parish, 3; Point Aux Loups Springs, Acadia Parish, 21. (Those from Acadia Parish not extreme.)

Sciurus carolinensis extimus subsp. nov. Everglade Gray Squirrel.

Type from Miami, Dade Co., Florida. No. 4519, ♀ young adult, collection of E. A. and O. Bangs. Collected March 12, 1895, by L. Brownell. Total length, 432; tail vertebræ, 194; hind foot, 54.

Geographic distribution.—Subtropical fauna of south Florida, northward about half way up the peninsula.

Habitat.—Everglades and oak and cabbage palmetto hammocks. Not found in the 'piney woods.'

General characters.—Size smallest of the *carolinensis* series; tail and hind foot short; color much lighter, more gray than in *carolinensis typicus;* soles naked; ears with sometimes a slight woolly tuft at base.

Color.—Upper parts yellowish gray, the hairs banded black and dull yellow, a few tipped with white (much the same color as the upper parts of *leucotis* in summer pelage); tail light colored, the hairs yellowish at base, then black and tipped with white; under parts white; ear tufts white.

Cranial characters.—Skull smaller than that of true *carolinensis*, otherwise similar. Size of an average adult skull, the type: basilar length, 47; occipitonasal length, 55; zygomatic breadth, 31.2; greatest height of cranium above palate, 18; greatest length of single half of mandible, 33.2.

Size.—Average measurements of seven adult specimens from Miami, Fla.: total length, 438.4; tail vertebræ, 190.9; hind foot, 47.

General remarks.—*Sciurus carolinensis extimus* represents in its small size, short tail, and small hind foot the extreme of differentiation of the *carolinensis* series, but differs widely from true *carolinensis*, its nearest geographical cousin, in its much grayer color. This yellowish gray color is probably highly protective, the animal spending most of its life among trees covered with the gray Spanish moss, *Tillandsia usneoides*, which its color almost exactly matches in tone.

S. carolinensis extimus is only typical in the peculiar subtropical fauna of the everglades and southern part of the Florida peninsula. Specimens from Citrus Co., Fla., are larger and darker in color and are rather nearer to true *carolinensis* than to *extimus*. The gray squirrel of northern Florida is true *carolinensis*.

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* Proc. Acad. Nat. Sciences Phila., 1896, p. 196.

Specimens examined.—Total number, 8, from the following localities: Florida: Miami, Dade Co., 7; Oak Lodge (east peninsula, opposite Micco), Brevard Co., 1; also 21 from Citrus Co. (Citronelle, 2; Blitches Ferry, 19), which are intermediates between *carolinensis* and *extimus*.

Sciurus hudsonicus hudsonicus (Erxleben). Red Squirrel; Chickaree.

1777. *Sciurus vulgaris ε hudsonicus* Erxleben, Mammalia, 1777, p. 416.
1778. *Sciurus hudsonius* Pallas, Nov. Spec. Glir., 1778, p. 376.
1820. *Sciurus rubrolineatus* Desmarest, Mamm., I, 1820, p. 333 (Encyclopédie Méthodique).
1827. *Tamia hudsonia* Lesson, Man. Mamm., 1827, p. 231.
1843. *Tamias rubrolineatus* Schinz, Syn. Mamm., II, 1843, p. 48.
1877. *Sciurus hudsonius* var. *hudsonius* Allen, Monog. N. Am. Sciuridæ, 1877, p. 672.

Type locality.—Hudson Strait. 'Ad fretum Hudsonis.'

Geographic distribution.—Boreal North America, from Labrador to Alaska, south to Maine and the northern peninsula of Michigan, and along the tops of the higher Alleghanies to Roan Mountain, North Carolina.

Habitat.—Spruce and fir forests. Feeds largely on the seeds of conifers.

The northern red squirrel is excessively abundant in all favorable situations. In many places one can often count twenty or thirty individuals within sight or hearing at one time. Always noisy and jerky in its motions, the red squirrel is usually tame and unsuspicious. It feeds and lives both on the ground and in the trees, and is a very agile climber.

General characters.—Size smallest of the eastern squirrels; tail short, flat, and narrow; a decided difference in color and markings between winter and summer pelage;* dorsal stripe in winter chestnut rufous; sides olivaceous gray; white of underparts vermiculated with black; in summer pelage hardly distinguishable from the next subspecies by color alone; soles densely furred in winter and somewhat so in summer; ear tufts in winter, long, protruding well beyond the ear; pelage in winter very full and soft.

Color.—*Winter pelage:* Upper parts with a broad dorsal band extending from between the ears down upper surface of tail, bright chestnut rufous; sides, upper surface of legs and arms, and cheeks olivaceous gray, the hairs banded with black; upper surface of feet and hands often more yellowish; under parts grayish white, thickly vermiculated with blackish, the hairs plumbeous at base. An indistinct blackish line usually shows on sides between colors of upper and under parts. On the upper surface of the tail the hairs are clear chestnut rufous, and only a few have black rings; on the sides and lower surface they are dull yellowish at base and tips and black in the middle. *Summer pelage:* Upper parts with no dorsal stripe; a peculiar ferruginous gray with an olivaceous cast, the hairs banded with black, becoming clear ferruginous on upper surface of hands and feet, and sometimes legs and arms also; under parts white, often

*In this connection, see Allen on 'Seasonal Variation in Color in *Sciurus hudsonius*,' Bull. Am. Mus. Nat. Hist., Vol. III, p. 41, 1890.

suffused with rusty yellow; a broad black stripe along side separating colors of upper and under parts.

Cranial characters.—Skull light, developing very slight lateral ridges with age; rostrum short and blunt; nasals ending at fronto-premaxillary suture; postorbital process of frontal light and long; zygoma standing out squarely from root, and more flaring than in either the fox or gray squirrels; audital bullæ large. Penultimate upper premolar either absent or present in the adult, though more often absent, and when present very minute.

