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(ZOOLOGICAL SERIES)

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WILFRED H. OSGOOD

Curator, Department of Zoology.



CHICAGO, U. S. A.

1923

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ERRATA

- Page 6, bottom line, for 167, read 154.
Page 7, top line, for 96, read 89.
Page 7, line 3 from bottom, for 2-2=8, read 3-2=10.
Page 8, line 3 from top, for more, read less.
Page 19, line 16 from top, for Underparts, read Upperparts.
Page 20, line 11 from top, for 150, read 155.
Page 21, line 16 from bottom, for December 2, read November 3.
Page 69, line 12 from top, for 7582, read 7682.
Page 70, line 4 from top, for 7583, read 7683.
Page 70, line 15 from bottom, for 7584, read 7684.
Page 71, line 2 from top, for 7576, read 7676.
Page 71, line 16 from top, for 7578, read 7678.
Page 71, line 5 from bottom, for 7580, read 7680.
Page 72, line 18 from bottom, for 7579, read 7679.
Page 73, line 13 from top, for 7581, read 7681.
Page 73, line 7 from bottom, for 7586, read 7686.
Page 74, line 15 from top, for 7585, read 7685.
Page 74, line 8 from bottom, for 7577, read 7677.
Page 85, line 9 from bottom, for *Stenarchus*, read *Sternarchus*.
Page 111, line 9 from top, for *Brachyrhaphus*, read *Brachyrhaphis*.
Page 112, line 18 from bottom, for *Pœcilopsis*, read *Pœciliopsis*.
Page 118, line 13 from bottom, for *masutus*, read *nasutus*.
Page 119, after line 10 from top, add, Type No. 79689, U.S.N.M.
Page 119, after line 13 from bottom, add, Type No. 81761, U.S.N.M.
Page 120, line 6 from bottom, for *Neomænsia*, read *Neomænia*.
Page 121, line 14 from bottom, for *Encinostomus*, read *Eucinostomus*.
Page 124, bottom line, for *Paranetroplus*, read *Paraneetroplus*.
Page 224, (plate opposite), for Plate VI, read Plate VI bis.
Page 226, (plate opposite), for Plate VII, read Plate VII bis.
Page 275, line 6 from bottom, for 8941, read 8944.
Page 277, lines 12 and 15 from top, for *atricaudata*, read *atracaudata*.



Peculiar Specimen of *Ursus emmonsii*.

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A PECULIAR BEAR FROM
ALASKA

BY

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CHICAGO, U. S. A.

November, 1909.

A PECULIAR BEAR FROM ALASKA.

BY WILFRED H. OSGOOD.

In view of the scanty knowledge of the small Alaska bear known as the glacier bear, it seems important to publish a figure and a description of a peculiar specimen (No. 13768) now on exhibition in Field Museum. This skin (there is no skull) was purchased from the fur dealers C. F. Periolat and Son by Mr. V. Shaw Kennedy and by him presented to the Museum. Later it was mounted by Julius Friesser, one of the Museum's taxidermists, and placed on exhibition. The skin is practically complete although some slight restoration of parts was necessary about the nose and one of the feet. It was received by the fur dealers with a consignment from Alaska, and according to report was obtained in the region of Mount St. Elias.

Its principal peculiarity is in the fact that it is very much darker than the majority of specimens heretofore regarded as representing typical *Ursus emmonsii*. Gray hairs are scattered throughout the pelage of the entire animal, but the predominating effect is black. The black is intense and nearly unmixed with gray on the lower cheeks and throat and thence down the middle of the breast. The nape and sides of the neck also are nearly pure glossy black. The outer sides of the forelegs and the front of the hind legs and the feet are chiefly black. On the feet, forelegs, and breast the hairs are mostly black to the roots but elsewhere in the areas which appear black on the surface, the hairs are grayish at the base. The parts of rather more gray than black are the lower shoulders, the sides, and the hips, but practically all the hairs are broadly tipped with black, the total amount being much greater than in ordinary *Ursus emmonsii*. A black line from the nape to the tail is fairly distinct and the tail itself is mostly pure black. The top of the rostrum is rich ferruginous slightly mixed with creamy, while sparsely scattered ferruginous or creamy hairs extend backward to the occipital region and nearly to the base of the ears, becoming fewer and largely replaced by white hairs posteriorly. The extreme tip of the nose and parts of the lips were missing when the skin was received and are shown restored in the mounted specimen.

It is evident, therefore, that this peculiar bear is practically intermediate in color between the glacier bear (*emmonsii*) and the pure black bear (*americanus*). By some, no doubt, it would be regarded as a hybrid and this it may very well be, but with the present limited knowledge of *Ursus emmonsii* as a species, any conclusion in regard to it is somewhat hypothetical. In casting about for an explanation of the peculiarity of this specimen, other than that of hybridity, one finds some probability in the idea that *Ursus emmonsii* may not be a species nor even a subspecies but only a color phase of *Ursus americanus*. It should be emphasized perhaps that such an idea is distinctly hypothetical and of value only as a possible alternative to be kept in mind in judging such facts as may be disclosed from time to time in the future.

Many circumstances in addition to our specimen lend probability to the view that the glacier bear may be a color phase. Since its discovery some fifteen years ago, scattering skins more or less similar to those seen by the original describer have found their way to various American museums and private collectors. The total number is very small, perhaps not exceeding fifteen,* in spite of the recent activity of travelers and collectors on the coast of Alaska. Of this small number, the majority are imperfect and nearly all are unaccompanied by skulls or with imperfect ones only. The number of authentic observations regarding the habits and distribution of this interesting bear is still smaller and our entire knowledge of it, therefore, is exceedingly incomplete. All the specimens thus far received are from a small part of the coast of Alaska, extending approximately from Lynn Canal to Cape St. Elias. The fact that this is a region of great glaciers caused the animal to be called the glacier bear and from this the idea soon prevailed that it lived exclusively in and about the glaciers and had otherwise remarkable habits. The same region is inhabited also by black and brown bears, both of which, especially the former, are frequently found on or near the glaciers. In fact, from such evidence as can be obtained from the inhabitants of the region, both white and Indian, there is not the slightest foundation for the belief that the habits of the so-called glacier bear differ in any way from those of the ordinary black bear of the coast of Alaska.

So far as can be judged by material now available, there is no proof that the glacier bear differs from the black in cranial characters, such fragmentary skulls as have been received being identical in every

* My own observation includes only eight, all in public museums, but several are known to be in private hands and doubtless a few others have been preserved.

respect with those of black bears from the same region. That it has been thought to be smaller than the black bear is explainable by the probability that a majority of the skins thus far received are those of females or young. Therefore, the only peculiarity of *Ursus emmonsii* is its gray color, which it now appears is subject to marked variation. As a specific character, this peculiarity might sooner have been questioned if the animal were not a large game animal of much popular interest and one of which it is impossible to obtain large series of specimens from single localities. Probably five hundred black bears are killed on the coast of Alaska to one of the gray color representing *Ursus emmonsii*.

If occasional specimens showing divergence in color are found among large series of a given species of small mammal, it is not unusual to regard them merely as examples of dichromatism. Especially is this the case if the species be one in which dichromatism is already known to occur. It is very significant in this connection that the cinnamon phase so well known in other parts of the black bear's range is unknown on the coast of Alaska. That a gray phase may represent it there certainly is not impossible. Another interesting factor in the case is the white bear of the coast of British Columbia, called *Ursus kermodei*, which some regard as an albinotic phase of *Ursus americanus*. Evidently there is an unusual instability in the color of the small bears of the American northwest coast. Doubtless extremely interesting results would be obtained if some of our zoölogical parks should be so fortunate as to obtain living examples of these bears and to successfully breed them in captivity.

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DIAGNOSES OF NEW EAST AFRICAN
MAMMALS, INCLUDING A NEW
GENUS OF MURIDÆ.

BY

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CHICAGO, U. S. A.

February, 1910.

DIAGNOSES OF NEW EAST AFRICAN MAMMALS, INCLUDING A NEW GENUS OF MURIDÆ.

BY WILFRED H. OSGOOD,
ASSISTANT CURATOR OF MAMMALOGY AND ORNITHOLOGY.

The following brief descriptions are published in advance of a detailed report, now in preparation, on the Field Museum's expedition to British East Africa in 1905-6. Through the courtesy of the officials of the British Museum, especially Mr. Oldfield Thomas, it has been possible to make direct comparisons with types and authenticated specimens of previously described species. The liberality of Mr. Thomas, himself at work on East African collections, in freely advising as well as in giving access to material, is most gratefully acknowledged.

Procavia mackinderi zelotes subsp. nov.

Type from between Naivasha and Kijabe, British East Africa. No. 17475, Field Museum of Natural History. Adult male (stage VIII). Collected January 27, 1906, by C. E. Akeley.

Characters. Similar to *Procavia mackinderi* but smaller; pelage shorter and harsher; subterminal zone of color on hairs of shoulders and back narrower and darker. Similar to *Procavia jacksoni* in color but widely different in cranial characters; skull shorter and broader throughout; nasals shorter; temporal fossæ more extended posteriorly; molariform teeth much larger and more hypsodont.

Measurements. Average of 6 adults from Kijabe, measured in the flesh by E. Heller: Total length 470 (420-530); ear 32.6 (30.5-38); hind foot (c. u.) 63.5 (60-68). Skull of type: Basal length 89.5; basilar length 78; zygomatic breadth 53.2; nasals 22.5 x 23.4; breadth between extremities of postorbital processes 38.8; diastema 8.4; maxillary toothrow (crowns) 40; greatest width of m^1 7, of m^2 8.4.

Remarks. *Procavia slatini* Sassi is evidently closely allied to *P. mackinderi* and the present form but no specimens representing it have been available for comparison. Since another form of the same group is known from the region intervening between the type locality of *slatini* and that of *zelotes*, it seems safe to assume that the two forms are well differentiated.

***Procavia brucei maculata* subsp. nov.**

Type from Lukenya Mountain, British East Africa. No. 17504, Field Museum of Natural History. Adult male (stage VIII). Collected December 18, 1905, by C. E. Akeley.

Characters. Similar to *Procavia brucei* and *Procavia brucei hindei* but color paler and more grayish throughout; underparts much less suffused with creamy or buffy, often nearly pure white; ears more whitish; dorsal spot almost entirely pure white; upperparts more distinctly spotted than in any other member of the *brucei* group, the dark spots in one specimen numbering between 40 and 50 and extending from the rump to the shoulders. Skull most similar to that of *hindei*, differing from that of typical *brucei* in the character of the basisphenoid which is broad and rounded on its lower surface instead of being narrow and laterally channeled; nasals broader and less emarginate behind than in *brucei*; audital bullæ smaller than in *hindei*.

Measurements. Collector's measurements of an adult male: Total length 465; ear 31.5; hind foot (c. u.) 60. Skull of type: Basal length 79.7; basilar length 70; zygomatic breadth 46.5; nasals 21.2 x 19.5; breadth between extremities of postorbital processes 36.3; diastema 10.4; maxillary toothrow 31.7; greatest width of m^1 5.4.

***Dendromus ochropus* sp. nov.**

Type from Lake Elementeita, British East Africa. No. 16715, Field Museum of Natural History. Adolescent male. Collected February 11, 1906, by E. Heller.

Characters. Allied to *Dendromus mesomelas* and its relatives, but having the feet, ears, and underparts chiefly ochraceous. Upperparts dull ochraceous, the subterminal zone of color being relatively narrow and considerably mixed with dusky, producing a slightly olivaceous effect; black dorsal stripe well developed; a small blackish marking on the inside of the hind leg just above the tarsal joint; underparts pale ochraceous except a patch of forwardly directed white hairs on the throat; ears well clothed inside and out with bright ochraceous hairs; fore and hind feet ochraceous except the toes which are whitish. Somewhat similar to *Dendromus nyikæ* but pelage coarser, longer, and duller in color; ears ochraceous instead of dusky; feet and underparts ochraceous instead of white; tail bicolor instead of blackish all around. Skull slightly smaller than in *nyikæ*, with smaller bullæ and shorter palatine slits.

Measurements. Type: Total length 167; head and body 71;

tail vertebræ 96; hind foot (c. u.) 19. Skull of type: Greatest length 20.4; basilar length 14.6; zygomatic breadth 10.7; nasals 7.1; palatine slits 4.1; maxillary toothrow 3.3; length of m^1 2.

Dendromus nairobæ sp. nov.

Type from Nairobi, British East Africa. No. 16709, Field Museum of Natural History. Old male. Collected November 6, 1905, by E. Heller.

Characters. Allied to *Dendromus ochropus* and *D. nyikæ* but tail shorter and color much brighter; upperparts bright tawny, with the black dorsal stripe sharply contrasted; zone of tawny color relatively wide; underparts pale creamy whitish; ears pale ochraceous; feet white, slightly touched with fulvous; tail distinctly bicolor; inner side of hind leg without dusky spot above tarsal joint. Skull very broad, with heavy, angled zygomata, the zygomatic breadth slightly greater anteriorly than posteriorly.

Measurements. Type: Total length 163; head and body 83; tail vertebræ 85; hind foot (c. u.) 18; ear 14. Skull of type: Zygomatic breadth 11.6; nasals 8; palatine slits 3.9; maxillary toothrow 3; length of m^1 1.7.

Dendromus whytei pallescens subsp. nov.

Type from Lukenya Mountain, British East Africa. No. 16710, Field Museum of Natural History. Adult male. Collected December 28, 1905, by E. Heller.

Characters. Similar to *Dendromus whytei* but paler; general color of upperparts pale buffy ochraceous instead of tawny; underparts creamy white, nearly pure white on chin and throat; facial region without dusky markings; dorsal stripe obsolescent, consisting of an indistinct narrow line of dusky-tipped hairs mixed with fulvous.

Measurements. Type and one topotype, respectively: Total length 147, 137; head and body 69, 60; tail vertebræ 78, 77; hind foot (c. u.) 15.5, 16; ear 11.2. Skull of type: Greatest length 19.8; basilar length 14.8; zygomatic breadth 10.3; nasals 7.2; palatine slits 3.7; maxillary toothrow 3; length of m^1 1.8.

Zelotomys gen. nov.

Type. *Mus hildegardæ* Thomas (= *Zelotomys hildegardæ*).

Characters. Size medium (hind foot 22-24); tail shorter than head and body; ear moderate, rounded; mammæ 2-2=8. Skull short and broad; braincase very short; frontals but little expanded posteriorly, their supraorbital boundaries smoothly rounded; nasals

extended posteriorly beyond anterior root of zygoma and ending about on the plane of the middle of the first upper molar; interparietal very small. Molars very broad and more hypsodont than in *Mus*; first upper molar longer than second and third combined; second upper molar broader than long and very obliquely set in toothrow; cusps of molars numerically as in *Mus*; upper incisors decidedly projecting.

***Thamnomys surdaster polionops* subsp. nov.**

Type from Lukenya Mountain, British East Africa. No. 17112, Field Museum of Natural History. Adult male. Collected December 20, 1905, by E. Heller.

Characters. Similar to *Thamnomys surdaster* but less tawny on the sides from the nose to the flanks; sides of face, arms, and sides of body more or less olivaceous gray with slight mixture of tawny; a distinct dusky area from the eye to the base of the whiskers; upperparts bright tawny as in *surdaster*. Skull much as in *surdaster*, but averaging slightly larger and broader. Distinguished from *Thamnomys dryas* by the possession of 6 mammæ instead of 4; from *T. macmillani* by larger size and darker color; from *T. ibeanus* by smaller size, smaller ears, brighter color, and paler under sides of hind legs.

Measurements. Type: Total length 284; head and body 120; tail vertebræ 164; hind foot (s. u.) 24; ear 16. Skull of type: Greatest length 30.4; basilar length 22.9; zygomatic breadth 14.3; nasals 11; least interorbital breadth 4.5; postpalatal length 10.5; diastema 7.4; palatine slits 6.8; maxillary toothrow 4.5.

***Thamnomys ibeanus* sp. nov.**

Type from Molo, British East Africa. No. 17096, Field Museum of Natural History. Adult male. Collected March 15, 1906, by E. Heller.

Characters. Size large; color dark and relatively dull; hind legs just above tarsal joint usually dark-colored all around; skull and teeth relatively large. Most similar to *Thamnomys dolichurus* but color darker; size larger; teeth slightly larger; audital bullæ smaller. Somewhat similar to *T. surdaster* and *T. s. polionops* but size larger and color duller; skull and teeth larger; audital bullæ relatively small, about equalling those of *polionops* in actual size.

Measurements. Type: Total length 329; head and body 136; tail vertebræ 193; hind foot (s. u.) 26; ear 21. Average of 8 adults from Molo, Gilgil, and Lake Elementeita: Total length 305 (290-330); head and body 121 (109-136); tail vertebræ 184 (174-204); hind foot

(s. u.) 25.3 (24-26.5); ear 20.7 (19-22). Skull of type and an adult from Lake Elementeita, respectively: Greatest length 32.7, 31.8; basilar length 25.3, 24.4; zygomatic breadth 15.9, 14.9; nasals 11.9, 12.3; least interorbital breadth 5, 4.7; postpalatal length 11.8, 11.2; diastema 8.4, 8; palatine slits 7.8, 7.2; maxillary toothrow 5.1, 4.6.

Cricetomys gambianus kenyensis subsp. nov.

Type from south side of Mount Kenya, British East Africa. No. 17517, Field Museum of Natural History. Adult male. Collected by C. E. Akeley.

Characters. Most similar to *Cricetomys gambianus preparator* but proximal dark color of tail more extensive, occupying at least three-fifths of the length of the tail; color of upperparts somewhat paler especially on the sides which are more contrasted with the back. Skull slightly larger than in *preparator*; nasals broader posteriorly, their outer sides nearly parallel; rostrum slightly thicker dorso-ventrally; infraorbital plate narrower and less forwardly projecting. Somewhat similar to *C. g. viator* but much darker in color, with a more marked dorsal area.

Measurements. Skull of type: Greatest length 76.3; basilar length 62.6; zygomatic breadth 36.5; least interorbital breadth 12; nasals 31; postpalatal length 25.5; diastema 25; palatine slits 8; maxillary toothrow 11.3.

Otomys thomasi sp. nov.

Type from Molo, British East Africa. No. 16698, Field Museum of Natural History. Adult female. Collected March 16, 1906, by E. Heller.

Characters. Allied to *Otomys irroratus tropicalis* and other species having narrow nasals and m^3 with seven laminæ, but color widely different and skull decidedly arched or "humped." Dominant color of upperparts varying from pale cinnamon to wood brown instead of rich hazel as in *tropicalis*; a rather conspicuous patch of creamy buff behind the ears; fore and hind feet entirely creamy buff; underparts wood brown.