Size of an average adult skull: basilar length, 38.4; occipitonasal length, 45; zygomatic breadth, 26.2; greatest height of cranium above palate, 15.6; greatest length of single half of mandible, 26.4.

Size.—Average measurements of four adult specimens from Hamilton Inlet, Labrador: total length, 309; tail vertebræ, 120.5; hind foot, 47.75 (all four are very old adults and the averages therefore large). Average measurements of ten adult specimens from Digby, Nova Scotia: total length, 296.5; tail vertebræ, 118.2; hind foot, 45.2

General remarks.—*Sciurus hudsonicus* has but one bad synonym—the *Sciurus rubrolineatus* of Desmarest. Desmarest based his name wholly on the 'Ecureuil rouge (*species nova*)' of the French edition of Warden's Description of the United States, published in 1820. Warden described under this name a red squirrel in winter pelage, assigning it no habitat. It is the only red squirrel Warden gives, and it is impossible to say which race it belonged to. In addition to *Sciurus rubrolineatus* Desmarest gives *Sciurus hudsonius*, his description of the latter being taken from a summer specimen. It is evident that the great difference between summer and winter specimens alone led Desmarest into the belief that there are two species of red squirrels.

Sciurus hudsonicus typicus belongs to the spruce and fir belt and only extends south as far as these trees. Wherever the Transition and Canadian faunas meet, as in central New York, New Hampshire, and Minnesota, intermediates between *hudsonicus typicus* and *hudsonicus loquax* occur. Only a very short distance south, however, into truly Transition country *loquax* is found in the typical form.

Specimens examined.—Total number, 89, from the following localities:

Labrador: Hamilton Inlet, 4.
Nova Scotia: Digby, 16; Granville, 4; James River, 1; Schenacidae (Cape Breton), 6.
New Brunswick: Campobello Island, 9.
Quebec: Lake Edward, 5.
Ontario: North Bay, 8; Nepigon, 1; Peninsula Harbor, 10.
Saskatchewan: Batoche, 5.
Maine: Greenville, 5; Upton, 5.
West Virginia: White Sulphur Springs, 1.
North Carolina: Roan Mountain, 4.

Intermediates:

New Hampshire: Franconia, 2; Antrim, 1.
New York: Peterboro, 1.

Sciurus hudsonicus loquax subsp. nov. Southern Chickaree.

1815. *Sciurus carolinensis* Ord, Guthrie's Geog., 2d Am. ed., II, 1818, p. 292. (Name preoccupied by Gmelin for the southern gray squirrel.)

Type from Liberty Hill, Conn., No. 4270, ♂ adult, collection of E. A. and O. Bangs. Collected by Outram Bangs December 24, 1895. Total length, 323; tail vertebræ, 141; hind foot, 47.

Geographic distribution.—Transition and Carolinian zones, from southern Maine and southern Minnesota to Virginia, west to the edge of the plains. Not found in the tops of the higher Alleghanies where *hudsonicus typicus* takes its place.

Habitat.—Mixed woods, groves, and in fact almost everywhere; perhaps most numerous where there are large tracts of *Pinus rigida*, the seeds of which it is very fond of. Very abundant over the whole of its range except the southern part, where it becomes rare and local.

General characters.—Size somewhat larger than *hudsonicus typicus;* tail longer; color of dorsal stripe in winter pelage usually brighter red; under parts pure grayish white, *not vermiculated;* soles and palms furred in winter, naked in summer.

Color.—*Winter pelage:* upper parts with a broad dorsal band extending from between ears down upper surface of tail, varying from bright ferruginous to orange rufous; sides and upper surface of arms and legs yellow or rusty gray, with sometimes an olivaceous cast, the hairs banded with black; under parts clear grayish white, without vermiculations, the hairs plumbeous at base; usually a black line shows indistinctly along sides between colors of upper and under parts; hairs of upper surface of tail clear ferruginous; those of lower surface and sides dull yellow at base and tip and black in middle. *Summer pelage:* Impossible to tell with certainty from summer pelage of *hudsonicus typicus*, but usually more ferruginous gray and less olivaceous gray.

Cranial characters.—Skull averaging larger than that of *hudsonicus typicus;* otherwise similar. Size of an average adult skull (the type): basilar length, 40; occipitonasal length, 46.4; zygomatic breadth, 27; greatest height of cranium above palate, 16.4; greatest length of single half of mandible, 28.

Size.—Average measurements of eight adult specimens from Liberty Hill, Conn.: total length, 318.3; tail vertebræ, 133.5; hind foot, 47.42.

General remarks.—Professor Baird, in his Mammals of North America, first pointed out the fact that northern examples of *Sciurus hudsonicus* had the under parts vermiculated with black and the southern examples did not. Dr. Allen, in his Monograph of the North American Sciuridæ, dwelt at some length on the differences between the two races, but did not separate them by name. In winter pelage *Sciurus hudsonicus typicus* and *Sciurus hudsonicus loquax* can be told apart at a glance, but in their summer coats they are not so easily distinguished; as a rule, however, *loquax* is more rusty and less olivaceous, and the difference in size between individuals of the same age is well marked, *hudsonicus typicus* being always the smaller of the two.

Specimens examined.—Total number, 56, from the following localities:

Connecticut: Liberty Hill, 11.

Massachusetts: Wareham, 24; Wayland, 1; Brookline, 1.

Indiana: Denver, 14.

Minnesota: Steel Co., 1.

Wisconsin: Waupaca, 2.

North Carolina: Magnetic City, foot of Roan Mountain, 2 (not quite typical).

Genus SCIUROPTERUS F. Cuvier.

Tail flat, laterally expanded, densely haired with fine hairs; an expansion of the skin of the sides extends from wrist to ankle, and when spread acts, with the flat tail, like a parachute, enabling the animal to make long, slanting descents through the air; pelage very fine and dense; skull light; audital bullæ large; end of the pterygoid process resting against audital bulla; rostrum short; occipital region slightly drooping and turned under; interorbital constriction deep and zygoma drooping to make room for the large eye; penultimate upper premolar always present; nocturnal animals.

Sciuropterus sabrinus (Shaw). Severn River Flying Squirrel.

1801. *Sciurus sabrinus* Shaw, Gen. Zoöl., I, 1801, p. 157.

1778. "*Sciuro volante majore*" Pallas, Nova Spec. Glires, 1778, p. 354 (not a scientific name).

1788. *Sciurus hudsonius* Gmelin, Syst. Nat., I, 1788, p. 153 (preoccupied).

1815. *Sciurus labradorius* Ord, Guthrie's Geog., 2d Am. ed., 1815, p. 292 (*nomen nudum*).

1828. *Pteromys sabrinus* Richardson, Zoöl. Journ., III, 1828, p. 519; Aud. and Bach., Quad. North Am., III, 1853, p. 202.

1829. *Pteromys hudsonius* Fischer, Syn. Mamm., 1829, p. 365; Baird, Mamm. North Am., 1857, p. 288.

1874. *Sciuropterus volucella* var. *hudsonius* Allen, Proc. Boston Soc. Nat. Hist., XVI, 1874, p. 289; Monog. N. Am. Sciuridæ, 1877, p. 655.

Type locality.—Severn River, James Bay, Canada.

Geographic distribution.—Boreal North America, south in the east to northern New York and southern New Hampshire.

Habitat.—Mixed woods and forest; nocturnal, spending the day in hollows and nests in the trees.

General characters.—Size, largest of the eastern flying squirrels; tail broad, the hairs long; hind foot large; a decided difference in color between winter and summer pelage; under side of tail washed with sooty; hairs of under parts, plumbeous at base, showing through, and giving a decidedly gray appearance to under parts; soles furred both in winter and summer, only the pads naked.

Color.—*Winter pelage:* upper parts very glossy, wood brown to cinnamon, often somewhat shaded with yellow, darkening on tail towards tip to sooty; hairs of back and sides dark plumbeous below, the merest tip being colored, the plumbeous color therefore showing through whenever the fur is the least disturbed; upper surface of feet and hands sooty gray;

cheeks gray; a black orbital ring; ears sparsely haired, dusky; under parts dirty white, the hairs plumbeous at base; under side of tail yellowish white washed with drab and sooty. *Summer pelage:* whole upper parts uniform sooty drab.

Cranial characters.—Skull large; audital bullæ small and flat (for the genus); the bone dense; nasals slightly turned up at end—pug-nosed; all the teeth, including penultimate upper premolar, large. Size of an average adult skull: basilar length, 32.4; occipitonasal length, 38.4; zygomatic breadth, 22.8; greatest height of cranium above palate, 12.4; greatest length of single half of mandible, 23.4.

Size.—Average measurements of seven adult specimens from Greenville, Maine: total length, 278.6; tail vertebræ, 130.4; hind foot, 37.6.

General remarks.—Dr. Allen, in 1874, relegated this fine species to subspecific rank, calling it a variety of *Sciuropterus volans* (alias *volucella*), and followed the same arrangement in 1877 in his Monograph of the Sciuridæ, where he makes the statement "Grades insensibly into var. *volucella*." How or where Dr. Allen found intergrades I am at a loss to know. In reality *Sciuropterus sabrinus* and *S. volans* are two distinct species and never intergrade. Wherever their geographic ranges meet they occur together, often in the same wood, each species keeping distinct and retaining its characters as well as where far removed from contact with the other. *S. sabrinus* meets and overlaps the range of *S. volans* for a short distance, wherever the Canadian and Transition faunas meet. Dr. C. Hart Merriam found both species breeding in the Adirondack region of New York, and in his interesting accounts of the habits of these squirrels clearly shows the two to be specifically distinct, although he retained the varietal names of Allen. In the same wood lot at Peterboro, N. Y., Mr. Gerrit S. Miller, Jr., took on November 22, 1894, a fine example of *S. volans*, and on December 28, 1895, a pair of *S. sabrinus*. He has kindly lent me the specimens, which are now before me. I have both species from Hancock, N. H., but there *volans* is apparently the more common. I have yet to see a specimen that is in any way intermediate between *S. sabrinus* and *S. volans*, and if one did turn up it would be safe to consider it a natural hybrid and not an intergrade.

Specimens examined.—Total number, 24, from the following localities:

Nova Scotia: Annapolis, 3; Digby, 1.
Ontario: Nepigon, 1.
Maine: Greenville, 8; Bucksport, 2.
New Hampshire: Hancock, 1.
New York: Peterboro, 2.
Arctic America: Red River, 2; Fort Resolution, 1; Big Island, 1; Moose Factory, 2.

Sciuropterus silus sp. nov. Alleghany Mountain Flying Squirrel.

Type from top of Katis Mountain, White Sulphur Springs, W. Va., at an altitude of 3,200 feet. No. 4931, ♂ adult, collection of E. A. and O. Bangs. Collected by Thaddeus Surber September 2, 1895. Total length, 214; tail vertebræ, 92; hind foot, 28.

Geographic distribution.—Limits of range unknown, probably the higher southern Alleghanies.

General characters.—Size smallest of the eastern flying squirrels; similar in general appearance to *S. sabrinus*, but darker in color; soles naked in summer.

Color.—The type (in summer, beginning to change to winter pelage): upper parts hair brown, shading in places toward isabella color; ears and upper surface of tail, feet, and hands sooty; cheeks dark gray; a black orbital ring; under parts grayish white, the hairs somewhat darker at base; under surface of tail drab, shading to sooty; soles and palms naked; the skin black.

FIG. 29.—Rostrum of *Sciuropterus silus*.