Measurements. Type and one topotype, respectively: Total length 282, 283; head and body 184, 180; tail vertebræ 98, 103; hind foot (s. u.) 30.5, 31; ear 24, 23.5. Skull of type: Greatest length 43.3; basilar length 34.6; zygomatic breadth 21.7; length of nasals 20.7; greatest breadth of nasals 7.5; least interorbital breadth 3.4; depth from highest point of orbit to alveolar border at front of m^3 14.5; postpalatal length 15.1; palatine slits 7.5; maxillary toothrow 9.2; greatest width of m^1 2.5.

Otomys angoniensis elassodon subsp. nov.

Type from Naivasha, British East Africa. No. 16684, Field Museum of Natural History. Adult female. Collected January 29, 1906, by E. Heller.

Characters. Similar to *Otomys angoniensis*, but paler and more grayish; molars narrower; nasals broadly expanded; m^3 with seven laminae. Distinguished from *Otomys nyikæ canescens* by slightly darker color but especially by more elongate skull, narrower braincase, and narrower molars.

Measurements. Type: Total length 270; head and body 183; tail vertebræ 87; hind foot (c. u., dry) 29; ear 21. Skull of type: Greatest length 41; basilar length 34.3; zygomatic breadth 21; length of nasals 17.7; greatest breadth of nasals 8.9; least inter-orbital breadth 4.5; depth from highest point of orbit to alveolar border at front of m^3 13.8; postpalatal length 15; palatine slits 8; maxillary tooththrow 8.2; greatest width of m^1 2.4.

Otomys nyikæ canescens subsp. nov.

Type from Kijabe, British East Africa. No. 16682, Field Museum of Natural History. Adult male. Collected January 20, 1906, by E. Heller.

Characters. Similar in size and cranial characters to *Otomys nyikæ*, but color much paler and grayer; general effect of upperparts grizzled wood brown or broccoli brown instead of deep russet; nasals broadly expanded anteriorly; m^3 with seven laminae. Color much as in *Otomys a. elassodon*, but slightly more grayish; skull shorter and broader; molars wider.

Measurements. Type and two topotypes, respectively. Total length 259, 255, 242; head and body 175, 165, 157; tail vertebræ 84, 90, 85; hind foot 29, 30, 27.5; ear 19.5, 21, 20. Skull of type: Greatest length 37.2; basilar length 30.9; zygomatic breadth 19.6; length of nasals 17.1; greatest breadth of nasals 8.5; least inter-orbital breadth 4.6; depth from highest point of orbit to alveolar border at front of m^3 12.8; postpalatal length 13.8; palatine slits 6.8; maxillary tooththrow 8.4; greatest width of m^1 2.6.

Arvicanthis barbarus convictus subsp. nov.

Type from Voi, British East Africa. No. 17206, Field Museum of Natural History. Adult male. Collected April 16, 1906, by E. Heller.

Characters. Allied to *Arvicanthis barbarus spekei*, *A. b. zebra* and other forms having unbroken stripes. Size about as in *spekei* but

color decidedly more rufescent. Light stripes pale ochraceous buff and numbering 5-6 of the heavier or primary ones and 4-5 of the secondary ones on each side. Four definite primary dark stripes on each side, each divided by a secondary light stripe. Ears bright cinnamon rufous; upper side of fore and hind feet ochraceous buff; underparts creamy buff. Skull much as in *spekei* but molars slightly smaller; larger and more elongate than in *zebra* and *albolineatus*.

Measurements. Type: Total length 228; head and body 104; tail vertebræ 124; hind foot (c. u.) 26; ear 14.5. Skull of type: Greatest length 29.9; basilar length 23.2; zygomatic breadth 13.6; nasals 11.2; least interorbital breadth 4.5; postpalatal length 10.7; diastema 6.7; palatine slits 5.8; maxillary tooththrow 5.2.

***Arvicanthus barbarus albolineatus* subsp. nov.**

Type from Lukenya Mountain, British East Africa. No. 17194. Field Museum of Natural History. Adult female. Collected December 14, 1905, by E. Heller.

Characters. Most similar to *Arvicanthus barbarus zebra* but paler with lighter, more whitish stripes and decidedly paler ears. Somewhat similar to *A. b. spekei* but smaller with paler stripes, paler ears, and smaller molars. Arrangement of stripes about as in *zebra* and *convictus*; light dorsal stripes pale creamy, those on the sides still lighter, almost white; median dark stripe extending forward beyond the ears; forehead and sides of face coarsely grizzled creamy; ears buff or cream buff instead of ochraceous or tawny as in allied forms; fore and hind feet buffy white. Skull with relatively short broad braincase, small molars, and good-sized audital bullæ.

Measurements. Type: Total length 216; head and body 102; tail vertebræ 114; hind foot (c. u.) 24; ear 13. Skull of type: Greatest length 27.6; basilar length 21.1; zygomatic breadth 13.1; nasals 11.1; least interorbital breadth 4.3; postpalatal length 9.3; diastema 6.5; palatine slits 5.3; maxillary tooththrow 5.1.

***Mus voi* sp. nov.**

Type from Voi, British East Africa. No. 17062, Field Museum of Natural History. Adult male. Collected April 22, 1906, by E. Heller.

Characters. Allied to *Mus chrysophilus* but duller in color; general tone of upperparts dull russet rather than bright ochraceous; skull with more slender nasals, lighter and narrower zygomatic plate, slightly smaller audital bullæ, and slightly smaller molars. Upperparts dull russet brightening on the sides and face to tawny ochra-

ceous; a slight dusky marking in front of and narrowly bordering the anterior half of the eye; ear; thinly clothed with tawny hairs; feet creamy white; underparts creamy white, the hairs slaty at their bases; tail dusky all around, annulations 10 per cm. Distinguished from *Mus hindei*, to which it has slight superficial resemblance, by its much longer tail and its smaller, flatter skull.

Measurements. Total length 315; head and body 154; tail vertebræ 161; hind foot (c. u.) 31; ear 19.5. Skull of type: Greatest length 36.3; basilar length 27.5; zygomatic breadth 17.9; nasals 14.7; least interorbital breadth 5.2; postpalatal length 12.6; palatine slits 8.2; diastema 8.2; upper toothrow 6.1.

***Mus niveiventris* sp. nov.**

Type from Voi, British East Africa. No. 17099, Field Museum of Natural History. Adult female. Collected April 22, 1906, by E. Heller.

Characters. Allied to *Mus verreauxi* and *Mus brockmani*; tail decidedly longer than head and body; mammæ 3-2=10. Tail shorter than in *brockmani* and color of upperparts very much darker. Slightly smaller than *verreauxi*; tail shorter; underparts entirely white with hairs white instead of slaty basally; skull smaller with relatively larger molars. Upperparts mixed buff or ochraceous buff and dusky producing a general effect of dull cinnamon to wood brown, in much worn pelage clear Mars brown; ears practically naked except near the edges where they are very thinly clothed with whitish hairs; underparts entirely creamy white to the roots of the hairs; dusky orbital very slight and scarcely evident.

Measurements. Type: Total length 262; head and body 109; tail vertebræ 153; hind foot (c. u.) 23; ear 17.5. Skull of type: Greatest length 30; basilar length 23.5; zygomatic breadth 14.2; nasals 13; least interorbital breadth 4.4; postpalatal length 10.2; diastema 8.1; palatine slits 7; maxillary toothrow 4.7.

***Mus niveiventris subfuscus* subsp. nov.**

Type from Lake Elementeita, British East Africa. No. 16972, Field Museum of Natural History. Adult male. Collected February 9, 1906, by E. Heller.

Characters. Similar to *Mus. niveiventris* but slightly darker colored above and with hairs of underparts broadly slaty at bases except on middle of chin and throat; skull essentially as in *niveiventris* but braincase averaging broader. Smaller and shorter-tailed than *Mus verreauxi*; skull smaller; molars larger.

Measurements. Type: Total length 257; head and body 105; tail vertebræ 148; hind foot (c. u.) 24; ear 17. Skull of type: Greatest length 29; basilar length 22.9; zygomatic breadth 14.7; nasals 12; least interorbital breadth 4.5; postpalatal length 10; palatine slits 6.3; diastema 7.7; maxillary toothrow 4.7.

Nasilio brachyrhynchus albiventer subsp. nov.

Type from Lake Elementeita, British East Africa. No. 16663, Field Museum of Natural History. Adult male. Collected February 9, 1906, by E. Heller.

Characters. Most similar to *Nasilio brachyrhynchus malosæ* but underparts nearly white instead of buffy; eye ring narrower; sides of face without blackish markings; inside of ears thinly clothed with whitish instead of ochraceous hairs; upper lip and sides of "proboscis" whitish rather than buffy; general color of upperparts practically as in *malosæ*, decidedly darker than in *delamerei*.

Measurements. Type: Total length 224; head and body 116; tail vertebræ 108; hind foot (c. u.) 31; ear 22. Skull of type: Greatest length 33.3; basilar length 31.7; zygomatic breadth 18.7; nasals 13.5; least interorbital breadth 5.9; upper tooth series 17.4.

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FURTHER NEW MAMMALS FROM
BRITISH EAST AFRICA.

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CHICAGO, U. S. A.

April 7, 1910.

FURTHER NEW MAMMALS FROM BRITISH EAST AFRICA.

BY WILFRED H. OSGOOD.

Continued study of the Field Museum's collection of African mammals, especially of the difficult *Crociduræ*, has resulted in the conclusion that eleven further new species and subspecies should be added to the rapidly growing list of the Mammalia of British East Africa. With one exception, these have been compared with specimens of allied forms in the British Natural History Museum. Types and important specimens have been consulted also in the Academy of Natural Sciences of Philadelphia and the United States National Museum at Washington. It is a pleasure to acknowledge the courtesies of the officials of these institutions.

Graphiurus parvus dollmani subsp. nov.

Type from Lukenya Mountain (Ulu Kenya Hills), British East Africa. No. 16722 Field Museum of Natural History. Adult female. Collected December 22, 1905, by E. Heller.

Characters. Similar to *Graphiurus parvus* in color but slightly larger in size and markedly different in cranial characters; skull larger throughout; braincase much deeper and decidedly elevated above the plane of the rostrum; molariform teeth broader. Upperparts pale wood brown to Isabella color, the hairs deep plumbeous basally, then narrowly buffy broccoli brown, then tipped with darker brown; sides similar to back, but inclining to cinnamon and then nearly pinkish or ochraceous buff along a narrow line between the color of the upperparts and the underparts; top of head like back, becoming slightly paler on the nose; a well-defined blackish area from the base of whiskers to and around eye; a slight buffiness just below the black bordering the lower anterior half of the eye; posterior cheeks below and in front of ear buffy; anterior cheeks below eye white, the uppermost hairs white to their bases, separated from those of the chin by hairs narrowly grayish basally; underparts creamy white, the hairs of the chin and anterior throat entirely white, those of the remaining underparts with broad slaty bases; pectoral region frequently stained with reddish brown; inner side of front legs and axillæ buffy;

feet white, tarsal joint dusky; tail brownish drab above, slightly paler below and finely vermiculated with whitish, certain white-tipped hairs of the under side sometimes showing from above as a narrow whitish border.

Measurements. Type: Total length 160; head and body 83; tail vertebræ 77; hind foot (c. u., dry) 15.8; ear 14. Skull of type: Greatest length 25; basilar length 18.3; zygomatic breadth 13.6; interorbital constriction 3.9; nasals 8.9; postpalatal length 10.5; diastema 5; depth from top of braincase to lower surface of audital bulla 10; length of upper toothrow 2.9.

Remarks. Comparison of the above-described form with the type of *parvus* reveals considerable difference in cranial characters but such color differences as are observable seem due to the fact that the type of *parvus* was preserved originally in alcohol.

The new form is named for Mr. Guy Dollman, of the British Museum, who has lately devoted considerable time to a study of the genus *Graphiurus*.

Thamnomys oblitus sp. nov.

Type from Voi, British East Africa. No 17123 Field Museum of Natural History. Adult female. Collected April 14, 1906, by E. Heller.

Characters. Allied to *Thamnomys macmillani* but tail decidedly longer and color somewhat deeper; skull slightly smaller. General coloration much as in *T. s. polionops*, but slightly paler with the rump more decidedly contrasted with the back, shoulders, and head. Anterior upperparts from crown to middle of back clay color slightly tinged with olivaceous; posterior back and rump bright ochraceous scarcely modified by scattered dusky-tipped hairs; forehead, nose, and sides of face olivaceous gray; underparts white distinctly tinged with strawcolor except on chin and sides of throat, all the hairs with white bases; feet pale buff, at least medially.

Measurements. Type: Total length 286; head and body 110; tail vertebræ 176; hind foot (c. u., dry) 22; ear 16. Skull of type: Greatest length 27.1; basilar length 20.5; zygomatic breadth 12.5; interorbital constriction 4.4; nasals 9.4; interparietal 8.7 x 4.8; postpalatal length 9.3; diastema 6.5; palatine slits 5.7; length upper toothrow 3.8.

Remarks. The single specimen representing this species was by chance not included with the others recently taken to the British Museum for study. Therefore, no actual comparison with *T. macmillani* has been made, but the type of that species was carefully examined and is still fresh in mind.

Arvicanthis dorsalis maculosus subsp. nov.

Type from Voi, British East Africa. No. 17265 Field Museum of Natural History. Adult male. Collected April 22, 1906, by E. Heller.

Characters. Similar to *Arvicanthis dorsalis rosalia* but upperparts more grayish except at the base of the tail and the posterior part of the rump; sides, especially toward the flanks marked with fairly distinct broken rows of quadrate spots of clay color on a grizzled olivaceous tawny ground; nape and shoulders grizzled olivaceous; sides of neck and face similarly olivaceous but slightly paler, the deep russet ears sharply contrasted; underparts pure creamy white to roots of hairs. Skull larger and with decidedly heavier dentition than in *A. d. rosalia*.

Measurements. Type: Total length 258; head and body 118; tail vertebræ 140; hind foot 29.5; ear 17. Skull of type: Greatest length 31.6; basilar length 25.5; zygomatic breadth 15.7; nasals 12.2; interorbital constriction 4.7; postpalatal length 11.3; diastema 7.6; palatine slits 6; upper toothrow 5.9; greatest width m^2 2.1.

Remarks. The type and only specimen of *Arvicanthis d. rosalia* in the British Museum differs so markedly from our small series from British East Africa that the separation of the latter is scarcely to be avoided although the two forms are geographically near. The type of *rosalia* may perhaps be abnormal, but this scarcely seems probable, since it differs from our series not only in color but also in cranial and dental characters.

Mungos ichneumon funestus subsp. nov.

Type from Naivasha, British East Africa. No. 17808 Field Museum of Natural History. Adult female. Collected February 1, 1906, by C. E. Akeley.

Characters. Similar in color to *Mungos ichneumon* of northern Egypt, the hairs of the upperparts being much more coarsely annulated than in *M. i. caffer* of South Africa. Size slightly smaller than in *M. ichneumon*; skull with shorter nasals and weaker dentition; width of incisive series reduced; pm^2 and pm^3 relatively weak and compressed; postorbital processes relatively broad and heavy.

Measurements. Type: Total length (dry skin, dressed) 1060; head and body 571; tail vertebræ 489. Skull of type: Greatest length 98; basilar length 90; zygomatic breadth 49.2; interorbital constriction 17.7; median length of nasals 18.9; width between outer sides of first upper premolars 16.7; width of upper incisive series 9.55; front of canine to back of m^3 34.8; length pm^2 5.25; length pm^4 (oblique) 9.75; greatest thickness pm^2 2.5.

Remarks. The cranial and dental characters given above are constant in the small number of skulls examined. Seven adult skulls from East Africa and five from Egypt have been available. Apparently none of the South and West African forms need to be considered as all are different in color. *M. i. angolensis* Bocage is practically identical with the East African form in cranial characters but differs widely in color. *M. i. parvidens* Lonnberg from Lower Congo has even weaker teeth than *funestus* and as described is further characterized by small size, short tail, and short hair. *M. i. caffer* differs still further both in color and in cranial characters. Typical *ichneumon* of northern Egypt is therefore the only form with which East African material needs close comparison.

Sylvisorex mundus sp. nov.

Type from Kijabe, British East Africa. No 16801 Field Museum of Natural History. Adult male. Collected January 24, 1906, by E. Heller.

Characters. Similar to *Sylvisorex granti* of Mount Ruwenzori; size larger; tail relatively shorter; braincase narrower and slightly deeper; rostrum more slender; second unicuspid relatively small. Skull and teeth smaller and braincase relatively wider than in *S. sorella*. Upperparts dark blackish slate; underparts slightly paler than upper; hairs of back 4-5 mm. in length; feet sooty brownish, darkest on the inside; tail blackish above, somewhat paler below.

Measurements. Type: Total length 129; head and body 70; tail vertebræ 59; hind foot 12.5. Skull of type: Greatest length 17.2; greatest breadth 8.45; postpalatal length 7.4; greatest width between outer sides of molars 5.3; length of upper toothrow 7.1.

Remarks. The types of the species allied to this form, *S. granti* and *S. sorella*, are both in alcohol, so it is not possible to determine their exact natural coloration, but they are sufficiently distinguished by cranial characters. Possibly further collections may demonstrate that all three are connected by gradations.

Crocidura voi sp. nov.

Type from Voi, British East Africa. No. 16942 Field Museum of Natural History. Adult male. Collected April 12, 1906, by E. Heller.

Characters. Size rather large; tail relatively short, scarcely half as long as head and body; general color slaty above and dull yellowish or grayish white below, the light and dark areas quite sharply contrasted; upper lip extensively whitish; feet white. Skull large, long, and narrow; teeth heavier than in any other east African shrew except *nyansa*; second unicuspid decidedly larger than third.

Measurements. Type and one topotype, respectively: Total length 136, 153; head and body 90, 116; tail vertebræ 46, 37; hind foot 14.5, 14. Skull of type: Greatest length 24.2; width of braincase 9.7; maxillary width 8.2; length of toothrow 11; i^1 to pm^4 5.7; alveolar length pm^4 2.3; breadth m^1 3.1; length molariform series 5.9.

Remarks. During a fairly critical examination of all the *Crociduræ* in the British Natural History Museum, no species has been found having any close relationship to the one here described. Its very short tail combined with its sharply contrasted slaty and white coloration distinguish it externally and its narrow skull and heavy dentition characterize it otherwise.