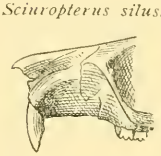

FIG. 30.—Rostrum of *Sciuropterus volans*.

Cranial characters.—Skull very small, similar to that of *S. sabrinus* in respect to the flat audital bullæ and large teeth, but differing in having the foramen ovale transversely oval instead of round. The peculiar pug-nosed effect given by the turned-up ends of the nasals is even more exaggerated than in *sabrinus*. Size of the type skull: basilar length, 25.8; occipitonasal length, 31; zygomatic breadth, 19; greatest height of cranium above palate, 12.2; greatest length of single half of mandible, 18.6.

Size.—The type: total length, 214; tail vertebræ, 92; hind foot, 28.

General remarks.—*Sciuropterus silus* is known at present only by the type, all my efforts to get additional specimens having so far failed. Lieut. Wirt Robinson spent part of the summer of 1896 at White Sulphur Springs, W. Va., and kindly offered to get me flying squirrels. He succeeded in taking but one, a perfectly typical example of *S. volans*. It was taken at an altitude of about 1,200 feet lower than the type of *S. silus*. It is probable that the ranges of the two species overlap.

Sciuropterus silus bears no very close relationship to *S. volans*, although it is even smaller than that species. Its affinities lie with *S. sabrinus*, of which it is probably the Alleghany Mountain representative. It is, however, so very much smaller than that species and differs from it so much in other respects that I have accorded it specific rank.

Specimen examined.—The type.

Sciuropterus volans volans (Linn.). Southern Flying Squirrel.

1758. *Mus volans* Linn., Syst. Nat., ed. 10, I, 1758, p. 63.
1758. *Sciurus volans* Linn., Syst. Nat., ed. 10, I, 1758, p. 64 (in part).
1788. *Sciurus volucella* Pallas, Nov. Spec. Glires, 1788, p. 351.
1818. *Pteromys volucella* Desmarest, Nouv. Dict. d'Hist. Nat., XXVII, 1818, p. 406; Aud. and Bach., Quad. N. Am., I, 1849, p. 216, pl. XXVIII; Baird, Mamm. N. Am., 1857, p. 286.
1828. *Sciuropterus volucella* Geoffroy, Dict. Class. d'Hist. Nat., XIV, 1828, p. 132.
1874. *Sciuropterus volucella* var. *volucella* Allen, Proc. Boston Soc. Nat. Hist., XVI, 1874, p. 189; Monog. N. Am. Sciuridæ, 1877, p. 655.
1890. *Sciuropterus volans* Jordan, Man. Vertebrates, 1890, p. 324, footnote.

Type locality.—North America (Virginia?).*

Geographic distribution.—Transition and Carolinian zones of the east; from northern New York and southern New Hampshire south to Georgia; west to the plains.

Habitat.—Forests and groves; everywhere abundant, nocturnal, spending the day in hollow trees or nests made of bark, leaves, and moss.

General characters.—Size medium, considerably smaller than *S. sabrinus;* hind foot smaller; tail narrower and of a rather different shape, tapering off more toward the end; no decided difference in color between winter and summer pelage; hairs of under parts white to the base; soles furred in winter, only the pads naked; wholly naked in summer; palms naked throughout the year.

Color.—*Winter pelage:* upper parts drab, often shaded irregularly with russet, slightly darker on upper surface of tail, the hairs plumbeous below, only the tips being colored; upper surface of hands grayish white; upper surface of feet drab, the toes and inner edge grayish white; cheeks grayish white; a black orbital ring; ears nearly naked, the skin dusky; under parts pure white, usually washed on lower surface of tail and sometimes of legs and flying membrane with pinkish buff, the hairs white basally. *Summer pelage* not differing materially from the winter, the upper parts usually more russet, having the appearance of being due to fading and wearing rather than to a change in color; the white of under parts often soiled, and the color of under surface of tail more intense.

Cranial characters.—Skull smaller and lighter than that of *S. sabrinus*, audital bullæ larger, not flattened, the bone light and papery; nasals not so much turned up at ends; teeth, including penultimate upper premolar, lighter throughout. Size of an average adult skull: basilar length, 28.8; occipitonasal length, 34.2; zygomatic breadth, 21; greatest height of cranium above palate, 12.2; greatest length of single half of mandible, 20.6.

Size.—Average measurements of seven adult specimens from Liberty Hill, Conn.: total length, 234.5; tail vertebræ, 99.6; hind foot, 31.4.

General remarks.—*Sciuropterus volans* retains its characters, with only a slight range of individual variation, throughout the whole of the Transition and Carolinian zones, but in the lower Austral Zone begins to approach the slightly different form of peninsular Florida. A series from St. Marys, Ga., is intermediate both in cranial characters and color between *S. volans typicus* and *S. volans querceti.* In the north *S. volans* overlaps the range of *S. sabrinus* for a short distance, the two meeting wherever the Transition and Canadian faunas run into each other.

Specimens examined.—Total number, 28, from the following localities:

New Hampshire: Hancock, 3.

New York: Peterboro, 1.

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* No definite type locality can be assigned the southern flying squirrel. Linnæus based his *Mus volans* on Ray, Edwards and Seba, and himself gives Virginia and Mexico as its habitat.

Ray tells us "In Nova Hispania atque etiam Virginia reperitur."

Seba does not specify where his specimen came from, though he calls it *Sciurus volans virginianus.*

Edwards says: "They are brought to us from several parts of North America and have been of late discovered in Poland."

Massachusetts: Wareham, 4; Mount Greylock, 1; Waverly, 3; Concord, 1; Waltham, 1.
Connecticut: Liberty Hill, 8.
Indiana: Denver, 1.
Missouri: Stotesbury, 1.
Maryland: Forest Glen, 1.
Virginia: Nelson County, 2.
West Virginia: White Sulphur Springs, 1.

Intermediates:
Georgia: St. Marys, 10; McIntosh County, 1.

Sciuropterus volans querceti subsp. nov. Florida Flying Squirrel.

Type from Citronelle, Citrus Co., Fla., No. 2451, ♀ old adult, collection of E. A. and O. Bangs. Collected by F. L. Small, September 17, 1894. Total length, 235; tail vertebræ, 95; hind foot, 32.

Geographic distribution.—Peninsular Florida, north to southern Georgia; exact western limits of range unknown.

Habitat.—The hammocks and margins, where there is plenty of live oak and water oak; nocturnal, spending the day in hollow stumps or in nests in the thick bunches of Spanish moss.

General characters.—Very similar to *S. volans typicus*, from which it differs in having the upper parts more uniform russet, and the under parts, especially the under surface of tail, strongly washed with the same color; soles naked; audital bullæ wheel-shaped, very large and deep.

Color.—Upper parts russet, shading to yellowish drab in places; cheeks grayish white; upper surface of feet and hands sooty gray; toes rather lighter; under parts white, a good deal shaded with pinkish russet.

Cranial characters.—Skull similar to that of *S. volans*, except that the audital bullæ are much larger, more inflated, and broadly wheel-shaped (see figs. 31 and 32). Size of an average adult skull (the type): basilar length, 30.2; occipitonasal length, 34.6; zygomatic breadth, 21; greatest height of cranium above palate, 12.8; greatest length of single half of mandible, 21.4.

FIG. 31.—Audital bulla of *Sciuropterus volans.*

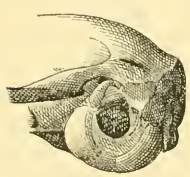


FIG. 32.—Audital bulla of *Sciuropterus v. querceti.*

Size.—Average measurements of three adult specimens from Citronelle, Fla.: total length, 237.66; tail vertebræ, 102.66; hind foot, 31.33.

General remarks.—*Sciuropterus volans querceti* passes into true *volans* in southern Georgia, a series of specimens from St. Marys, Ga., being intermediate between the two. A specimen from Powhatan Plantation, near Gibson, La., without a skull, seems referable to this form, and may thus extend its range to the coast of Louisiana.

Specimens examined.—Total number, 3, all from Citronelle, Citrus Co., Fla.

EXPLANATION OF PLATES.

All the figures are life size and were drawn by Dr. J. C. McConnell.

Plate VIII.

Fig. 1. *Sciurus niger* L.—♀ old adult, Citronelle, Fla. (No. 1978, Bangs coll.)

2. *Sciurus ludovicianus* Custis—♂ old adult, Point aux Loups Springs, La. (No. 2929, Bangs coll.)

3. *Sciurus ludovicianus vicinus* Bangs—♀ old adult; the type, White Sulphur Springs, W. Va. (No. 5215, Bangs coll.)

4. *Sciurus carolinensis hypophæus* Merriam—♂ old adult, Elk River, Minn. (No. 3942, Merriam coll.)

Plate IX.

Fig. 1. *Sciurus carolinensis leucotis* Gapper—♀ old adult, Liberty Hill, Conn. (No. 1043, Bangs coll.)

2. *Sciurus carolinensis fuliginosus* (Bach.)—♂ old adult, Gibson, La. (No. 2833, Bangs coll.)

3. *Sciurus carolinensis* Gmelin—♀ old adult, St. Marys, Ga. (No. 5141, Bangs coll.)

4. *Sciurus carolinensis extimus* Bangs—♀ adult; the type, Miami, Fla. (No. 4519, Bangs coll.)

Plate X.

Fig. 1. *Sciurus hudsonicus loquax* Bangs—♂ old adult; the type, Liberty Hill, Conn. (No. 4270, Bangs coll.)

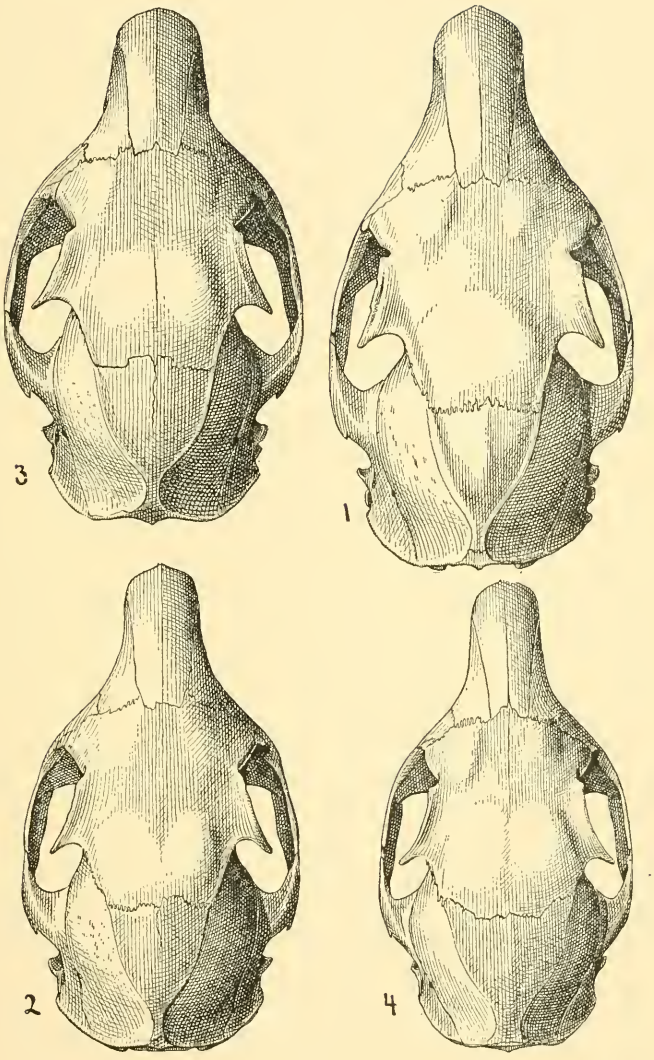
2. *Sciurus hudsonicus* (Erxleben)—♂ old adult, Hamilton Inlet, Labrador. (No. 3956, Bangs coll.)