***Crocidura parvipes* sp. nov.**

Type from Voi, British East Africa. No. 16890 Field Museum of Natural History. Adult male. Collected April 18, 1906, by E. Heller.

Characters. Size medium; hind foot and tail very short, the latter less than half the length of the head and body. Underparts brownish fawn color slightly broken with a fine speckling of paler approaching drab gray, about the same color as pale examples of *C. jacksoni*; underparts white tinged with creamy, the bases of the hairs pale slate gray; line of demarcation between upper- and underparts sharp, passing along the side of the face just below the eye through the ear (the upper part of the ear thus being brownish and the lower whitish) and along the sides above the foreleg to the thigh; feet and legs whitish; tail broadly whitish below, brownish above. Skull about the size of that of *C. jacksoni* but slightly shorter and broader with the teeth slightly shorter and broader and more crowded; third unicuspid slightly larger than second but appearing smaller in lateral view since its posterior third is hidden by the anterior cusp of pm^4 , the next tooth.

Measurements. Type: Total length 122; head and body 84; tail vertebræ 38; hind foot 11.5. Skull of type: Greatest length 20.7; breadth of braincase 9.5; maxillary breadth 7.1; length of upper toothrow 8.7; i^1 to pm^4 4.2; length of molariform series 4.75; width m^1 2.35.

Remarks. The coloration and proportions of this species suggest a possible relationship with *Crocidura bicolor* as represented by specimens from Caconda, Angola. But *C. bicolor* is a much smaller species with a relatively longer tail and decidedly smaller skull.

***Crocidura xantippe* sp. nov.**

Type from Voi, British East Africa. No. 16888 Field Museum of Natural History. Adult male. Collected April 15, 1906, by E. Heller.

Characters. Allied to *Crociodura argentata fischeri*, with which it agrees in the general color of the upperparts, but tail decidedly longer and more extensively dusky on the upper side. Upperparts in fresh pelage fawn color with a fine vermiculation of lighter (almost ecru drab); underparts and upper lip dull grayish white, the bases of the hairs mouse gray to smoke gray; feet white; tail above broadly dusky brownish, below whitish for proximal two-thirds, mixed dusky and whitish for terminal third. Skull similar to that of *fischeri* but smaller and with a more compressed rostrum and decidedly smaller teeth; second unicuspid very slightly smaller than third.

Measurements. Type: Total length 150; head and body 90; tail vertebræ 60; hind foot 15. Skull of type: Condyllo-incisive length 22; length of toothrow 9.6; maxillary width 6.8; greatest width of m^1 2.3.

Remarks. The few differences between this species and *C. a. fischeri* are so pronounced that it is not possible at present to include it with that form as a subspecies of *argentata*. The difference in the size of the teeth is quite decided and there is no indication of gradation. The color, however, is about as in *fischeri* except that the tail is darker.

***Crociodura allex* sp. nov.**

Type from Naivasha, British East Africa. No. 16820 Field Museum of Natural History. Adult male. Collected January 31, 1906, by E. Heller.

Characters. Allied to *C. bottegi* and possibly to *C. cunninghamei*; size larger than in *bottegi* with larger skull and teeth; color lighter especially on underparts and feet; size somewhat smaller than in *cunninghamei*; skull shorter with a higher, more vaulted braincase; teeth smaller. Upperparts dull brown; underparts buffy gray; feet grayish, practically same color as underparts; pelage longer and coarser than in *cunninghamei*.

Measurements. Type: Total length 109; head and body 64; tail vertebræ 45; hind foot 12. Skull: Greatest length 17.1; greatest breadth 7.7; maxillary breadth 5.2; postpalatal length 7.9; toothrow 7.15; greatest width m^1 1.7.

Remarks. The shape of the skull in this species is more like that of *bottegi* than that of *cunninghamei* and its teeth though larger are more like those of *bottegi*. *C. cunninghamei* has a longer, narrower skull and a flatter braincase, and its teeth are scarcely smaller than in small specimens of *hildegardeae*.

***Crociodura fumosa schistacea* subsp. nov.**

Type from Lukenya Mountain, British East Africa. No. 16884

Field Museum of Natural History. Adult female. Collected December 15, 1905, by E. Heller.

Characters. Similar to *C. fumosa* but paler and less brownish in color especially on the underparts. Upperparts in fresh pelage dark mouse gray with a little light silvery ticking; underparts paler, the basal color slate color to blackish slate instead of slate black, the tips very pale broccoli brown, much paler than in *fumosa*; feet averaging considerably paler; tail decidedly more distinctly bicolor (in *fumosa* as a rule the tail is practically all dark or at most only very slightly lighter below).

Measurements. Type: Total length 145; head and body 93; tail vertebræ 52; hind foot (c. u.) 15. Skull of type: Greatest length 23.1; zygomatic breadth 10.1; postpalatal length 10.6; length of toothrow 10.2.

Remarks. This is in general a bluish gray shrew while true *fumosa* is a dark brownish one almost as dark below as above. Specimens from Nairobi tend more or less toward the new form but appear to be referable to *fumosa*.

***Crociodura turba zaodon* subsp. nov.**

Type from Nairobi, British East Africa. No. 16929 Field Museum of Natural History. Adult male. Collected December 2, 1905, by E. Heller.

Characters. Very similar to *C. turba* but slightly larger, with a slightly longer tail and somewhat heavier dentition. Color rather darker than in the type of *turba* especially on the underparts. Upperparts rich seal brown; underparts dark mummy brown; feet entirely dark blackish brown like upperparts; tail entirely blackish. Skull somewhat larger than in *turba* with a broader and relatively flatter braincase; teeth slightly larger and heavier throughout.

Measurements. Type: Total length 158; head and body 98; tail vertebræ 60; hind foot (c. u.) 18; ear 9. Average 10 topotypes: Total length 160 (155-165); head and body 99 (89-110); tail vertebræ 60 (56-65); hind foot 17 (16.5-18). Skull of type: Condylar incisive length 24.3; breadth of braincase 10.4; maxillary breadth 7.4; length of upper toothrow 10.65; i^1 to pm^4 5.3; length molariform series 5.9; breadth m^1 2.5.

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MAMMALS FROM THE COAST AND
ISLANDS OF NORTHERN
SOUTH AMERICA

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CHICAGO, U. S. A.


October 20, 1910

MAMMALS FROM THE COAST AND ISLANDS OF NORTHERN SOUTH AMERICA.

BY WILFRED H. OSGOOD.

While collecting birds for the Field Museum during 1908 and 1909, Dr. N. Dearborn and the late Mr. John F. Ferry secured a few specimens of mammals in northern Venezuela and on several of the nearby islands. Most of these are such as chanced to fall to their guns, since they carried no traps and made no special effort to obtain a representative collection of mammals. The collection, therefore, is a small one, but so little mammal collecting has been done in this region that many of the specimens are of considerable interest and several prove to belong to undescribed forms. The principal localities represented are in the districts of Aragua and Zulia, Venezuela, and on the islands of Aruba, Curaçao, Testigos, and Margarita.

In reporting on the specimens collected by Messrs. Dearborn and Ferry, it has seemed desirable to include descriptions of two new species from other sources, but from the same general region. One of these is a squirrel from Tobago acquired by the Museum with the Cory collection of birds and the other is a deer from Margarita Island, presented by Mr. C. Freeman of Puerto Viejo.

***Didelphis marsupialis* Linnæus.**

One specimen, Lake Valencia, Venezuela; collected by N. Dearborn. This is in very pale, somewhat worn pelage, chiefly whitish, but agrees with specimens in similar condition from Guiana representing typical *marsupialis*.

***Tamandua tetradactyla instabilis* Allen.**

One specimen, Orope, Zulia; Venezuela; collected by N. Dearborn. This is too young to show any subspecific characters, but it seems reasonable to refer it to the Colombian form *instabilis* rather than to typical *tetradactyla* of Brazil. If it were assumed, as has been done,* that Guiana is the type locality of *tetradactyla*, it might be safer on geographic grounds to refer our specimen to that form.

* Allen, The Tamandua Anteaters, Bull. Am. Mus. Nat. Hist., N. Y., XX, p. 391, Oct. 1904.

But examination of the principal literature concerned is convincing that Brazil and not Guiana should be regarded as the type locality of *tetradactyla*. Linnæus based the name entirely on Marcgrave and Ray, these being the only authors cited in the sixth edition of the *Systema*, and only one, Seba, being added in the tenth edition. Marcgrave referred exclusively to Brazil, and apparently Ray also, since he uses the words, "Tamandua I Brasiliensibus."¹ Subsequent authors, so far as consulted, almost invariably give Brazil or Brazil and Paraguay as the habitat of *tetradactyla*. In one case,² Brazil is definitely stated to be the type locality. The fact that the name *tamandua* is of Brazilian origin also is worthy of consideration. If, therefore, it is necessary to consider *tetradactyla* as Brazilian, the status of *Tamandua t. chapadensis* becomes involved, for with *tetradactyla* Linnæus, *bivittata* Desmarest, *opisthomelas* Gray, and *straminea* Cope, all from Brazil, it is difficult to see how room can be found for still another.

***Odocoileus margaritæ* sp. nov.**

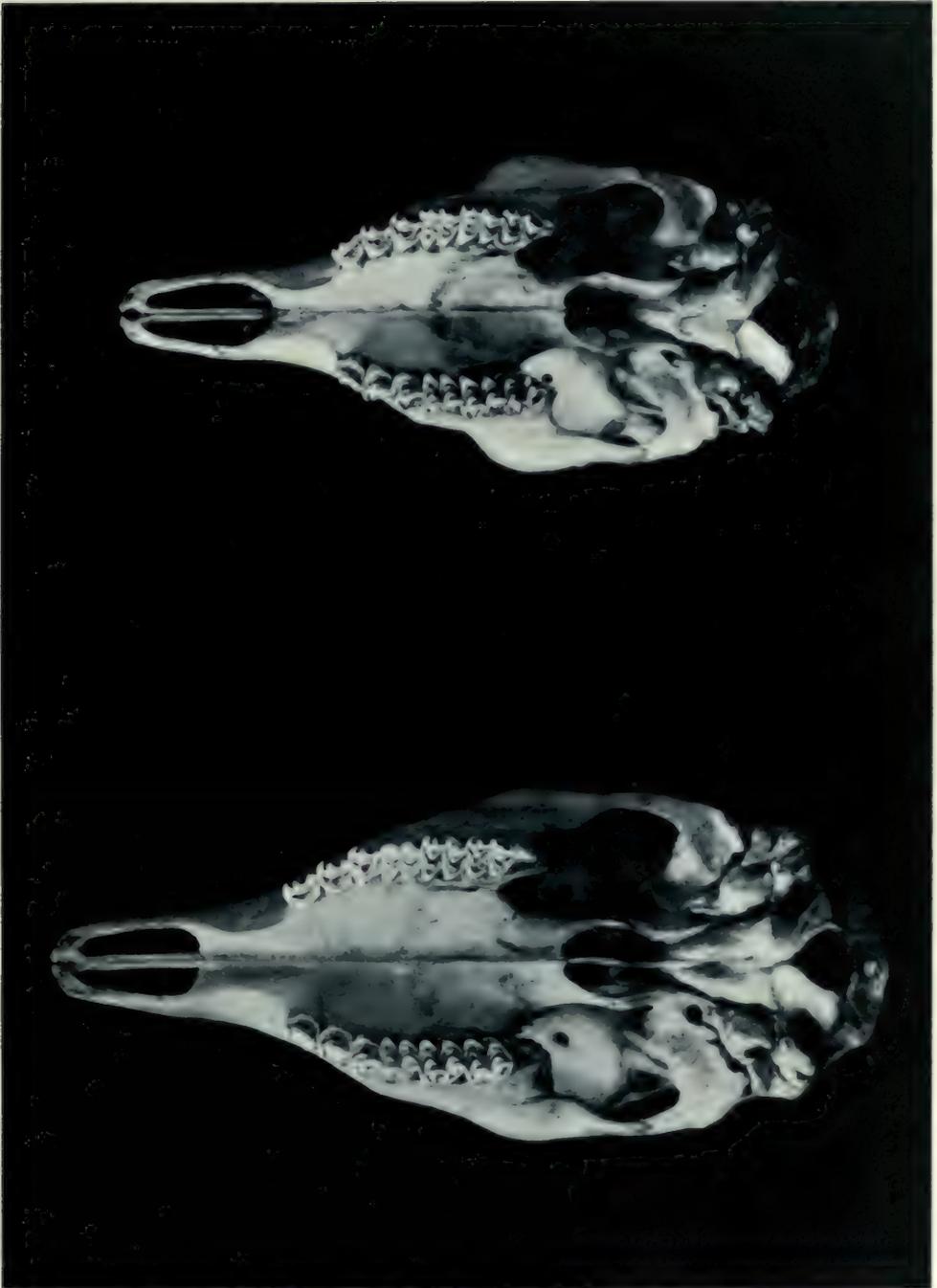
Type from vicinity of Puerto Viejo, Margarita Island, Venezuela. No. 18,137 Field Museum of Natural History. Adult male. May, 1910. Presented by C. Freeman.

Characters. Size small; metatarsal gland absent; color practically as in *O. gymnotis*; hairy part of ears about base and at side considerably darker, more grizzled; white area on upper throat slightly more restricted; median line of chest darker. General color of upperparts tawny ochraceous to clay color, the hairs pale fawn at base and tipped with bright creamy ochraceous; lower sides and flanks becoming paler, almost cream buff, with little or none of the finely punctulated appearance of the median dorsal region; a line from the top of the head to the interscapular region distinctly darker than remaining upperparts; upper throat rather narrowly white; lower throat and sides of neck pale grayish fawn, finely punctulated; cheeks same as sides of neck; a well-defined creamy white eye-ring, interrupted on the upper side posteriorly by an extension of buffy from the top of the head; top of head with long coarse hairs tipped with buffy and separated from the grizzled short hairs of the rostrum and antorbital region by an indistinct V-shaped blackish marking; rhinarium narrowly bordered by white above and broadly on the sides; a buffy white marking from the top of the rostrum to the angle of the mouth

¹ Vide Erxleben, *Syst. Regn. Anim.*, p. 95, 1777. Ray's work not accessible.

² Miller and Rehn, *Proc. Bont. Soc. Nat. Hist.*, XXX, p. 10, Dec. 1901.

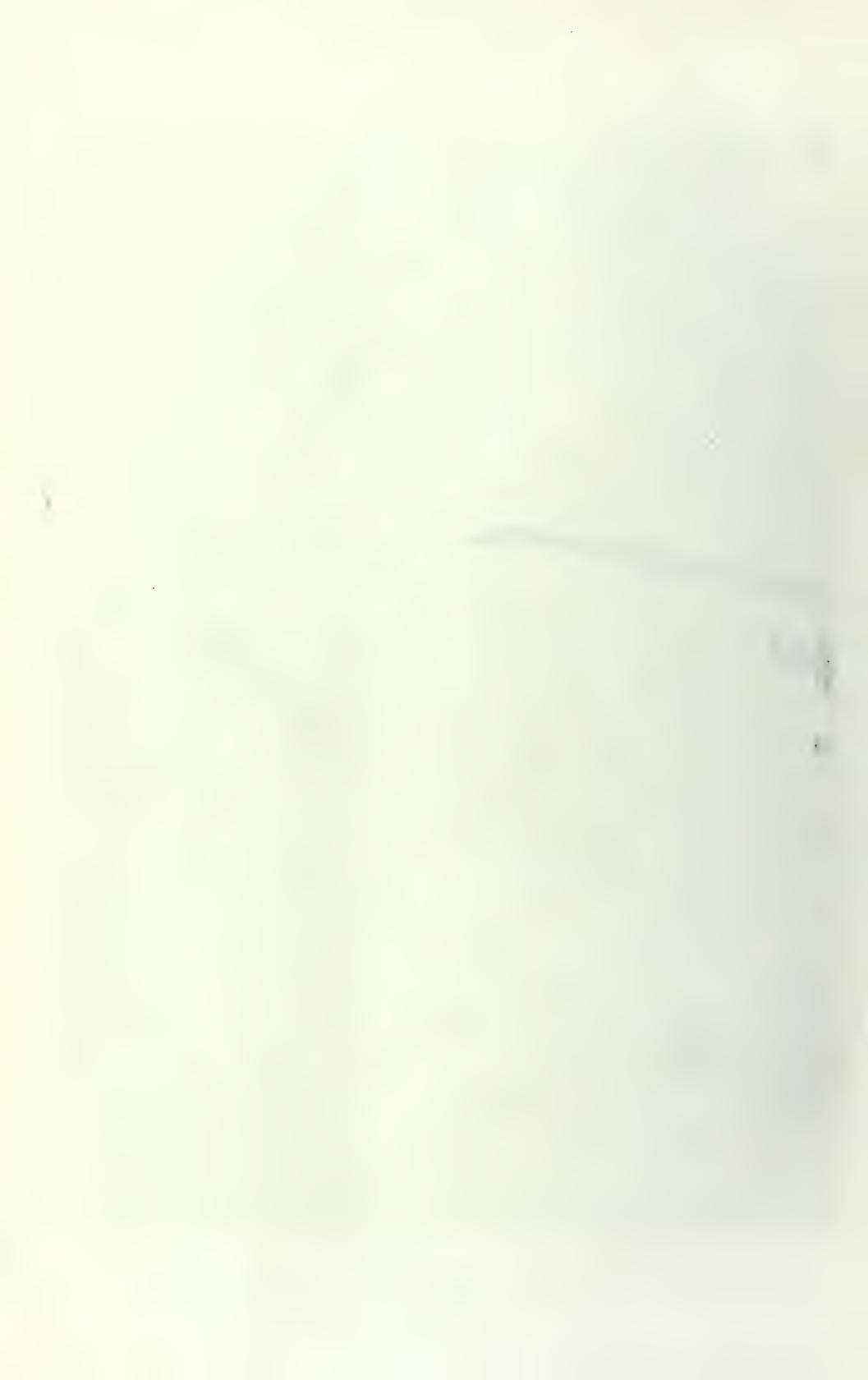
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Upper figure — Type of *Odocoileus margaritæ*. No. 18137 Field Museum of Natural History.

Lower figure — *Odocoileus gymnotis* from La Guaira, Venezuela. No. 36817 U. S. National Museum.

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Upper figure—Type of *Odocoileus margaritæ*. No. 18137 Field Museum of Natural History.

Lower figure—*Odocoileus gymnotis* from La Guaira, Venezuela. No. 36817 U. S. National Museum.