3. *Sciuropterus sabrinus* (Shaw)—♂ old adult, Greenville, Me. (No. 4962, Bangs coll.)

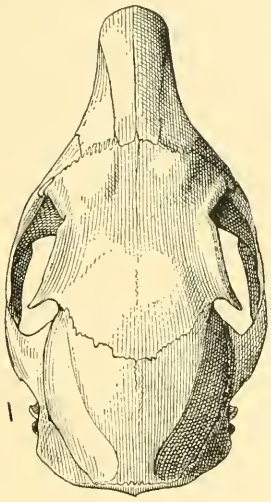
4. *Sciuropterus volans querceti* Bangs—♀ old adult; the type, Citronelle, Fla. (No. 2451, Bangs coll.)

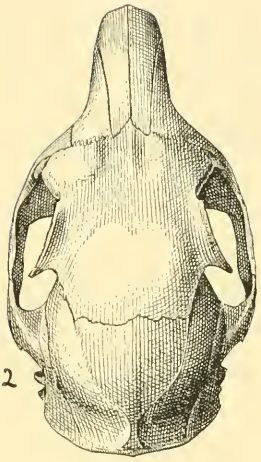
5. *Sciuropterus volans* (L.)—♂ old adult, Liberty Hill, Conn. (No. 4269, Bangs coll.)

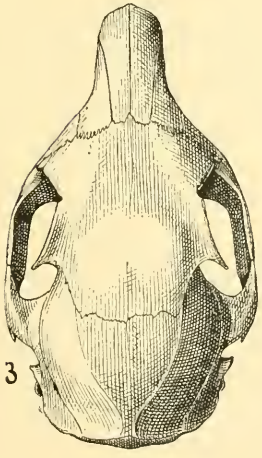
6. *Sciuropterus silus* Bangs—♂ adult; the type, top of Katis Mountain, White Sulphur Springs, W. Va. (No. 4931, Bangs coll.)

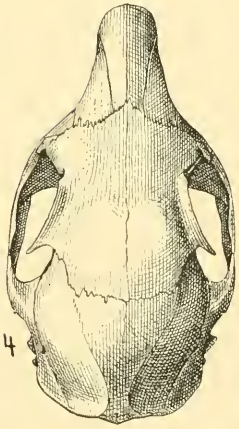


1 SCIURUS NIGER
2 SCIURUS LUDOVICIANUS
3 SCIURUS LUDOVICIANUS VICINUS
4 SCIURUS CAROLINENSIS HYPOPHÆUS

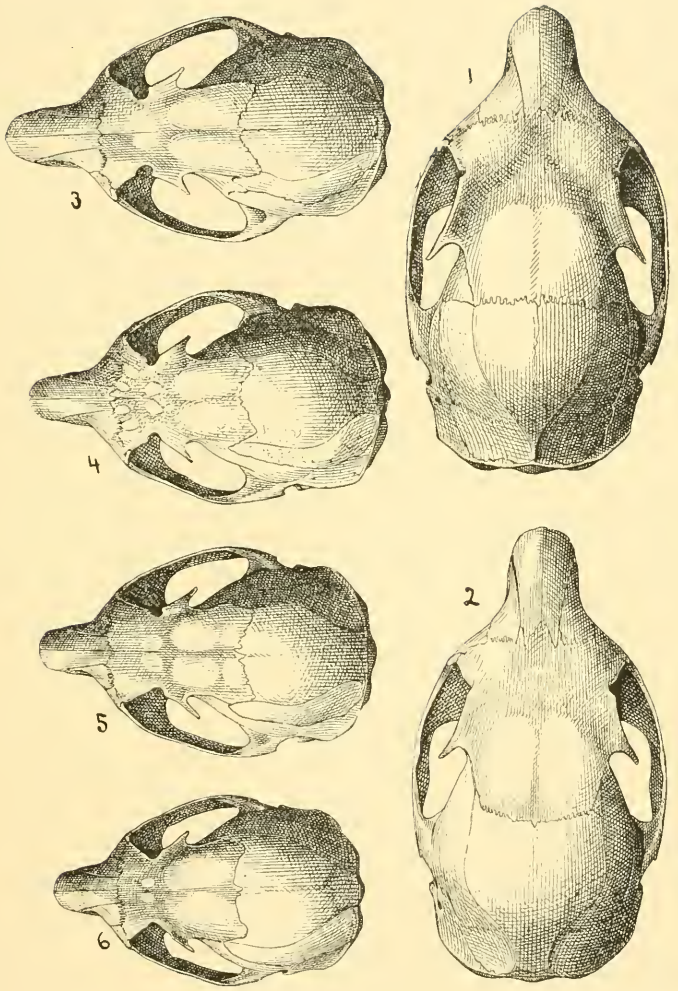








1 SCIURUS CAROLINENSIS LEUCOTIS
2 SCIURUS CAROLINENSIS FULIGINOSUS
3 SCIURUS CAROLINENSIS
4 SCIURUS CAROLINENSIS EXTIMUS



1 SCIURUS HUDSONICUS LOQUAX
2 SCIURUS HUDSONICUS
3 SCIUROPTERUS SABRINUS
4 SCIUROPTERUS VOLANS QUERCETI
5 SCIUROPTERUS VOLANS
6 SCIUROPTERUS SILUS

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PROCEEDINGS

OF THE

BIOLOGICAL SOCIETY OF WASHINGTON

ROMEROLAGUS NELSONI, A NEW GENUS AND SPECIES OF RABBIT FROM MT. POPOCATEPETL, MEXICO.

BY DR. C. HART MERRIAM.

Among the many new and interesting mammals collected by Mr. E. W. Nelson in Mexico during the past five years, one of the most remarkable is a small, short-eared, tailless rabbit discovered high up on Mt. Popocatepetl, at and above an altitude of 3,000 meters (approximately 10,000 feet). This singular animal has exceedingly short hind legs, and instead of moving by a series of leaps like ordinary rabbits, runs along on all fours, and lives in runways in the grass like the meadow mice.

Mr. Nelson has prepared, at my request, the following account of his experience with this extraordinary animal. He says: "On my first visit to Mt. Popocatepetl in the spring of 1893, I learned that these little rabbits were found there, and on my return to the city of Mexico I prepared for an expedition to secure them. On January 5, 1894, my assistant, Mr. E. A. Goldman, and I made our camp on the side of a cañon at an altitude of about 3,350 meters (11,000 feet) on the northwest slope of the mountain. We were accompanied by three Indian hunters and our packer. Among the firs and alders at this altitude the northerly slopes of the hills and cañons are covered with a luxuriant growth of saccaton grass in huge bunches, from three to six feet across, and often reaching a height of 6 or 8 feet, which covers the ground so that the only open spaces are small spots scattered irregularly here and there. A search under the overhanging masses of long grass blades showed a perfect network of large arvicola-like runways tunneling through the bases of the tus-

socks, and passing from one to another under the shelter of the outcurving masses of leaves. It was evident that the rabbits were very numerous here, and we all proceeded to hunt the vicinity carefully for them. The first day I saw three, but was unable to get a shot at any. One came running through the grass along one of the hidden trails and, seeing me, stopped in a little opening only seven or eight feet away. It was too near to shoot, and so escaped after looking at me with inquiring eyes for a few moments. The next evening I shot one by taking a stand on a large log, whence I could see several small openings in the grass, and saw one as it stopped a moment at the entrance of a runway. By persistent hunting for three days my Indians secured three more.

"On our first night wire snares were set without success, so the next night we put out a lot of steel traps in the runways. This latter method was very successful, and three fine specimens were taken in a small area a few yards across. So far as observed, these animals are strictly limited to the heavy growth of saccaton grass, between about 3,050 and 3,650 meters (10,000 and 12,000 feet), a few ranging a little above and below these limits in favorable places along cañon slopes. I found them equally numerous in the heavy grass on cañon slopes and hillsides and in the dense growth of grass about the sides of the small park-like openings in the forest. They make their forms within the matted bases of the huge grass tussocks by tunneling passageways along the surface of the ground through the mass of old grass leaves and stems and then hollowing out snug retreats within the weather-proof shelters thus obtained. Their concealed runways were intermingled with those of the common meadow mice of the mountains, and the striking resemblance in coloration and habits between the two animals was remarkable. Like the arvicolas, the rabbits are mainly nocturnal, but are occasionally found moving about by day. They become more active just at dusk, and on frosty mornings sometimes come out at sunrise into the small openings among the grass to bask in the warmth. My Indian hunters claimed that they often found them out sunning themselves in this way on summer afternoons after cold, heavy showers.

"This species has practically no external tail, though in some specimens there is a small fleshy papilla two or three millimeters in length; in others even this is absent. In this respect the animal resembles the pikas (*Lagomys*)."

Animals differing so widely in habits and manner of progression as the present species and the ordinary rabbits would be expected to differ in their skeletons. Fortunately, Mr. Nelson preserved a perfect skeleton of the new rabbit, which on comparison with those of the several subgenera of *Lepus* shows differences of considerable morphologic weight.

The clavicle is complete and articulates directly with the sternum (fig. 33)—a thing that never happens in the genus *Lepus*. Huxley describes the clavicle of the rabbit as "incomplete at both ends," and Flower states that it "is very short and is suspended by long ligaments between the scapula and the sternum." The manubrium or presternum is broadly expanded between and anterior to the articulation of the first pair of ribs (fig. 33), a condition unknown in the genus *Lepus*, in which it is always long and narrow (fig. 34). Flower calls attention to the correlation existing between the form of the presternum and the degree of development of the clavicle, stating that "the presternum is compressed and produced forwards in those rodents in which the clavicle is absent or rudimentary," as the hares, and "is generally broad in the forms which have the clavicle well developed, as the rats, beavers, &c." This interesting correlation is well exemplified in the Popocatepetl rabbit, which, having a complete clavicle, has also a broad manubrium. The segments of the mesosternum (between the presternum and xiphoid) are only three in number (fig 33), while in all the subgenera of *Lepus* the number is four (fig. 34). The ribs are correspondingly reduced, only six pairs instead of seven articulating with the sternum. The tubercles of the ribs are not produced into spiniform processes, as in *Lepus*, and disappear in the sixth pair. In *Lepus* they extend to the eighth pair. The scapula is rather narrow, with a long metacromial process, as in *Lepus*. There are four sacral vertebræ, as in *Lepus* (the first and anterior part of the second articulating with the ilia), and nine

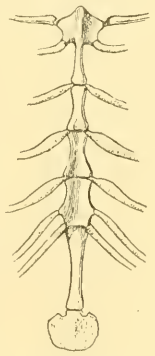

FIG. 33—Sternum of *Romerolagus nelsoni* (nat. size).

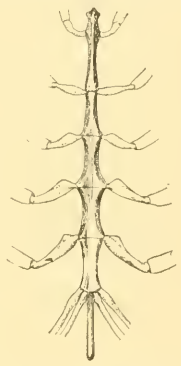

FIG. 34—Sternum of *Lepus timidus* (much reduced).

caudal vertebræ, the last three of which are upturned and rudimentary.