Reduced 2 2-5.

and thence to the white of the chin; a prominent blackish spot on each side of the chin with an irregular line of buffy between; outside of ears naked medially, grizzled buffy at the base and more blackish along the anterior edge, inside broadly white at the base and rather heavily clothed with white toward the tip; underparts broadly brownish buff on the breast and for a short distance posteriorly on middle of abdomen, the middle part forming a distinct dark line; abdomen, inguinal region, and inner sides of hind legs nearly to hock, white; inner sides of forelegs white to the elbow joint, this white being unconnected with that of the abdomen; front side and lower half of legs nearly clear buffy ochraceous, somewhat paler posteriorly; tail ochraceous above, white below.

Skull and teeth decidedly smaller than in *O. gymnotis*; audital bullæ smaller and more rounded; frontals very abruptly elevated and strongly ridged medially; occipital condyle lower than the palatal plane; antorbital vacuities relatively small; frontals deeply indented between the base of the horn pedicel and the orbit; upper molariform teeth slightly smaller than in *O. gymnotis*; lower molar teeth also somewhat smaller, but first and second lower premolars actually and relatively larger; posterior lobe of last lower molar reduced to a slender column. Antlers small and rugose except at points, consisting of a single branch with a slight fork at the tip and a stout upright subbasal snag.

Measurements. Type (dressed skin, measured dry): Total length 1,415; head and body 1,310; tail vertebræ 105; hind foot 293; ear from notch 110. Skull of type and of an adult male *O. gymnotis*, respectively: Greatest length 218, 261; basilar length 191, 230; tip of premaxillæ to end of palate 136, 162; zygomatic width 90, 107; mastoid width 70.8, 83.7; interorbital width 52, 63; median length of nasals 59.5, 79; greatest width of nasals 27.4, 30; width between outer sides of second upper molars 62.9, 73.5; length of upper molariform series (crowns) 64.5, 71.2; length of first and second lower premolars 20, 18.4.

Remarks. Externally there is little except its smaller size to distinguish this insular species from its mainland relative *O. gymnotis*. Its skull, however, differs markedly from that of *gymnotis* not only in size but also in many detailed characters, while in its abruptly elevated braincase it differs from any deer known to me. The type and only specimen was secured and presented by Mr. C. Freeman of Puerto Viejo in generous response to the suggestion of Mr. Ferry, who was greatly assisted by Mr. Freeman during his work on Margarita

Island. The deer was kept alive by Mr. Freeman for nearly a year, and according to his statement was about a year and a half old at the time of shipment. It was received alive at New York, May 16, 1910, and there killed and prepared as a museum specimen. For comparison with it, two specimens from the mainland of South America have been available, representing *Odocoileus gymnotis* or an allied form. One of these is an adult male (skin and skull) from La Guaira, Venezuela, courteously loaned by the U. S. National Museum through Mr. N. Hollister, Assistant Curator of Mammals; the other, a young male (skull only) from San Mateo de Caicara, Orinoco River Venezuela, for the loan of which the Museum is indebted to Mr. F. A. Lucas, Curator-in-Chief of the Museum of the Brooklyn Institute of Arts and Sciences.

Sciurus nesæus G. M. Allen.

Two specimens of this well-marked species are in the collection taken by Mr. Ferry on Margarita Island.

Sciurus griseogena Gray.

Two specimens, Mountains near Maracay, Aragua, Venezuela; collected by N. Dearborn. These agree very closely with Gray's type, with which they were compared in the British Museum. They show much resemblance in general appearance to *S. hoffmanni* and doubtless are closely related to that species, though readily distinguishable by their more rufescent tails. Two specimens from Caracas collected by Mr. Ferry may be referable to *griseogena* also, but their general color is much paler, being scarcely brighter than in *S. quebradensis*.

Sciurus versicolor zuliae subsp. nov.

Type from Orope, Zulia, Venezuela. No. 16,584 Field Museum of Natural History. Adult male. Collected March 1, 1908, by Ned Dearborn.

Characters. Similar to *Sciurus versicolor* of Ecuador but with black instead of ferruginous predominating on the nape and interscapular region; feet and upper side of forelegs scarcely grizzled but nearly clear ferruginous; tail more broadly black terminally; black of back continuous with that of proximal part of tail; pelage rather short and harsh. Upperparts chiefly black to roots of hairs, only the lower sides, the shoulders, hips, and thighs being mixed black and ferruginous; interscapular region, nape and top of head mainly

black with a light punctulate mixture of tawny ochraceous; feet, toes, and upper side of forelegs clear, rich ferruginous; underparts clear ferruginous with or without irregular white markings on the throat and chest; chin and sides of throat finely mixed dusky and clay color, only slightly paler than cheeks; upper side of tail black proximally and terminally, the intervening part clear ferruginous (the hairs of this part very narrowly or quite broadly black basally); terminal black occupying nearly or quite one-third of length; under side of tail black with a broad ferruginous edging in middle or black proximally and terminally with clear ferruginous or mixed black and ferruginous in middle.

Measurements. Type: Total length 440; head and body 235; tail vertebræ 205; hind foot (s. u.) 57; ear 26. Skull of type: Greatest length 68.3; basilar length 45.5; zygomatic breadth 33.6; inter-orbital breadth 17.7; median length of nasals 18.8; diastema, 15.5; crowns of upper toothrow 9.4.

Remarks. This form, like typical *versicolor*, is doubtless highly variable, but the three specimens examined differ constantly from any of a considerable series of typical *versicolor* in at least three characters, increased black across the shoulders and nape, increased black on the end of the tail, and decrease or entire absence of black on the feet and forelegs. In *versicolor*, there is only an inch of terminal black in the tail at the most and many specimens have the tail ferruginous to the very tip; while in *zuliae* the terminal black amounts to as much as three inches. The only other form likely to be related is *Sciurus variabilis morulus* of Panama, which is said to have "most of the hairs above, . . . ringed-blackish at base, then ferruginous, and blackish again at tip"; whereas, in *zuliae* the hairs of the back are pure black to the roots.

***Sciurus tobagensis* sp. nov.**

Type from Tobago Island, Caribbean Sea. No. 14,954 Field Museum of Natural History. Adult female. Collected May 12, 1892, by W. W. Brown, Jr.

Characters. Similar to *Sciurus chapmani*, with which it agrees in size and general coloration, but terminal color of hairs of tail paler and subterminal black more extensive; sides of face slightly more richly colored. Color of tail much as in *S. hoffmanni*, but size decidedly smaller. The subterminal black in the hairs of the tail forms a well-defined lateral stripe about 5 mm. in width extending the length of the tail to a broad black tip 25 to 50 mm. in width. In *chapmani*, the black lateral stripe and subapical black is much reduced

and in specimens in slightly worn pelage is scarcely distinguishable from the grizzled central part of the tail, especially when viewed from the under side. General color of upperparts mixed "peppery," clay color and blackish; orbital ring and sides of nose clay color to ochraceous; chest and belly clear ochraceous rufous; upper side of tail from a point about 50 mm. from its base to the black of the tip mostly clear ochraceous instead of hazel or ferruginous as in *chapmani*; tip of tail black with few ochraceous hairs intermixed and a few of the black hairs faintly tipped with ochraceous. Skull practically as in *chapmani*.

Measurements. Type (dry skin): Total length 330; head and body 165; tail vertebræ 165; hind foot (c. u.) 45.

Remarks. The heavy black tip of the tail is the principal character distinguishing this form from *S. chapmani*. A complete revision of this group of squirrels with ample material is necessary before it will be possible to decide how many of the various described forms should be regarded as species and how many as subspecies.

***Dasyprocta variegata colombiana* Bangs.**

One specimen, Orope, Zulia, Venezuela; collected by N. Dearborn. Comparison of this and other specimens of the same form with those belonging to allied forms from Panama to Peru shows sufficiently complete intergradation to convince that at least *colombiana* and *isthmica* should be regarded as subspecies of *variegata*.

***Hydrochoerus capybara* Linnæus.**

One specimen (skull only), Lake Valencia, Venezuela; collected by N. Dearborn.

***Sylvilagus cumanicus* Thomas.**

One specimen, Maracay, Venezuela; collected by J. F. Ferry. This is by no means typical, being considerably larger and more rufescent than the type of *cumanicus*. It is also decidedly larger than *S. orinoci* but agrees closely with that species in color. Its external resemblance to the insular form *margaritæ* also is marked. Without a series of typical *cumanicus*, however, it does not seem safe to separate it from that species. Possibly it should be regarded as intermediate between *orinoci* and *superciliaris*, since it agrees in color with one and in size with the other.

***Sylvilagus nigronuchalis* (Hartert).**

Three specimens, Aruba Island, collected by J. F. Ferry; one specimen, Curaçao, collected by N. Dearborn. The single adult

from Aruba, the type locality of this species, is in rather worn bleached coat much paler than that of the one from Curaçao, which is quite fresh and new. The skull of the Curaçao specimen also differs in narrower nasals and interorbital region and in slightly weaker dentition. Without additional material it is impossible to judge of the importance of these differences.

***Sylvilagus margaritæ* (Miller).**

Thirteen specimens, Puerto Viejo (5), Porlamar (1), and Macanao (7), Margarita Island, Venezuela; collected by J. F. Ferry. A few of this series have the under side of the tail nearly pure white and the sides lighter and more grayish than the back, thus approaching the coloration of *S. cumanicus*. The sides of the head and face are in nearly all cases uniform grayish with slight buffy or more heavily grizzled areas below the eye and between the eye and the ear.

***Sylvilagus avius* sp. nov.**

Type from Testigos Islands (Testigo Grande), Venezuela. No. 16,593 Field Museum of Natural History. Adult female. Collected February 14, 1909, by John F. Ferry.

Characters. Similar to *Sylvilagus margaritæ* but smaller and darker; skull smaller and relatively broader; audital bullæ smaller. Upperparts pale cinnamon rufous and black, the hairs rufous subterminally and broadly black terminally; shoulders and rump slightly lighter than back but not grayish as in *S. cumanicus* and *S. superiliaris*; top of head rich cinnamon rufous finely mixed with black, darker than in allied forms; upper side of tail, hind legs and sides of hind feet nearly clear cinnamon rufous; a buffy white line over the eye and a rufous spot below it; remainder of sides of face pale whitish clay color mixed with black, the black more intense posteriorly where it forms a rather distinct blackish area between and below the eye and the ear; underparts dull whitish, strongly tinged with buff on the chest and along the sides of the belly where the transition to the color of the sides is rather gradual; under side of tail dull dark buff. Skull rather short and broad; incisor teeth relatively heavy, cheek teeth weaker than in *margaritæ*; audital bullæ smaller.

Measurements. Type: Total length 420; tail vertebræ 20; hind foot 85; ear 53. Skull of type: Greatest length 74.5; basilar length 57.7; zygomatic breadth 36; interorbital breadth 19.2; combined width of nasals 15.6; diastema 21.2; width between outer sides of maxillary tooththrows 23.2; alveolar length of maxillary tooththrow 15.3.

Remarks. This form and also *S. margarita* and the mainland forms *cumanicus*, *orinoci* and *superciliaris* are doubtless allied to *S. brasiliensis* and *S. minensis* and quite probably some, if not all, will eventually be reduced to subspecific rank.

Felis pardalis subsp.

One specimen, a fine adult male from Oropo, Zulia, Venezuela; collected by N. Dearborn. This differs from typical *pardalis* to some extent in color and quite markedly in cranial and dental characters. The form which it represents is possibly undescribed but the confused state of nomenclature caused by the large number of worse than useless names given by early authors to members of this group makes it impossible to identify specimens without extended studies and reference to material in museums in various parts of the world.

Mormoops megalophylla intermedia Miller.

Eighty specimens, Curaçao, Dutch West Indies; collected by N. Dearborn.

Phodotes tumidirostris (Miller).

Two specimens, Curaçao, Dutch West Indies; collected by N. Dearborn.

Noctilio minor sp. nov.

Type from Encontrados, Zulia, Venezuela. No. 18,044 Field Museum of Natural History. Female adult (in alcohol). Collected February 15, 1908, by N. Dearborn.

Characters. Allied to *Noctilio albiventer*, but smaller throughout; foot, tibia, and forearm shorter; skull and teeth decidedly smaller; braincase shorter and more nearly spherical, but with rather marked depression of the parietals on each side of and near the base of the well-developed sagittal crest; supraorbital crests more abruptly divergent; m^1 and m^2 separated by a slight space and with the commissure less obvious between the hypocone and the commissure between the protocone and the metacone. Ear laid forward, reaching slightly beyond muzzle; forearm with wings folded extending 4-6 mm. beyond the muzzle; chin with various small plications, nowhere smooth; a lunate lappet below the central prominence of the lower lip and from the lower side of this an undulate cutaneous ridge extending roughly parallel with each side of the lower lips; below this lappet two additional but smaller and scarcely differentiated median promi-

nences from which slender ridges extend backward about 6 mm.; six small papillæ on each side of the face, two pairs behind each nostril and one pair behind each upper lip; ear slightly lobulate terminally. Color of upperparts a little lighter than mummy brown; a narrow, whitish median streak from the interscapular region backward; underparts tawny olive, somewhat brighter on the sides near the base of the volar membrane.

Measurements. Head and body 67; tail 12; ear conch, inner margin 17.5, outer margin 20.5, breadth 8.7; tragus 4; forearm 58.4; pollex 10; 3rd metacarpal 51.5; 4th metacarpal 52.5; 5th metacarpal 50.4; foot with claws 15.6; tibia 21.5; calcar 30.5. Skull: Condylion to front of canine 17.2; zygomatic width 14.6; mastoid width 12.6; width of braincase 11.2; inion to anterior division of sagittal crest 12.5; upper teeth, c-m³ 7.5; width of m² 2.7.

Remarks. The differences between the above-described species and *Noctilio albiventer* are quite convincing of their distinctness although only one specimen of each has been available for comparison. Of these, one (the type) is in alcohol and the other is a dry skin from Brazil, kindly loaned by the authorities of the U. S. National Museum through Mr. N. Hollister, Assistant Curator of Mammals. No comparison has been possible with *Noctilio zaparo* Cabrera but since that species is even larger than *Noctilio albiventer* it need not be considered. Careful comparison of *N. albiventer* and *N. minor* with a specimen of *N. leporinus mastivus* shows so much detailed similarity throughout even to minor external features and color, that it is difficult to subscribe to their generic separation. The genus *Dirias*, with *Noctilio albiventer* as type, has been separated from *Noctilio* (type *N. leporinus*) on the basis of a proportionately shorter tibia and foot, slight spaces between upper molar teeth, and the development of a well-defined commissure from the hypocone of m¹ and m² to the commissure extending from the protocone to the metacone.* The commissure is not absent in *N. mastivus* but merely not so well developed as in *N. albiventer*. But in *N. minor*, the commissure is scarcely more prominent than in *N. mastivus*, while the spacing of the upper molars is practically the same as in that species, due allowance being made for the disparity in size. In dental characters, therefore, *N. minor* is intermediate between "*Dirias*" and *Noctilio* and even nearer to the latter; while in the relative shortness of its foot and tibia it differs from typical *Noctilio* even more widely than does *albiventer*, the

* See Miller, The Families and Genera of Bats, Bull. 57, U. S. Nat. Mus., p. 99, 1907.

genotype of *Dirias*. Evidently the dental characters are not correlated with the length of the tibia and foot in any natural association of species, and since it is difficult to see generic significance in the relative shortness of the tibia and foot, the recognition of *Dirias* as a distinct genus is open to serious question.

***Cebus apella leucocephalus* Gray.**

Seven specimens, Orope, Zulia, Venezuela; collected by N. Dearborn. One of these (No. 16,567) has been compared with the type of *Cebus leucocephalus* in the British Museum. The type is somewhat larger and its pelage slightly fuller and longer than in our specimen, but the color is practically identical, the only difference being in the color of the under side of the tail which is slightly darker in the type. Comparison has not been made with *Cebus albifrons* and it is therefore somewhat of an assumption to use the name *leucocephalus* as that may possibly prove to be a synonym of *albifrons*. However, the belief that *leucocephalus* differs from *albifrons* is encouraged by the original description* of *albifrons*, which states that the forehead is black, whereas in our specimens it is brown. Moreover, the face in our specimens is scarcely white, but pale brown. The locality assigned to *leucocephalus* by Gray is simply "Columbia"†—but its agreement with our specimens makes it probable that the exact locality was at least in northeastern Colombia and probably in western Venezuela near the coast. This is the more probable since a well-distinguished form (*malitiosus*) inhabits the Santa Marta region.

* As follows: "*Simia albifrons*, ex albo cinerascens, vertice nigro, facie caerulea, fronte et orbitis niveis, cruribus et brachiis fuscentibus."

† P.Z.S., 1865, p. 827.

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MAMMALS FROM
WESTERN VENEZUELA AND
EASTERN COLOMBIA

BY

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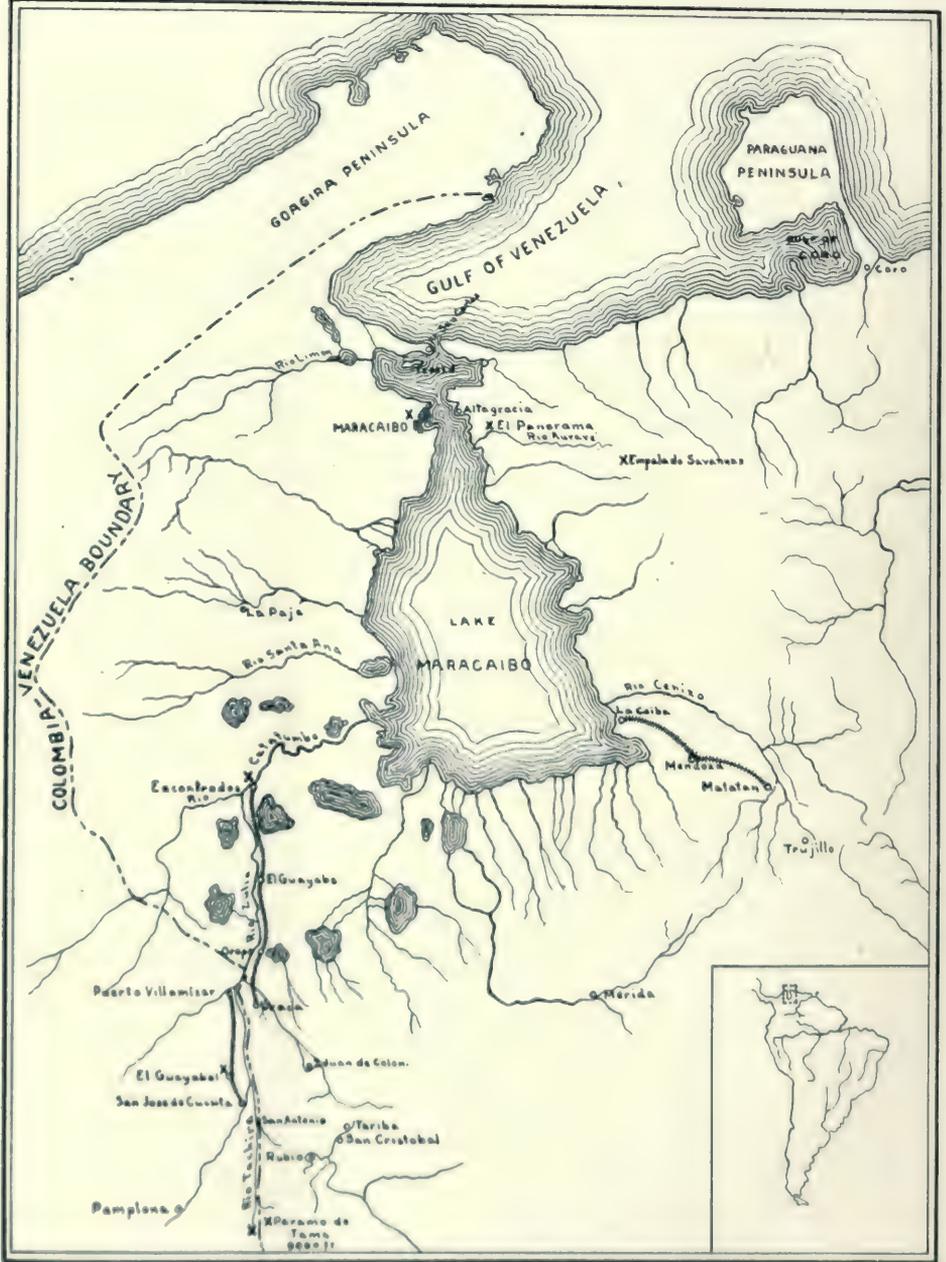
CHARLES B. CORY,

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CHICAGO, U. S. A.