The fifth cervical vertebra is peculiar. Its transverse process projects directly outward instead of backward, and its inferior lamella has only a trace of the posterior extension usual in rabbits. The metapophyses begin on the tenth dorsal vertebra and are present in all the succeeding vertebræ to the last lumbar, inclusive. The anapophyses are much as in *Lepus* proper, being present, though small, on the ninth to twelfth dorsals, inclusive, and on all the lumbar vertebræ except the sixth and seventh. The transverse processes of the lumbar vertebræ are peculiar, each developing a broad posterior flange, which extends the full length of the side of the vertebra. Hypopophyses are present on the first, second, and third lumbar vertebræ, as in *Lepus*, though relatively short.

The bones of the legs and feet show a number of more or less important differences, some of which may be mentioned here. The depression on the inner side of the trochlear facet of the humerus is small and flat instead of deeply sulcate; the fibular malleolus is less strongly developed; the navicular bone differs materially in form and its inferior crest is conspicuously shorter than in *Lepus*, and does not reach forward beneath the bases of the metatarsals.

The skull, singularly enough, does not show the departure from *Lepus* that one would expect from a study of the other bones. It agrees in the main with skulls of the American cottontails (subgenus *Sylvilagus*), but differs in the postorbital processes, which are small, divergent posteriorly, and altogether wanting anteriorly, and in the jugal, which is greatly elongated posteriorly. The interparietal is distinct, and in old age becomes ankylosed with the supraoccipital. The thoroughly leporine character of the skull shows that the animal can hardly be regarded as ancestral to *Lepus*, as might have been inferred from its short ears, short hind legs, and various skeletal characters, but that it is a specialized offshoot from the genus *Lepus* itself.

The taxonomic value of the characters which serve to distinguish the Popocatepetl rabbit from the true rabbits, and more particularly the peculiarities of its sternum and clavicle, require the erection of an independent genus for its reception. Heretofore the genus *Lepus* has enjoyed the distinction of coincidence in characters with the family to which it belongs. Now the

family circle of the Leporidæ must be extended to include the new member.*

From the foregoing it will be evident that the new animal is of unusual interest to naturalists. The curious combination of its anatomical characters, the peculiarity of its mode of locomotion, the oddity of its habits, and the isolation of its home—high up on lofty Popocatepetl—give it an interest quite apart from that which attaches to most new discoveries. For this reason it affords me special pleasure to bestow upon the new and remarkable genus, of which it is the type, the name *Romerolagus*, in honor of the venerable Señor Don Matias Romero, Envoy Extraordinary and Minister Plenipotentiary from Mexico, as a slight token of appreciation for the active interest he has taken in the explorations of the United States Biological Survey in Mexico, and in recognition of the many courtesies he has extended to our field naturalists during the past five years.

ROMEROLAGUS gen. nov.

Type.—*Romerolagus nelsoni* sp. nov., from Mt. Popocatepetl, Mexico.

Diagnosis.—Size small; ears exceedingly short, shorter than in any known species of *Lepus;* hind legs and feet short; skull much as in *Lepus* (subgenus *Sylvilagus*), except that the postorbital processes are small, divergent, and wanting anteriorly, and the jugals much elongated posteriorly; clavicle complete and articulating with both sternum and scapula; presternum broadly expanded anteriorly, much broader than long in front of first pair of ribs [narrow and slender in *Lepus*]; mesosternum of 3 segments [4 in *Lepus*]; 6 pairs of ribs articulating with sternum [7 pairs in *Lepus*]; transverse process of 5th cervical vertebra directed straight outward (instead of backward), its inferior lamella lacking the usual posterior extension; transverse processes of all lumbar vertebræ broadly expanded, their bases covering entire length of vertebræ; hypopophyses present on first 3 lumbar vertebræ, but small; inferior crest of navicular bone short and not produced under base of metatarsal.

Romerolagus nelsoni sp. nov. Popocatepetl Rabbit.

Type from Mt. Popocatepetl, Mexico (altitude 3,350 meters or 11,000 feet). No. 57949, ♂ ad., U. S. Nat. Mus., Dept. Agric. coll. Collected Jan. 6, 1894, by E. W. Nelson and E. A. Goldman. Original number 5639.

Geographic distribution.—Boreal Zone of Mt. Popocatepetl, between the altitudes of 3,050 and 3,660 meters (10,000–12,000 feet).

* It is singular that of the four characters given by Flower and Lydekker in the first sentence of their diagnosis of the family Leporidæ ("imperfect clavicles, elongated hind limbs, short recurved tail, and long ears"), not one applies to the Popocatepetl rabbit.

General characters.—Size small; ears and hind feet very short; no external tail; coloration dark.

Color.—Upper parts, sides, and pectoral collar grizzled grayish brown, with a yellowish suffusion, and strongly mixed with black-tipped hairs (the yellowish due to a broad subapical zone of this color on each hair); belly and chin smoky grayish washed with buffy; upper surfaces of feet buffy yellowish, much lighter than rest of upper parts; ears without markings.

Cranial characters.—Skull similar in a general way to that of *Lepus sylvaticus*, but much smaller; supraorbital processes small, slender, divergent, and not approaching frontals posteriorly; jugals much elongated and incurved posteriorly, not defined anteriorly (supraorbital notch absent); braincase less decurved and more depressed posteriorly than in *Lepus sylvaticus* and its allies; zygomata standing far out from sides of cranium; palatal bridge relatively broad; audital bullæ moderately inflated.

Measurements.—Type specimen: total length, 311; tail vertebræ, 0; hind foot, 53; ear from notch in dry skin, 36. Average of 6 adults from type locality: total length, 295; hind foot, 52. The type is the largest of the seven specimens.

Remarks.—Mr. Nelson's account of the habits of this rabbit, as observed by him on Mt. Popocatepetl, has been given at the beginning of the present article. Mr. Nelson saw runways which he believes were those of the same species, at an altitude of 3,050 to 3,350 meters (10,000 te 11,000 feet) on the southeast side of Mt. Iztaccihuatl.

INDEX

Names of new species and subspecies are printed in **heavy type**

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BY

DR. C. HART MERRIAM

WASHINGTON, D. C.

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