January 10, 1912.



Map of Lake Maracaibo and adjacent region. Collecting stations marked x.

MAMMALS FROM WESTERN VENEZUELA AND EASTERN COLOMBIA.

BY WILFRED H. OSGOOD.

The subjoined report comprises the more obvious results derived from a study of the mammals recently collected in Venezuela and Colombia by the writer and Mr. Stanley G. Jewett, assistant. Owing to the relatively large amount of time necessarily spent in travel and preparation, actual field work was limited to about 40 days, but in that short time the rich fauna yielded 232 specimens of large and small mammals and 462 birds.

The birds have not yet been studied, but the percentage of novelty and value among the mammals is worthy of remark as indicating in slight degree the possibilities of South America as a field for zoological exploration. The mammals obtained include 10 species and subspecies new to science, some eight genera new to Field Museum, and three or four genera for the first time brought to an American institution. Practically all the species, known and unknown, were unrepresented in our collections, and a considerable number were not to be seen outside of Europe.

Of particular interest and value were the discovery of the habitat and the acquirement of complete specimens of the extraordinary marsupial, *Cænolestes*. This was previously known only from imperfect native-made skins with skulls or parts of skulls and is one of the extremely few mammals, perhaps the only one of superfamily rank, of which the general anatomy and osteology are unknown. Study of the relationships of this animal and their numerous important bearings demands more time than is at present available. It is therefore deferred for adequate treatment in a later paper.

Sailing from New York December 31, 1910, we reached Maracaibo, Venezuela, via Porto Rico and Curaçao, January 9, 1911. During the delay before proceeding inland, a short trip was made from this point to the opposite shore of Lake Maracaibo where we were guests of Sr. Alberto Tinedo Velasco at his *hato* or ranch called El Panorama. Later on January 28, we took a lake steamer and proceeded to the southern end of the lake and thence up the Catatumbo River to the small settle-

ment of Encontrados. Disembarking, we continued by rail the following day to Uraca, the terminus of the "Gran Ferrocarril del Tachira." Thence with mules we quickly passed into the highlands to San Juan de Colon, and after slight delay in securing fresh animals, went on from there westward to San Jose de Cucuta, Colombia. Further mule travel brought us to the upper slopes of the Paramo de Tama, south of Cucuta, where camp was established at about 7,000 ft. altitude, first on the Colombian side of the boundary and later a few miles away on the Venezuelan side.

On the return a month later, several days were spent at El Guayabal near Cucuta. Rail transportation was then available to Puerto Villamizar and canoes from there to Encontrados, where we found a steamer lying at the bank bound for Maracaibo. Proceeding directly there, Mr. Jewett, who had contracted a slight malarial fever, immediately took passage for the United States while I remained to make a brief trip to the savannas of Empalado, some thirty miles east of Maracaibo.

Our collecting stations were comparatively few: (1) El Panorama, Rio Aurare, Venezuela; (2) Paramo de Tama, Colombia and Venezuela; (3) El Guayabal, Colombia; and (4) Empalado Savannas, Venezuela. A few specimens from other places were obtained from natives in Maracaibo, and a small collection secured for the Museum by Mr. H. F. Raven at Encontrados also is recorded at this time. The localities of our own work may be described briefly as follows:

El Panorama, January 17-24. Situated nearly due east of Maracaibo and scarcely beyond the sound of its church bells some eight miles away, El Panorama, the *hato* of Sr. Tinedo, is nevertheless a place of apparent isolation. It is reached by means of a shallow winding slew or *canya*, the lower part of which traverses a heavy growth of overhanging mangroves and the upper a broad expanse of waving bulrushes. The house and surrounding shelters from which we worked are on high ground overlooking a sea of bulrushes and grassy swamp with patches of open water in the distance. To the southwest is a mangrove swamp extending to the shore of the big lake, while south and east is relatively high dry land covered with the open forest characteristic of arid tropical regions. Wild pineapples or *mayas* abound, small palms and various cacti are scattered about, and numerous small and mostly thorny shrubs are features of the vegetation. A half a mile from the house is a large *ciénega*, or spring-fed pond, and a few miles beyond are several smaller ones. The course of the Rio Aurare, which carries no water in the dry season, runs near by and is lost among

the mangroves bordering the lake. Cattle trails and bridle paths lead in all directions, and in general great freedom of movement is possible. Animal life is abundant and varied, including at least three associations of species, that of the mangroves, that of the rushes and open swamps, and that of the dry wooded upland.

Paramo de Tama, February 12–March 6. Paramo de Tama is the name applied to the more or less distinct mountain mass lying near the boundary between Venezuela and Colombia at the source of the Tachira River.* Our approach to it was along the course of this river and our final camps were near the headwaters, two days' hard travel from the hot valley in which Cucuta lies. Much of the lower slopes of the mountains is cultivated, or at least cleared and used for pasture. The country is rugged, however, and the mountains close in rapidly, sloping steeply to both sides of the river only a few miles south of the picturesque pueblo of San Antonio. Among the steep canyons well along the way is the settlement of Planadas, and some miles farther is Mundo Nuevo, a forlorn but quaint-looking little village perched on a shelving bit of mountain-side, from which steep declivities drop almost directly to the river.

Here we are in the *tierra fria* and although an occasional palm, a small cultivation of plantains, or a hedge of golden-fruited wild oranges still reminds that we are not in a northern region, there are many features distinctly incongruous with these. Waste places in the clearings support great patches of familiar looking wing ferns and thickets of veritable blackberries in full fruit, while about some of the houses are peach trees, and on the cultivated hillsides growing corn, potatoes, and beans.

Our headquarters were at the very last and uppermost hacienda, known as El Severia, where we were introduced by our good friend Sr. Don Mario Gonzales, the owner, and cordially received by Don Sebastian Valencia, the dueño, or manager. Considerable clearing surrounds the hacienda, and a few outlying *ranchos*, or thatched shelters for laborers, are encountered here and there, but in general the country above and beyond is in virgin condition. A great unbroken forest covers the slopes lying below the crescentic crest of the paramo, which is largely rugged, rocky, and bare, but with tongues of forest or straggling trees creeping over the summit at certain points.

The first camp was in the heart of this forest at an estimated altitude of 7,500 feet. A narrow rough trail having been cut for several

* The word *paramo*, strictly speaking, applies to the bleak plateau which usually characterizes the summit of such mountains, but in this case it often refers to the entire elevated region.

miles directly into the forest, a clearing was made for the camp, and short radiating trails cut in various directions, providing somewhat greater possibilities of movement than beating one's way through the undergrowth with a machete. The large forest trees, all of unfamiliar species, lace their tops together at an average height of something over 100 feet. Mists and drizzling rains prevail a great part of the year and mosses, air plants, and climbing vines thrive, but the growth in general is not so profuse as that of the hot tropics. A beautiful climbing bamboo is exceedingly abundant, and graceful tree ferns raise their spreading tops at pleasing intervals.

After two weeks in the forest we returned to the hacienda, and from there crossed the river and ascended the opposite slope on the Venezuelan side. Here we stopped at approximately the same altitude as at the former camp, but although heavy forest was readily accessible, clearings and partly burned areas predominated. An indistinct trail led upward to the cliffs of the summit of the paramo. A visit to these was very disappointing, for although scattered thickets and clumps of trees alternate with grassy openings and small ponds in somewhat Alpine character, little sign of animal life appears. The few birds seen were of species common at less elevation, and signs of small mammals were entirely lacking. In the swamps and woods about the camp, however, we obtained most of the species taken at the other camp and a few additional ones.

El Guayabal, March 12-17. The station of El Guayabal is a small one on the railroad connecting Cucuta and Puerto Villamizar. It serves only a very limited population engaged in farming and although only some ten miles north of Cucuta, it is in a region of slightly different character. This difference is not very pronounced and consists chiefly in the presence at El Guayabal of some features indicating a slightly more humid climate than that of Cucuta. That is, its character is somewhat intermediate between that of Cucuta, where it is dry, and that of Puerto Villamizar where it is relatively humid.

At Cucuta conditions are very arid, except near the river and in cultivated areas more or less under irrigation. Cacti and small thorny shrubs are the dominant types of vegetation. At Puerto Villamizar, on the other hand, there is heavy forest and luxuriant undergrowth. In passing by train between the two places one observes that the change from the arid type to the humid one is quite gradual. It has only begun at El Guayabal and in general the birds and mammals taken there belong to associations of species usually found in arid rather than humid regions. During the few days spent there, collecting was

done mostly along a wooded quebrada some three miles west of the railroad. This was probably quite dry earlier in the season but recent rains had left pools of water of considerable extent at frequent intervals along its course. The surrounding country consists of low rolling hills a few hundred feet in height and covered with forest of considerable density. The general elevation, however, is not great and the descent is very gradual to the Zulia River and the lowlands, through which it flows to Lake Maracaibo.

Empalado Savannas, April 6-14. In the vicinity of El Panorama and thence inland, there is practically continuous growth of moderate-sized trees, palms, cacti, and small shrubs, but some thirty miles to the east we suddenly emerge upon grassy openings varying in extent from two or three to several hundred acres. These, the so-called savannas of Empalado, are, strictly speaking, neither level nor treeless. Open natural pastures alternate with fairly extensive wooded areas, but narrow leads usually permit passage from one opening to another. The heaviest growth is naturally along the watercourses or quebradas, which are mostly dry during a great part of the year. Near our camping place, which was chosen with regard for them, were several cienegas and permanent pools of water. Abundant rains, however, soon robbed these spots of their distinction, and turbid floods covered the sandy bottoms formerly so conveniently used as highways by man and beast.* Many of the trees are of the same species found in the vicinity of El Panorama. The big feathery-leaved carocaro (*Pithecolobium*) is the most impressive of those growing near the quebradas, but is rivaled in size by the smooth yellow-barked copaiba which is found more commonly on higher, drier ground. Cacti are less common than at El Panorama but palms are more so. A large heavy bamboo is abundant, often covering extensive areas on low ground near the quebradas.

Passing acknowledgment has been made on other pages for some of the hospitable aid received during our work, but too much can scarcely be said. Mr. Ralph J. Totten, then American Consul at Maracaibo, assisted us in many ways, not only officially but also through a lively personal interest in natural history. Through him we met Sr. Don Alberto Tinedo Velasco, in whom we found a genial host at El Panorama as well as a hunter and naturalist with a keen interest in, and wide knowledge of, the animals of his country. Later, the trip to Paramo de Tama was made possible by Sr. Don Mario Gonzales of Cucuta, who invited us to his hacienda and even accompanied us on the rather

* It is perhaps worthy of note that we experienced one severe hailstorm, a phenomenon entirely novel to our native guides, some of whom were over fifty years of age.

arduous trip to it. The short visit to El Guayabal was arranged for us by Messrs. Köhler and Boué, German business men of Cucuta. To Mr. Boué we were indebted also for other courtesies. Sr. Don Jose Osorio, a prominent citizen of Maracaibo, went with us to the Empalado Savannas and performed various services for us in Maracaibo.

In identifying the collection of mammals, it has been necessary to borrow specimens from the U. S. National Museum, the American Museum of Natural History, and the Museum of Comparative Zoology. In addition, specimens were sent to the British Museum for comparison, since it is the unfortunate fact that all American institutions combined have not as yet sufficient material from South America to insure satisfactory identification of specimens requiring only a few weeks to gather. The cordial coöperation received from the officers of these institutions is most gratefully acknowledged. Special mention of courtesies received from particular individuals will be found elsewhere.

For the final preparation of the accompanying map, I am indebted to Mr. A. B. Walcott, Assistant in the Department of Zoology, Field Museum.

Cænolestes obscurus Thomas. Dusky Cænolestes.

Eleven specimens, Paramo de Tama, head of Tachira River, Colombia and Venezuela.

Being fortunate enough to find the home of these most interesting and little known animals, we made every effort to secure as many as possible, but after a month's work our series was still quite small. A limited amount of material for study of the osteology and gross anatomy was preserved and this it is hoped may form the basis of a subsequent paper to include also a discussion of habits and relationships.

One of our specimens was submitted to Mr. Thomas of the British Museum, who pronounces it specifically identical with *C. obscurus* from Bogota, agreeing in color and cranial characters and only showing such differences in proportions as are doubtless due to the unreliability of measurements taken from native-made skins. External measurements of 5 males average: Total length 240.6 (235-251); head and body 119.2 (113-135); tail vertebræ 121.4 (118-126); hind foot (c. u.) 23.5 (23-24.5). Of 5 females: 223 (209-230); 107.6 (106-113); 115.4 (103-121); 22.5 (22-23).

Didelphis marsupialis colombica Allen. Colombian Opossum.

One specimen, El Panorama, Rio Aurare, Jan. 21, 1911.

Owing to its very large size, this specimen, an old male, seems clearly referable to *D. m. colombica*, if that be a valid form. In fact, our specimen exceeds the average size of the Santa Marta series forming the original basis of the name *colombica* and almost equals *D. m. insularis* of Trinidad, the largest of the forms of *Didelphis marsupialis*. Flesh measurements are: Total length 865; tail vertebræ 435; hind foot 64. Skull: Greatest length 110.7; zygomatic breadth 63.5; post-orbital breadth 27.4; nasals 53.3 x 17.6; upper toothrow, including canine 42, without canine 34.4.

Local name *Rabo Pelado*.

Didelphis paraguayensis meridensis Allen. Merida Opossum.

One specimen, Paramo de Tama, Venezuela. Alt. 6,000-7,000 ft.

This was caught by Mr. Jewett in a trap set in a large cavity under the roots of a tree in the deep forest. It is in the light phase and the dark facial markings are evidently not so greatly reduced as in the type of this subspecies. Possibly it is nearer to *D. p. andina*.

Local name *Faro*.

Marmosa mitis pallidiventris subsp. nov. Pale-bellied Mouse Opossum.

Type from El Guayabal, 10 miles N. of Cucuta, Colombia. No. 18692 Field Museum of Natural History. Female adult. Collected March 14, 1911, by W. H. Osgood and S. G. Jewett.

Characters. Similar to *M. mitis* but slightly smaller and considerably paler, especially on the underparts. Chin, throat, chest, and middle of belly delicate pale whitish creamy instead of cream buff as in *mitis*; forefeet and carpal joint whitish without extension of darker from the forearm; upperparts, sides, and flanks a slightly paler shade of clay color than in *mitis*, the color of the sides gradually paling over the area of hairs with dark bases on either side of the midventral region; face markings practically as in *mitis*, the lower cheeks somewhat paler.

Skull slightly smaller than in *M. mitis*; rostrum more "pinched" in front of lateral expansions of nasals; otherwise similar.

Measurements. Type: Total length 284; head and body 129; tail vertebræ 155; hind foot (c. u.) 20. Skull of type: Greatest length 33.8; condylo-basal length 33.2; zygomatic breadth 18.9; nasals 15 x 4.5;

interorbital breadth 5.6; breadth of braincase 12.8; postpalatal length 12.2; three anterior molariform teeth 6.2.

Remarks. The area of hairs with dark bases seems to be quite as extensive in this form as in *M. mitis*. Therefore it seems scarcely possible that it is the same as *M. m. casta* in which this area is said to be greatly reduced.

The single specimen was brought to us by a boy who killed it with a stick as it ran from an overturned corn shock. Considerable trapping was done in the same field but none of this species was caught.

Myrmecophaga tridactyla artatus subsp. nov. Venezuelan Ant-bear.

Type (skull only) from Empalado Savannas, 30 miles east of Maraicao, Venezuela. Adult. Collected March 1911 by W. H. Osgood.

Characters. Differs from *M. tridactyla* and *M. t. centralis* in its much narrower nasals and less expanded maxillaries, making the entire rostral part of the skull decidedly narrower; anterior lateral extensions of frontals less produced than in *centralis* but more so than in *tridactyla*; greatest depth of maxillary much less than in *tridactyla*; antero-inferior production of parietal considerably exposed on ventral surface of skull as in *centralis*.

Measurements of skull. Greatest length 346 (344);* length of nasals (median) 148.7 (150), (diagonal) 177 (178); greatest width of nasals 16 (19.6); least width of nasals 10 (14.2); greatest width of rostrum 22.3 (28.2); least width of rostrum 19.8 (24.3); greatest depth of maxillary 20.3 (20); least interorbital width 42.2 (45); median length of frontals 144.2 (140); mastoid width 54.4 (55.7); lacrymal 38.5 x 17.5 (31 x 18).

Remarks. This form seems well distinguished from both *M. tridactyla* of Brazil and *M. t. centralis* of Central America, the characters of which have been so clearly pointed out by Lyon (Proc. U. S. Nat. Mus., XXXI, pp. 569-571, pl. XIV, 1906). It is somewhat nearer *centralis*, agreeing with that form in the character of the antero-inferior part of the parietal and in the relatively shallow maxillæ. In the relations of the anterior productions of the frontals it is somewhat intermediate. A specimen from Dibulla, Colombia, loaned by the Museum of Comparative Zoology, evidently is referable to the new form although less pronounced in its characters than the type; while one from Ciudad Bolivar, Venezuela, belonging to the American Museum of Natural History, is quite as definitely referable to the Brazilian form.

Material is not as yet available to determine what external charac-

* Measurements in parentheses are those of an adult skull of *centralis* (No. 15066) from Guatemala.

ters, if any, distinguish the three forms. Our specimen was obtained through Don Alberto Tinedo who killed the animal a few weeks before our visit to the Empalado Savannas. During the few days we spent in this locality we failed to see any large anteaters, although they are regarded as not uncommon.

Local name *Oso Palmero*.

Tamandua tetradactyla instabilis Allen. Tamandua Anteater.

Two specimens, El Panorama, Rio Aurare (1), Empalado Savannas (1).

These agree closely with topotypes in the small size which seems to be the principal character. The animal is only moderately common in the Maracaibo region and the two specimens secured were the only ones seen. One was shot from the top of a small tree where it was discovered and called to my attention by workmen cooking their supper after dark under the tree. The other was met in midday ambling across the end of a small savanna. It quickened its pace somewhat when it saw me and as I advanced it finally broke into an awkward lope toward the nearest tree, which it started to ascend.

Local name *Oso Hormiguero*.

Dasyus novemcinctus Linnæus. Nine-banded Armadillo.

Fourteen specimens (skulls), vicinity of Maracaibo, Venezuela.

The nine-banded armadillo, *cachicamo* of the natives, is exceedingly abundant in the sandy regions on both sides of the northern end of Lake Maracaibo. Its favorite abode and safe retreat is in the extensive areas grown to the wild pineapple or *maya* the sharp claws of which, curving both inward and outward, render progress much simpler for armorclads than for animals less protected. The armadillos, the large land turtles, and certain iguanas, therefore, are found associated in these areas which are shunned by other quadrupeds except where open leads or trails permit easy passage. In the Empalado Savannas, armadillos were found inhabiting more accessible places, burrowing under clumps of low bushes, or in crevices of rock ledges. Their flesh is eaten by all classes of people and the stripped carcasses may be seen hanging in the market almost daily.

Possibly the Venezuelan nine-banded armadillo is not subspecifically identical with the Brazilian one which was the basis of the name, but this can best be settled by examination of the type which is still existing (see Thomas, P.Z.S., p. 142, Mch. 1911).

Local name *Cachicamo*.

Sotalia sp. Beaked Dolphin.

Small schools of dolphins were repeatedly observed in Lake Maracaibo from the brackish waters at the northern end to the most southern part as well as just within the mouth of the Catatumbo River. In most instances, they seemed to move rather sluggishly, appearing and reappearing at the surface with considerable regularity but without the vigor and dash usually displayed by more northern species. Their color, too, is dull and in muddy water they are rather inconspicuous.

A standing order for specimens was placed with the Chinese and native fishermen of Maracaibo, but they did not succeed in capturing any until a few weeks after our departure when two full grown individuals were secured. Through the interest of U. S. Consul Totten and Sr. Domingo Betancourt Sucré of Maracaibo, the skins of these were shipped in salt to the Museum together with the "beaks" of their skulls, the braincases unfortunately having been chopped away by the fishermen. Owing to the lack of complete skulls and to the confused state of knowledge of the genus *Sotalia*, the true relationships of the Maracaibo dolphins cannot well be determined at present. It is probable, however, that complete skeletons will be obtained later. The teeth in our specimens are slightly more numerous than usual, the formulas being $\frac{34-35}{33-33}$ and $\frac{32-33}{31-32}$. Measurements taken from a roughly stuffed skin with the long bony beak *in situ* are as follows: Total length 1700 mm.; front of dorsal fin to end of snout 740; front base of pectoral to end of snout 400; basal length of dorsal 240; height of dorsal 120; anterior base to tip of pectoral 260; greatest width of pectoral 113; angle of mouth to end of snout 220; front of eye to angle of mouth 38; total breadth of flukes 425; girth behind pectorals 720.

Local name *Tornina*.

Odocoileus gymnotis Wiegmann. South American White-tailed Deer.

Six specimens. Empalado Savannas, 30 miles east of Maracaibo, April 8-14, 1911.

This deer ranges throughout most of the drier parts of the region surrounding Lake Maracaibo, but it is much more abundant in the savannas of Empalado than in any other locality that came under our notice. This is perhaps partly due to the greater number of hunters that pursue all kinds of game for food in the immediate vicinity of the lake. A few tracks were seen near El Panorama and thence eastward, but in the heart of the savannas they were excessively abundant. Here within a few days we obtained a good series of specimens and saw

a number of animals daily. The region affords excellent opportunity for still hunting, but since the deer are most active after dark and our object being specimens rather than sport, we adopted the method of the native hunter, that is, watching from a point of vantage in a tree.

Although there is an abundance of other food, the deer prefer the fruit of various trees which they glean from the ground and since the fruit falls little by little from day to day, the animals form the habit of going regularly from tree to tree in search of the tidbits. The trees being often widely separated, it is perfectly simple to track the deer to their favorite resorts and await their return. In April the trees in bearing and therefore most resorted to were a large beautiful *Pithecolobium* known as the *carocaro* and yielding a curled fleshy brown pod and an unidentified smaller tree with rough bark and glossy leaves known as the *moquillo*, bearing scanty clusters of green drupes somewhat resembling short plump olives. Our watch was usually from 5 to 9 P. M. or even until 10 P. M., at which hour the animals were still moving. The greatest activity, however, seemed to be between six and eight.

The specimens obtained should eventually throw considerable light on the relationships of the nominal species *O. gymnotis* and *O. savannarum*, but without material from the savannas of Guiana little can be done at present. The type of *O. gymnotis*, in the Berlin Museum, is said to have come from Colombia but its exact source is unknown. As the earliest name applied to a deer coming from northern South America, it is more than likely to be the proper one for our specimens even though they were obtained in the "savannas." Moreover, they lack metatarsal glands and have practically naked ears, characters supposed to distinguish *gymnotis* from *savannarum*. External field measurements of an eight point buck are: Total length 1570; tail vertebræ 185; hind foot 392; height at shoulder 930; front of shoulder to hip 810; pectoral girth 870; circumference of neck 435.

Mazama americana citus subsp. nov. Venezuelan Brocket.

Type from El Panorama, Rio Aurare, eastern shore of Lake Maracaibo, Venezuela. Adult male. No. 18776 Field Museum of Natural History. Collected Jan. 19, 1911, by W. H. Osgood and S. G. Jewett.

Characters. Similar to *M. americana* (*M. nemorivaga* of authors*), but slightly larger with especially large cheek teeth and minor cranial

* *Moschus americanus* Erxleben 1777 unquestionably applies to the same animal as *Cervus nemorivagus* Cuvier 1817 and there appears to be no reason for continuing the use of the later name. The dubious *americanus* found on an anterior page of Erxleben's work applies to the genus *Odocoileus* and therefore has no interest in this connection except among those not only making the strained attempt to give it nomenclatural status, but also failing to see generic distinction between *Mazama* and *Odocoileus*.

peculiarities; color paler and more grayish; cheek teeth 10 to 15 per cent larger than in *M. americana*; anterior half of parieto-squamosal suture abruptly deflected downward; basioccipital broad. General color of upper parts grizzled cinnamon gradually becoming paler on the sides where the punctulated effect is diminished and along the not very sharp demarcation between upper and under parts where the color becomes pale fawn or nearly ecru drab; top and sides of neck and sides of head and face brownish drab gray in considerable contrast to general body color; chin and upper throat buffy white becoming pale drab gray or ecru drab on lower throat and chest; belly buffy white, this continued about half way down the inner sides of the legs; front of forelegs deep brownish fawn merging into cinnamon and ochraceous buff on the sides and about the hoofs; hind legs below the hock pale drab all around, slightly darker in front; a white spot at tarsal gland; tail white below, pale cinnamon above, the hairs drabbish at bases; ears drabbish gray, the outside hairy at base and laterally but naked or nearly so in middle, inside and anterior edges with long white hairs; a prominent white spot on each side of the rhinarium and thence bordering the upper lips; a white spot also above each eye; ocular and post-narial areas rather indefinitely cinnamomeous in contrast to more grayish surrounding parts.

Measurements. Type and adult female, respectively: Total length 1,090, 1,060; tail vertebræ 105, 115; hind foot 278, 280; circumference of chest 600, 560; neck 240, 218; shoulder to hip 550, 570; height at shoulder 545, 587. Skulls of type, one adult female from Empalado Savannas, and one adult female *M. americana* from British Guiana,* respectively: Greatest length 189, 185, (183); zygomatic breadth 80.6, 81.8, (76.3); greatest length of nasals 50.6, 59, (51.5); tip of premaxillæ to front of pm^1 55.5, 56.1, (57.4); least breadth of basioccipital 16.6, 16.1, (14.5); greatest depth of squamosal (from top of meatus) 25, 25.5, (18.4); breadth of braincase 57.4, 55, (54.4); maxillary toothrow 61.5, 58.8, (51.5); breadth between outer sides of M^2 56.2, 56.3, (52.1); pm^1 9.5 x 6, 9.9 x 7.6, (7.6 x 6.8); M^2 12.7 x 12.4, 12.1 x 12.2, (10.2 x 10.8).

Remarks. Although there is considerable color difference, perhaps the principal character distinguishing this form from typical *americana* is the large size of the cheek teeth. To represent *americana*, one skin and two skulls from the vicinity of Georgetown, British Guiana have been available. Four specimens of the new form were taken by our party: The type, an adult male; a slightly younger female which was

* Measurements of *M. americana* in parentheses.

accompanying it when both were killed near El Panorama; a second female, fully adult, taken on the savannas of Empalado; and a spotted fawn which had been kept some days as a pet at El Panorama but obligingly died the night before our arrival there. Specimens from Bonda and Guairaca, Colombia, seem referable to the new form; likewise two adults from Dibulla, Colombia, loaned by the Museum of Comparative Zoology. All the skulls examined except very aged ones show traces of sockets of upper canines and it seems probable that these teeth are normally present in the young. In the skull of the spotted fawn above-mentioned, the canines are well-developed.

The tarsal gland in our three specimens is perfectly obvious in the dried skins, situated in a tuft of long hairs on the inner side of the hock, the central hairs which cover it being pure white except at the bases which are stained by sebaceous secretion. In the only Guiana specimen available, no traces of the gland are to be seen although it is possible they may have been destroyed in the preparation of the skin. Fitzinger and Lydekker, following him, state that this gland is not present in *M. nemorivaga*, but it is described and figured by Pocock (P. Z. S., p. 962, fig. 139, 1910) from a specimen which he believed "to have been correctly determined." Its source is unmentioned.

These little *matacanes* are quite abundant a short distance from the shore of Lake Maracaibo and thence eastward to the Empalado Savannas where they are much less numerous than the large deer (*Odocoileus*) to which the Spanish word *venado*, or deer, is exclusively applied. Like the larger deer, they feed upon the fallen fruits of various large trees, the "moquillo," the "carocaró" (*Pithecolobium*), and the so-called ebony being the particular ones in bearing at the time of our visits. Our specimens were killed with buckshot, two as they came to feed at the foot of a large ebony tree and the third as it jumped and galloped excitedly for cover when suddenly surprised feeding under the brow of a low ridge in the savannas.

Another brocket called *locho*, perhaps *M. rufa*, is described by the natives as larger and more reddish and of rather rare occurrence in the region.

Local name *Matacan*.

? *Mazama bricenii* Thomas. Merida Brocket.

Tracks and fresh signs of a small deer, possibly of this species, were seen in rather rare instances on the upper slopes of Paramo de Tama.

Tayassu torvum Bangs. Collared Peccary.

Two specimens, Maracaibo.

Peccaries are fairly common in the vicinity of Maracaibo, but although many tracks and at least one adult animal were seen, no specimens were obtained except two little ones only a few days old which were purchased alive in Maracaibo. These were led into my hotel room one morning trotting at the end of a string like a pair of puppies. I kept them alive for a few days in a corner of the room screened off by a woven wire bed spring. This was not altogether sufficient and had to be covered at the top, for much to my surprise, the little squealers were able to climb over. They would get in the angle, put their backs against the wall and their little hoofs in the meshes of wire and quickly scramble to the top and leap three and a half feet to the floor. At other times they did not seriously object to being handled, but when stopped in these attempts to escape, they snapped viciously with their tiny needle-pointed tusks. I gave them a plate of milk, but although I rubbed their noses in it and otherwise forced it upon them, it was some time before they understood it, although squealing with hunger all the while. Finally the larger more active one managed to suck up a little but the other seemed content to stand in the plate or to slide around in the milk spilled on the floor, constantly getting tangled up in his own umbilicus which dragged after him. Later they learned to eat rolled oats and water and sopped around in it with contented little grunts, which were much more agreeable than the plaintive squealing with which they had introduced themselves.

The color of these young peccaries, which were eventually made into specimens, is bright rufescent tawny thinly mixed with black, except a line from the occiput to the rump which is intense, sharply defined black.

The use of the name *torvum* for these specimens is necessarily provisional, since they are much too young for satisfactory identification.

Local name *Báquiro*.

Tapirus terrestris Linnæus. Tapir.

One specimen (skull), Empalado Savannas.

Contrary to our expectations, tapirs were found in relatively arid lowlands in regions of rather thin forest and little plant life of a succulent character. Tracks were seen in the sandy bottom of a dry quebrada a few miles west of El Guayabal near Cucuta, Colombia, and numerous others in a somewhat similar place in the Empalado Savannas east of

Maracaibo. At the latter place a fine adult female had been killed recently by Don Alberto Tinedo and we were able to obtain its skull. My only sight of one of the living animals was a brief glimpse at about 9 o'clock at night while on the watch in a hammock strung between bamboos at the edge of a dry quebrada. My attention was attracted by its heavy tread and the sharp crack of breaking sticks, and after a few moments of straining my eyes in the dim moonlight I saw the animal clearly outlined for a moment as it passed between two trees. It was moving deliberately and scarcely twenty yards away, but its position was such that I was unable to shoot.

Local name *Danta*.

Sciurus versicolor Thomas. Varicolored Squirrel.

Five specimens, El Guayabal, 10 miles north of San Jose de Cucuta, Colombia, March 12-17, 1911.

Reference of squirrels from this region to *S. versicolor* is necessarily provisional. They differ from typical *versicolor* in somewhat increased black on the end of the tail and perhaps, therefore, should be regarded as intergrades between *versicolor* and *zuliae*.

The great variability of the squirrels of this group often has been remarked, and, while this is undeniably justified to a certain degree, it seems probable that with exact knowledge of physiographic and climatic conditions and good series of accurately labeled specimens, it will be found that this variation is not so much fortuitous or individual as it is local and environmental.

Squirrels were fairly common in the rather open forest along the quebradas a few miles west of El Guayabal. During our visit they were marauding the crops of our host, Señor Niño, and several were shot in the act of carrying away big yellow ears of corn.

Sciurus versicolor zuliae Osgood. Zulia Squirrel.

Five specimens, El Panorama, Rio Aurare (2), Shore of Lake Maracaibo opposite Maracaibo (1), Empalado Savannas (1), Encontrados (1 H. F. Raven.)

Squirrels are sparingly distributed in the dry open woods on the northeast side of Lake Maracaibo, extending eastward at least to the wooded quebradas of the Empalado Savannas. At El Panorama, during eight days constantly in the field, I saw but one, and on the savannas for the same time, also one. On the immediate shore of Lake Maracaibo likewise they are scarce. The single specimen ob-

tained there was shot from a coco palm and its stomach was well filled with coconut.

At Orope, the type locality of *S. v. zulia*, the climate is so much more humid and the vegetation so much more luxuriant than at the northern end of Lake Maracaibo, that considerable difference in the animal life should obtain. However, it does not seem advisable at present to attempt the separation of the squirrels of these regions. Those from the more arid region have somewhat lighter heads, more intensely ferruginous feet, and broader, more abundantly haired tails.

Sciurus griseogena tamae subsp. nov. Tama Squirrel.

Type from Paramo de Tama, Colombia. Alt. 6,000–7,000 ft. No. 18736 Field Museum of Natural History. Male adult. Collected Feb. 14, 1911, by W. H. Osgood and S. G. Jewett.

Characters. Similar to *Sciurus g. meridensis*, but paler colored throughout; general color of upperparts only slightly darker than in *S. quebradensis*, but more rufescent on shoulders; tail and other parts quite different. Upper parts mixed clay color and blackish; shoulders heavily suffused with ochraceous continuous with the same but slightly heightened color on the outer sides of the forelegs; postauricular spot cream buff bordered with ochraceous buff. Underparts bright tawny ochraceous and white, the latter variable in extent, generally extending medially from the throat to the groin, widening on the chest and extending to the forelegs; fore and hind feet tawny ochraceous, on the metapodials more or less mixed with dusky; upper side of tail about as in *S. g. meridensis*, base (2 inches) grizzled, middle (4 inches) clear ochraceous buff, tip (1½ in.) black; under side of tail correspondingly colored but middle part strongly mixed with blackish.

Skull practically as in *griseogena* and *meridensis*; rostrum apparently a trifle more attenuate.

Measurements. Average of four topotypes: Total length 396 (385–416); head and body 216 (209–223); tail vertebræ 180 (176–193); hind foot (c. u.) 54 (53–55). Skull of type: Greatest length 53; basilar length 39.3; zygomatic breadth 30.5; nasals 16.7; interorbital breadth 17; diastema 13; maxillary toothrow 8.6.

Remarks. This form is most closely allied to *Sciurus g. meridensis* but is well distinguished by its general lighter color and the extensive white markings on the under parts. These white markings are variable, but three of the four specimens taken have them highly developed.

The extensive dense forests on the upper slopes of the Paramo de Tama no doubt harbor considerable numbers of these squirrels, but in

any particular locality they are scarce and difficult to obtain. They frequent the tops of trees most of the time none being seen on or near the ground. Their extreme shyness was remarkable, and unless they were suddenly surprised, it was impossible to get within gunshot of them.

Local name *Ardita*, variant of the Spanish *ardilla*.

Epimys alexandrinus (Geoffroy). Roof Rat.

One specimen, El Panorama, Rio Aurare.

Rats are perhaps more abundant in the seaport of Maracaibo than in the small interior villages but they are quite generally distributed, even extending to isolated houses near regular routes of travel.

Oryzomys meridensis Thomas. Merida *Oryzomys*.

Nineteen specimens, Paramo de Tama, Feb. 12-Mch. 6.

The habitat of these large long-tailed mice is in the cool depths of the heavy forest which prevails on the high mountain slopes. Here they live under logs and roots and about the mass of vegetable refuse covering the ground. Most of our specimens were caught in special size mouse traps but these are not quite strong enough for them and a fair percentage escaped.

The series shows considerable uniformity in color and agrees with a single typical specimen of *meridensis* but exhibits a few slight differences from a series representing *O. m. maculiventer*. The light markings of the under parts are less extensive than in *maculiventer* and more nearly pure white. The light inguinal area is much reduced and in some specimens is practically nonexistent. It seems possible, therefore, that *maculiventer* may be recognizable as a slight subspecies of *meridensis* and it remains to be seen whether or not both are subspecies of *albigularis*.

Average measurements of 10 adults are: Total length 303.3 (282-326); tail vertebrae 161.7 (145-175); hind foot (c. u.) 33.4 (32-35).

Oryzomys griseolus sp. nov. Grayish Pigmy *Oryzomys*.

Type from Paramo de Tama, head of Tachira River, Venezuela. Alt. 6,000-7,000 ft. No. 18635 Field Museum of Natural History. Male adult. Collected March 1, 1911, by W. H. Osgood and S. G. Jewett.

Characters. Most similar to *Oryzomys vegetus* Bangs but slightly smaller and much duller in color; upper parts with an abundant mixture

of black-tipped hairs producing a somewhat grizzled effect most pronounced on the forehead and sides of face where fulvous is minimized and gray predominates. Ground color of upper parts pale clay color much duller than the ochraceous or ochraceous buff of the related forms *vegetus*, *tenuipes*, *humilior*, and *navus*; a small preauricular tuft of ochraceous-tipped hairs usually present. Under parts mostly between clay color and ochraceous buff almost or quite concealing the slaty bases of the hairs; middle of chin and throat white or whitish to bases of hairs; feet white; outer sides of tarsal joints broadly dusky; tail dusky above, dull whitish below. Mammæ 3-3 = 6.

Skull similar to that of *O. vegetus*; braincase deeper and more inflated; rostrum slightly more slender; zygomatic plate well developed, projecting forward farther than in related forms; palatine slits long, extending posteriorly to slightly beyond plane of front of first cheek tooth.

Measurements. Average of 7 specimens: Total length 183 (173-199); head and body 81 (76-85); tail vertebræ 102 (96-114); hind foot (c. u.) 21.7 (20-23). Skull of type: Greatest length 23; basilar length 17.1; postpalatal length 7.4; palatine slits 4.1; zygomatic breadth 12.3; interorbital constriction 3.6; width of zygomatic plate 2; diastema 5.7; maxillary tooththrow 3.2.

Remarks. This species belongs to the group of small slenderly formed mice to which the subgeneric name *Oligoryzomys* has been applied. Although geographically nearer to *O. dryas humilior*, it shows greater resemblance to *O. vegetus* of Panama, especially in the extent of white on the throat and in the forwardly projecting zygomatic plate. *O. navus* of northern Colombia is brighter colored and has white under parts. *O. tenuipes* of Merida, which also belongs to this group, is paler throughout, the head and ears, especially, being more ochraceous. These appear to be the only described forms with which *griseolus* requires close comparison and its grayish head is sufficient to distinguish it from any of them.

Our series of thirteen specimens was obtained in and about small grassy swamps in clearings on the upper slopes of Paramo de Tama on the Venezuelan side of the Tachira River. Here they were not common and a line of 50 carefully placed traps seldom yielded more than two specimens in one night.

Thomasomys hylophilus sp. nov. Forest Vesper Rat.

Type from Paramo de Tama, head of Rio Tachira, Santander, Colombia. No. 18583 Field Museum of Natural History. Adult male. Collected Feb. 18, 1911, by W. H. Osgood and S. G. Jewett.

Characters. Somewhat similar to *T. laniger* and *T. monochromos*, but larger with relatively small ears and a very long white-tipped tail. Pelage very long, soft, and lusterless; upper parts tawny olive rather heavily mixed with blackish, occasionally with a heavy concentration of blackish on middle of back; ears thinly haired or nearly naked distally, a tuft of soft black or blackish hairs at their anterior bases and extending backward over the anterior third of the ear conch; sides and face wood brown to tawny olive; a narrow and indistinct blackish eye ring; under parts cinnamon overlying slate color; fore feet silvery gray; forearm blackish; hind feet whitish drab, tarsal joints blackish brown, digits white; tail blackish above and below except a well-marked white tip.

Skull with ample braincase, the parietals slightly bulging; rostrum rather narrow and slightly depressed; front border of zygomatic plate somewhat receding; supraorbital border rounded anteriorly, very slightly angled posteriorly; palatine slits nearly or quite reaching plane of first molars; mesopterygoid fossa extending anteriorly to plane of middle of last molar; upper incisors with relatively little recurvature.

Measurements. Type: Total length 273; head and body 126; tail vertebræ 147; hind foot 26.5. Average of 10 adult topotypes: 261 (240-275); 120 (108-126); 141.6 (132-152); 25.8 (25-27).

Skull of type: Greatest length 30.5; basilar length 24.5; zygomatic breadth 16.3; interorbital constriction 4.7; length of nasals 10.8; width of nasals 1.3-3.7; postpalatal length 11.3; diastema 8.3; palatine slits 6.1 x 2.5; maxillary toothrow 5.1.

Remarks. Although well characterized otherwise, this species is to be recognized most readily by its long white-tipped tail. The amount of apical white varies from a mere pencil to nearly two inches and is totally absent in only one of a series of twenty-nine specimens. These were found associated with *Oryzomys meridensis* in the depths of the forests on the upper slopes of the paramo living among the innumerable galleries naturally formed under moss-covered roots, logs, and debris.

Rhipidomys fulviventor Thomas. Buff-bellied Vesper Rat.

Two specimens, Paramo de Tama, Venezuela.

The under parts of these specimens are quite sharply distinguished from the upper parts and although there is slightly more buffy suffusion across the middle of the belly than elsewhere, the general color from the chin to the vent is creamy white rather than fulvous. Still it cannot be called pure white and it may be within the variation of this species which is described as "fulvous or even buff, the line of demarcation

scarcely marked." Mr. Thomas has kindly compared one of our specimens with the type without finding differences that would warrant separation.

Microxus bogotensis Thomas. Bogota Microxus.

Eighteen specimens, Paramo de Tama, head of Tachira River, Colombia and Venezuela.

These mice were taken in small numbers in the depths of the forest on the Colombia side of the Tachira but were much more common in open grassy swamps on the slopes of the Venezuela side of the river. In fresh specimens, the pointed noses and rather small ears combined with the dense dark-colored fur, give them quite a soricine appearance. Their identification as *M. bogotensis* has been substantiated by the submission of specimens to Mr. Thomas of the British Museum. Average external measurements of ten adults are: Total length 150 (145-156); head and body 85.4 (82-91); tail vertebræ 63.4 (61-67); hind foot (c. u.) 19.1 (18-20).

Zygodontomys thomasi Allen. Thomas Zygodontomys.

Seven specimens, El Panorama, Rio Aurare (5) and Empalado Savannas (2).

Although trapping was done in various other places, specimens of this species were taken only on the low ground near the dry bed of the Rio Aurare among loose sticks, logs, and drift. The majority of them are practically indistinguishable from typical *thomasi*. Two individuals, although apparently mature, are decidedly smaller than the others, but it is difficult to believe this to be of specific significance.

Although formerly associated with *Oryzomys*, the species of this genus seem to have much in common with *Akodon*, but their true position in the involved series of Neotropical rodents is doubtless yet to be ascertained.

Zygodontomys thomasi sanctæmartæ Allen. Santa Marta Zygodontomys.

Two specimens, El Guayabal, 10 miles N. of San Jose de Cucuta, Colombia.

These mice, caught at the edge of a cornfield after much fruitless trapping, were practically the only small mammals secured at this locality. The single adult male agrees in color with lighter examples of *sanctæmartæ* from the type locality, but its skull is very large and

heavy. It may represent a separable form, but for the present it seems best to regard it as an exceptionally large and aged male of *sanctamartæ*. The relation of this form to *Z. thomasi* is evidently very close, *sanctamartæ* being characterized only by slightly larger size and somewhat more elongated skull. For the privilege of examining topotypes of both forms, I am indebted to Dr. J. A. Allen of the American Museum of Natural History.

Chilomys fumeus sp. nov. Smoky Chilomys.

Type from Paramo de Tama, head of Tachira River, Santander, Colombia. Alt. 6,000–7,000 ft. No. 18690 Field Museum of Natural History. Male adult. Collected Feb. 18, 1911, by W. H. Osgood and S. G. Jewett.

Characters. Similar to *Chilomys instans* as described, but end of tail, digits of front feet, and distal phalanges of digits of hind feet white; size slightly smaller. Skull differing in slight details of measurement but in general similar to that of *C. instans*. Color of upper and under parts practically uniform, the hairs dark slate color except for a narrow tipping of silvery hair brown or broccoli brown; face between nose and eyes blackish; feet brownish; toes, at least the distal phalanges, white; tail brownish above and below except the terminal inch which is white with a few irregular underlying blotches of brownish; a bright buff pectoral spot (in one specimen) continuous with a white line from throat to middle of belly.

Measurements. Type and topotype, respectively: Total length 211, 206; head and body 90, 86; tail vertebrae 121, 120; hind foot (c. u.) 22, 23. Skulls of same: Greatest length 23.8, 23.4; basilar length 19.1, 18.9; postpalatal length 8.8, 8.4; zygomatic breadth 13.2, 12.8; braincase 12.8 x 11.1, 12.5 x 11.4; interorbital constriction 4.6, 4.8; width of zygomatic plate 2.1, 2; diastema 6.7, 6.5; maxillary toothrow 3.1, 3.15.

Remarks. Only two specimens of this peculiar mouse were obtained during some twenty days' trapping in the forests about the head of the Tachira. It inhabits the same dark damp depths of the forest as *Thomasomy shylophilus*, and from its peculiar plumbeous color, white-tipped tail, and slender form was at first believed to represent the immature of that species.

Material is not at hand for satisfactory discussion of the generic characters of *Chilomys* from a comparative standpoint, but several peculiarities not mentioned heretofore may be noted. The pollex is extremely rudimentary, and the soles of the hind feet lack imbrications, the subdigital pads being relatively large and the interspaces smooth and

without scales; the upper side of the hind feet, however, is unusually scaly and the scales being dark colored with lighter margins and but slightly overlaid by hairs, they are quite obvious. The skull is peculiar in shape and the dorsal view reminds rather forcibly of immature skulls of *Evotomys*. Aside from the forwardly projecting incisors, there are certain slight dental peculiarities not easily described, but it may be mentioned that the second upper molar is as wide as long and its outer side is markedly external to the outer sides of M_1^1 and M_3^3 . Another unusual feature is a pair of swollen ridges lying on either side of the palatine foramina and in front of M_1^1 . So far as I am aware, with the exception of the type in the British Museum, no other specimens of this interesting genus have been recorded.

Sigmomys alstoni Thomas. False Cotton Rat.

Seven specimens, El Panorama, Rio Aurare (4), Empalado Savannas (3).

These were taken about the roots of cacti and small thorny shrubs and among crumbling exposed rocks in decidedly dry situations but always closely adjacent to grassy openings. They are evidently diurnal as practically all were caught in the day time. The exact type locality of this species is unknown but specimens from Cumana are regarded as typical by Thomas.* Whether our specimens differ from these cannot be determined except by comparison.

Heteromys anomalus brachialis subsp. nov. White-armed Spiny Pocket Mouse.

Type from El Panorama, Rio Aurare, eastern shore of Lake Maracaibo, Venezuela. No. 18623 Field Museum of Natural History. Adult female. Collected Jan. 19, 1911, by W. H. Osgood and S. G. Jewett.

Characters. Similar to *Heteromys anomalus jesupi* but upper parts paler and front legs nearly all white; dark marking on outer side of arms reduced to a few scattered grayish hairs widely separated from the main body color by pure white. Ground color of upper parts drab somewhat brightened in middorsal region by wood brown and cinnamon; rump grayish drab or hair brown continuing along outer side of hind legs to calcaneum; feet white; tail grayish drab above, white below; ears narrowly edged with whitish.

Skull practically as in *H. anomalus* and *H. a. jesupi*.

Measurements. Type: Total length 284; head and body 134;

* Ann. & Mag. Nat. Hist. (7), VIII, p. 150, footnote, 1901.

tail vertebræ 150; hind foot (c. u.) 34. Skull of type: Greatest length 35.2; basilar length 25.5; zygomatic breadth 16.1; interorbital breadth 7.3; length of nasals 14.2; width of nasals 2.5-4.6; width of braincase 14.8; maxillary toothrow, crowns 4.8, alveoli 5.6.

Remarks. With a small series of each of the forms of the *anomalus* series before me, it is obvious that the one here described is sufficiently characterized for recognition, although it may be found to have a limited range. Specimens from San Julian, Venezuela, in the collection of the U. S. National Museum, supposed to represent "*melanoleucus*," seem to be tending slightly toward *brachialis* but are much nearer typical *anomalus*. Since the original description of *melanoleucus* states "legs and feet black" there can be little doubt that the type is of the dark form of eastern Venezuela and Trinidad. The majority of the specimens of *H. a. jesupi* seem to be almost or quite as dark as *anomalus*, differing mainly in the white inner sides of the arms.

Our specimens, six in number, were obtained under *mayas* and thorny shrubs which form hedgelike borders to the trails leading in various directions from El Panorama.

***Dasyprocta rubrata flavescens* Thomas.** Yellow-rumped Agouti.

One specimen, El Panorama, Rio Aurare, Jan. 23.

This example, an adult male, was shot as it crossed a trail one evening just before dark. A few tracks of others were seen in various places, but with the one exception, the animals themselves succeeded in evading observation.

No material is available for comparison, but judging from descriptions our specimen differs but little from typical *flavescens*, possibly being slightly larger and darker.

Local name *Picure*.

***Dasyprocta variegata colombiana* Bangs.** Colombian Agouti.

A skull of a young *Dasyprocta*, apparently of this species, was obtained in Maracaibo from a market hunter who said it came from the Limon River some 20 miles west of Maracaibo.

***Agouti sierrae* Thomas.** Mountain Paca.

Said to be fairly common in certain heavily wooded parts of the mountains. We did not find it on Paramo de Tama although it is well known to the natives there.

Local names *Lapa* and *Tinaja*.

Hydrochærus hydrochæris (Linnæus). Capybara.

Six specimens, El Panorama, Rio Aurare.

A series of shallow ponds near the Tinedo *hato* were the resort of several families of capybaras and during our stay from one to a dozen individuals were almost always to be found there. The ponds were surrounded by mangroves and heavy thickets of a tall clustering fern under which the animals retreated when alarmed. Once within the intricate depths of this cover they were almost as safely concealed as the rails and gallinules which frequently accompanied them. Although they fled precipitately upon sighting a man, they could hardly be called shy since they fed daily within a fourth of a mile of the *hato* where people were constantly coming and going. Moreover, they paid not the slightest attention to cattle and domestic hogs which wallowed in the same ponds with them. So far as could be observed their food at this time consisted principally of a fine slimy algæ forming a thick mat on the bottom of the ponds. They seemed to be quite diurnal and were most often seen feeding in glaring midday standing belly deep or with only their heads and hips above water, alternately rooting in the bottom and raising their heads to chew contentedly and look about. As they stand in the water, they have a decidedly saddle-backed appearance and the general shape of the body is that of a common guinea pig on a large scale.

The specimens secured range from quite young to fully adult. Measurements of an adult male are: Total length 1,000 mm.; circumference of chest 730; of belly at middle 900; of neck 445; hip to shoulder 650; height at shoulder (to end of toe) 500; hind foot 215.

Local name *Piropiro*.

Proechimys ochraceus sp. nov. Ochraceous Spiny Rat.

Type from El Panorama, Rio Aurare, Zulia, Venezuela. No. 18687 Field Museum of Natural History. Male adult (last molar very slightly worn). Collected Jan. 17, 1911, by W. H. Osgood and S. G. Jewett.

Characters. Size small; tail short; color pale. Somewhat similar to *P. canicollis* but coloration of the head, neck, and legs not grayish but uniform with back and sides. Similar to *P. guairæ* but smaller and paler, therefore much the palest of the known members of the *cayennensis* group. Spines rather weak, confined to back, about 19 mm. long by .6 mm. wide. Color of upper parts chiefly tawny ochraceous lightly lined with blackish, the rump, sides of body, and outer sides of hind legs somewhat paler, more buffy; under parts pure white; hind

feet white except a slight extension of buffy and grayish on the tarsal joint; inner sides of forefeet white, outer sides including the fourth and fifth toes pale grayish; tail hair brown above, white below.

Skull short, broad, and but slightly ridged; parietals smoothly rounded laterally; palatine foramina broad; palate with a median ridge, but no lateral channels; pterygoid processes broad; teeth relatively large and heavy; audital bullæ actually and relatively larger than in *P. guaira*.

Measurements. Type and one topotype, respectively: Total length 346, 341; head and body 196, 209; tail vertebrae 150, 132; hind foot (c. u.) 45, 44. Skulls of same: Greatest length 49.1, 49; basilar length 34.9, 35; zygomatic breadth 24.7; 24.3; length of nasals 18.1, 17.6; interorbital breadth 11.2, 11.3; interparietal 12 x 6.4, 12.5 x 7.1; diastema 9.9, 10; postpalatal length 19.2, 19.2; palatal foramina 6.2 x 2.8, 5.7 x 3.1; width of pterygoid process 1.9,—; crowns of upper toothrow 9.2, 8.8

Remarks. The bright ochraceous or almost ochraceous buff color of this species combined with its small size distinguish it from the other forms of northern South America. Its closest relationship is perhaps with *P. guaira* but it is readily distinguished by its paler color, nearly pure white hind feet, and its small size. *P. cherriei* of the upper Orinoco evidently approaches it in size but is much darker in color. Practically all the other described forms are much larger.

Our specimens were trapped about the roots of the wild pineapple, locally known as *maya* and very abundant in the arid parts of the northeast shore of Lake Maracaibo.

Sylvilagus nigronuchalis continentis subsp. nov. Black-naped Rabbit.

Type from vicinity of Maracaibo, Venezuela. No. 18695 Field Museum of Natural History. Collected Jan. 13, 1911, by W. H. Osgood and S. G. Jewett.

Characters. Very similar to *S. nigronuchalis* of the islands of Aruba and Curaçao but slightly more rufescent in color especially on the forehead and nose; ears more broadly tipped with black. Skull practically as in *nigronuchalis*. Upper parts mixed with pale buffy or clay color and black; interorbital region slightly more buffy or rufescent than back; nape deep black extending in made skins about to the ends of the laid back ears; ears ("proectote") buffy brown except a grayish area near the inner base and a broad intensely black tip; a broad buffy ring surrounding the eye except the anterior lower half; rump grayish; under-

parts except throat white, somewhat more narrowly so than in *nigro-nuchalis*.

Measurements. Average of five adults: Total length 403 (390-415); tail vertebræ 39.6 (35-43); hind foot 78 (75-80); ear from notch (dry) 52 (50-54). Skull of type: Greatest length 72.4; basilar length 67.5; zygomatic breadth 33.7; width of mesopterygoid fossa 5.4; nasals (diagonally) 30.7; interorbital breadth 17.8; diastema 21; palatine foramina 19.8 x 5.8; maxillary toothrow, crowns 11.7, alveoli 14.3.

Remarks. This black-naped rabbit is excessively abundant in the vicinity of Maracaibo and in the similarly arid region on the east side of the lake, extending in this direction at least to the Empalado Savannas where it is rather rare. It is sold daily in the market of Maracaibo and it was there our specimens were obtained. The Venezuelans hunt it at night with a torch made from a tightly wrapped bundle of dry sticks, one man carrying the torch and another the gun, usually a single-barreled muzzle-loader of the cheapest possible construction. At other times small ground fires are kindled at intervals throughout several acres and the hunter goes stealthily from one to the other shooting such rabbits as have been attracted by the lights. The rabbits seem to be exclusively nocturnal, not stirring even in the short twilight of morning and evening. At daybreak or nightfall I repeatedly traversed localities much frequented by them but had no glimpse of one.

The abundance of these rabbits at this locality combined with the fact that specimens have not before reached a museum probably indicates that their range is limited. They are quite distinct from the rufous-naped species of the *gabbi* and *brasiliensis* series which occur east and west in Colombia and eastern Venezuela respectively. From the insular form, however, they are distinguished only by slight average characters.

? *Sylvilagus meridensis* Thomas. Merida Rabbit.

Some small rabbit is of rare occurrence on the upper slopes of Paramo de Tama, but we were unable to obtain it. It is known to the natives and we corroborated their reports by finding a few much-weathered pellets of dung.

Tremarctos ornatus majori Thomas. Northern Spectacled Bear.

The spectacled bear inhabits the heavy forests of the Paramo de Tama but is very seldom seen and at least in the particular localities we visited is decidedly rare. We found no tracks and only one frag-

ment of dung was observed during our four weeks on the paramo. The dried foot and claws of a bear killed several years previously was exhibited to us at the hacienda "El Severia" just below our camps. Natives say the bears live almost exclusively in the forest and it is only on the very rare occasions when they wander out into the cultivated clearings that they have been killed. One of their favorite foods is said to be obtained from some part of a small hardy palm which grows sparingly at considerable altitudes.

Potos flavus meridensis Thomas. Merida Kinkajou.

A captive kinkajou was seen in Cucuta, and although the species was not noted elsewhere, it is probably generally distributed.

Local name *Cuchi-cuchi*.

Canis thous savannarum Thomas. Savanna Fox.

Two specimens, Empalado Savannas, 30 miles east of Maracaibo, Venezuela, April 8, 1911.

Foxes or "zorros" are common from the shore of Lake Maracaibo eastward. Our specimens agree very closely with the description of the subspecies *savannarum* from the savannas of Guiana. They were killed with small shot from a lookout in a tree at about nine o'clock in the evening. As seen from above in rather dim moonlight against a background of sandy soil and tufts of dry grass, only their black dorsal streaks were visible. These appeared to glide sinuously over the ground in a most uncanny manner and as I fired I could not imagine what they would prove to be.

Field measurements are, for male and female respectively: Total length 870, 890; head and body 616, 597; tail vertebræ 254, 293; hind foot 125, 130.

Felis onca Linnæus. Jaguar.

One specimen, Maracaibo (purchased).

Jaguars are quite common throughout the region surrounding Lake Maracaibo. They are held in considerable fear by most of the native hunters and though frequently killed by them it generally occurs when all the circumstances favor the hunter. This is most often when *el tigre* unexpectedly appears while the hunter is perched in a tree watching for deer and a heavy charge of buckshot at short range is generally effective. We noted considerable evidence of the destruction of cattle by jaguars, especially in the region between Lake Maracaibo and the

Empalado Savannas. Of their natural prey, the capybara is perhaps the favorite and they doubtless do not hesitate to pursue it into the water. A partly eaten carcass of one of the big rodents was found near our camp in the Empalado Savannas but the jaguar that had been frightened from it failed to return.

Jaguars seem not only to have less distaste for water than most cats but even enter it and swim freely. In some of the mangrove swamps near Maracaibo their trails are frequently found leading to the edge of rather wide channels of water and out on the other side. According to report, two were killed in Lake Maracaibo not long ago while swimming from the mainland to Toas Island, a distance of more than two miles.

Felis pardalis subsp. Ocelot.

Evidently not very common. Several poorly prepared skins offered for sale in Maracaibo were purchased for a few cents each. The enterprising venders, in the expectation of a higher price, insisted that these were the skins of young jaguars but after being convinced that we could not be fooled in this way, acknowledged their deception.

An occasional track of an ocelot was seen near El Panorama and once I was so fortunate as to see one of the animals. This was in the full heat of midday and rather unexpected. It was surprised at a little pool of water among some large mangroves and bounded across in front of me scarcely 30 yards away, presenting a very attractive sight.

Tracks of some small cat about the size of an ocelot were seen at high altitudes on Paramo de Tama.

Local name *Tigrillo*.

Felis concolor Linnæus. Cougar.

According to report, cougars are not uncommon in certain districts near Maracaibo. They are seldom seen, however, and to successfully hunt them good dogs are necessary. One hunter living on the shore of the lake and almost directly opposite Maracaibo is reputed to have killed from twenty to thirty during the last fifteen years. Several hides in poor condition were seen in Maracaibo.

Local name *Leon* or *Leon bayo*.

Lutra sp. Otter.

One hears but little of otters although it is probable they are generally distributed. A dressed hide was seen in Colon.

Tayra barbara Linnæus. Tayra.

One specimen, Empalado Savannas, April 8.

This is an adult male shot and presented by U. S. Consul Totten who encountered it roving about in midday. External field measurements are: Total length 1035; head and body 625; tail vertebræ 410; hind foot 118.

Local names *Guache* and *Guanaico*.

Mustela affinis Gray. Allied Weasel.

Two specimens (♂ and ♀), Paramo de Tama, head of Tachira River, Venezuela and Colombia.

One of these was caught in a steel trap baited with birds and set by the side of a rushing mountain stream, the conditions being essentially those under which so many weasels are caught in more northern countries. The other was shot in midday as it came prowling about our "house" in the clearing on the Venezuelan side of the Tachira.

No doubt these specimens are fairly typical of *M. affinis*, the type of which is stated to have come from "Columbia." They differ from a specimen from Sierra de Merida only in somewhat richer color of the under parts, the male being bright orange rufous on the abdomen and paler on the chest, throat, and inguinal region. The white marking in front of the ear is absent in the female which is in very fine coat, the entire upper parts except the head and tip of tail being rich seal brown so dark that the blackish head and tail-tip are not in great contrast. The general appearance of the upper parts, therefore, is extremely suggestive of a miniature of a North American mink.

Conepatus mapurito Gmelin. Hog-nosed Skunk.

One specimen, El Panorama, Rio Aurare, Jan. 19.

Although taken in the dry coast lowlands, this specimen must for the present be referred to *C. mapurito*, the type locality of which is Pamplona, Colombia, in the cool highlands not far from Paramo de Tama. It is greatly to be regretted that our efforts to secure skunks in that vicinity were unsuccessful. The Rio Aurare example is thinly haired and has two short white dorsal stripes, apparently being quite similar in markings to the Bogota specimen to which Thomas has referred.* External field measurements are: Total length 600; head and body 387; tail vertebræ 213; hind foot 74.

Local name *Mapurite*.

* Ann. & Mag. Nat. Hist., (7), II, p. 318, 1898.

Blarina meridensis Thomas. Merida Short-tailed Shrew.

Sixteen specimens, Paramo de Tama, head of Tachira River, Venezuela and Colombia.

The locality from which this series comes lies between Bogota and Merida, type localities respectively of the two known South American species of *Blarina*. The difference between the two forms is mainly of size and our specimens agree in that respect with *meridensis*. A specimen submitted to Mr. Oldfield Thomas is pronounced by him to be typical of that species.

Shrews can scarcely be called abundant in this locality since a line of over 100 traps seldom yielded more than one or two in a single night. Their habits apparently are similar to those of their northern relatives and like them they readily take oatmeal bait in traps set in moist places in the heavy woods or along trickling streams. Average flesh measurements of ten adults are: Total length 123.7 (120-129); tail vertebrae 36.3 (35-38); hind foot (c. u.) 15.4 (15-16).

Molossus crassicaudatus Geoffroy. Lesser Dusky Molossus.

Eleven specimens, Maracaibo, March 23-29.

Two of these were caught fluttering about a lighted room at night and the others were taken from the hollow pillars surrounding the patio of the American consulate. The species is excessively abundant in the city of Maracaibo in which every suitable building harbors it in numbers. In walking the streets towards evening, or frequently during the day, one hears the wheezing cries of many bats from concealed cavities under eaves and cornices.

Dr. G. M. Allen, who has recently elucidated the status of this species, has kindly made critical examination of specimens from our series. Measurements of forearms of 10 alcoholic specimens average 39.3 (38-40.5) mm.

Noctilio albiventer minor Osgood. Lesser Noctilio.

Noctilio minor Osgood, Field Mus. Pub. No. 149, Zool. Ser. X, p. 30, Oct. 20, 1910.

Two specimens (skins), El Panorama, Rio Aurare, Jan. 18.

A slight difference in size between these two specimens, both of which are males, and the fact that both are slightly larger than the type of *N. minor*, which is a female, makes it more than likely that *N. minor* is only subspecifically separable from *N. albiventer*. The color also is variable, the upper parts in one being bright cinnamon

rufous to chestnut without trace of middorsal streak and in the other dull clay color with an indistinct light median streak.

***Diæmus youngi* (Jentink).** Blood-sucking Bat.

One specimen (skin), El Panorama, Rio Aurare, Jan. 21.

This rare bat, one of the few known specimens, was disabled by a blow from a light club in the hands of our cook-boy who discovered it hovering near his fire one evening after complete darkness had set in. The color of the under parts in our specimen is much as in many examples of *Desmodus rotundus*, the hairs cinnamon brown or lighter at the bases and ecru drab at the tips. The upper parts are rather dark cinnamon brown more glossy and uniform than in *Desmodus*;* between the shoulders is a thinly haired patch in which the light bases of the hairs are evident. The white wing markings are very pronounced, as follows: Antebrachial membrane sharply and narrowly white-bordered; membrane between second and third fingers largely white, this extending to the covering of the bones of the second finger; wing tips white to middle of membrane between third and fourth fingers; lower edge of wing white-bordered throughout. The skull differs from that of *Desmodus* in several characters which have not been pointed out. The braincase is much broader and more expanded laterally; the zygomata are heavier and more angular anteriorly; the audital bullæ are nearly twice as large; and the palate is shorter, broader, and less excavated.

A specimen of *D. youngi* from Parana, Brazil, loaned by the U. S. National Museum, is markedly paler than ours, being uniform rather glossy clay color; but considering the great color variation in bats and since no dry specimens from Guiana are available, separation at this time does not seem warranted.

***Artibeus jamaicensis palmarum* Allen and Chapman.** Palm Artibeus.

One specimen (skin), Encontrados, Sept. 25, 1910; collected by H. F. Raven.

Andersen, in his careful monograph of *Artibeus*,† has recognized a subspecies under the name *palmarum*, on the basis of a very slight average reduction in the size of the teeth. Therefore, it seems best at

* In selecting specimens of *Desmodus* for comparison, I find a noticeable difference in size between examples of typical *D. rotundus* from Paraguay and specimens from Mexico and Central America. In typical *rotundus*, the forearm measures 60-64 mm., while in Mexican and Guatemalan specimens the maximum is 55. A corresponding difference is shown by the skulls. It would seem advisable, therefore, to recognize a northern subspecies, using Wagner's name *murinus* (Suppl. Schreb. Säugeth., I, p. 377, 1840) which would stand as *Desmodus rotundus murinus* Wagner.

† Proc. Zool. Soc. Lond., pp. 205-319, 1908.

present, with no great accession of new material, to use this name. But after noting the faint-hearted and apologetic way in which the monographer has given it place,* and after the comparison of our Venezuelan specimen with a single Brazilian one and finding the teeth of the latter actually the smaller, one is strongly tempted to discard *palmarum* in favor of *lituratus*.

Uroderma bilobatum Peters. Common Uroderma.

Two specimens (skins), Encontrados, Sept. 25, 1910; collected by H. F. Raven.

Vampyrus spectrum (Linnæus). False Vampire.

One specimen (skin), Encontrados, Sept. 30, 1910; collected by H. F. Raven.

Saccopteryx leptura (Schreber). Striped Sac-winged Bat.

Three specimens (skins), El Panorama, Rio Aurare, Jan. 18-21, 1911.

Two were obtained from their diurnal resting place in a decayed crevice in the side of a tree and the third was shot while flying back and forth over a trail bordered on either side by tall trees. Others, apparently of the same species, were seen.

The palest specimen agrees well with the description of *S. canescens* except for the slight development of the light superciliary stripe. The head and under parts are pale Isabella color, the back more brownish, and the marginal hairiness on the membranes slightly rusty. The darkest one is chiefly Vandyke brown, becoming seal brown between the light stripes. The third is intermediate between the other two, thus forcing the conclusion that color is of relatively little importance.

Rhogeësa io Thomas. South American Rhogeësa.

One specimen (skin), El Panorama, Rio Aurare, Jan. 24; two specimens (in alcohol), 10 miles north of Cucuta, March 16; seven specimens, Empalado Savannas, April.

The color of the body and head of the dry specimen evidently is even brighter than that of the type as described by Thomas. Both upper and under parts are bright clay color (Ridgw., Pl. V, No. 8), the head and shoulders being somewhat lighter than the back and rump

* In one place (p. 278), he says,—"I should not have tried to keep this form separate from *A. lituratus*, if the name *palmarum* had not been available," thus confessing a prostitution of zoology to nomenclature which scarcely seems justifiable.

and the bases of the hairs everywhere being lighter than the tips. A specimen of *R. tumida* from Mexico is very decidedly darker throughout. The skull is slightly smaller and especially narrower than in *R. tumida*, but the braincase is by no means lower and flatter as is said to be the case in the type. Measurements of forearms indicate some variation in size, the smallest scarcely exceeding *R. minutilla*. They are as follows: 27.2, 26.8, 25.8. Probably this and other forms will eventually be regarded as subspecies of *R. tumida*.

One specimen was caught in a net as it was issuing from its roosting place among the dead rushes forming the thatched roof of an outbuilding; two others were "switched" as they rapidly flitted about our heads under the covered portico of a dwelling house; and the remainder were obtained in similar manner about the camp in the savannas.

Myotis nigricans concinnus (H. Allen). Northern Blackish Bat.

One specimen (skin), El Panorama, Rio Aurare, January 22.

The small size, narrow skull, and dull color of this specimen amply distinguish it from typical *nigricans* of Brazil. It agrees closely with certain specimens from southern Mexico in the collection of the U. S. Biological Survey probably representing *M. n. concinnus*, a name which has been called to my attention by Mr. Gerrit S. Miller, Jr.* *M. nesopolus* of the island of Curaçao also is closely related.

Myotis albescens (Geoffroy). Pale-bellied Bat.

One specimen (skin), El Panorama, Rio Aurare, January 22.

Comparison of this bat with typical examples of *albescens* from Paraguay reveals a few slight differences; but until the status of several names is determined, especially *Vespertilio arsinœ* Temminck of Surinam, and until more material is secured, it seems best to allow our single specimen to rest under the "blanket name" *Myotis albescens*.

Alouatta senicula Linnæus. Red Howler.

The red howlers are abundant in the Maracaibo region. They are heard daily in the mangrove thickets on the east side of Lake Maracaibo and several were seen in the *canya* leading from El Panorama to the lake. One very large male was encountered there at very short range, suddenly coming into view through an opening as we pushed our little flat-bottomed *cayuca* up the oozy channel. He appeared too startled

* Cf. Proc. Biol. Soc. Wash., XIII, p. 154. June 13, 1900.

to move immediately but stood facing us from the top of a mangrove, his rich color glowing in the full glare of the sun. In ascending the Catatumbo River to Encontrados by steamer, we saw some forty or fifty howlers from the deck of the boat. They were in parties of five or six nearly always including several half grown young.

Local name *Araguato*.

Cebus apella leucocephalus Gray. Brown-faced Capuchin.

A small troop of monkeys apparently of this species was seen clambering through the tops of some thinly foliated trees near El Panorama, Rio Aurare. Several captive animals were seen at various times in Maracaibo.



Interior of forest on Paramo de Tama at 7,000 ft. altitude.



Vegetation of arid region near Lake Maracaibo.

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DESCRIPTIONS OF NEW FISHES
FROM PANAMA

BY

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AND

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CHICAGO, U. S. A.

February 10, 1912.

DESCRIPTIONS OF NEW FISHES FROM PANAMA.

BY S. E. MEEK AND S. F. HILDEBRAND.

The following preliminary descriptions are of new fishes obtained by the authors during their first season's work on the Biological Survey of the Canal Zone, the ichthyological work of which is being conducted coöperatively by the Field Museum of Natural History and the Smithsonian Institution.

***Astyanax grandis* sp. nov.**

Type No. 7571, F. M. N. H.; length 260 mm.; Rio Juan Diaz, Panama.

Head $4\frac{1}{8}$; depth $2\frac{1}{2}$; D. 9; A. 24; scales 38.

Body compressed; mouth moderate, the maxillary reaching past front of orbit, its length $2\frac{1}{2}$ in head; eye 3; snout 4; suborbital 3; no teeth on maxillary; base of anal $3\frac{1}{2}$ in body; longest dorsal ray $3\frac{3}{8}$; pectorals equal length of head; origin of dorsal nearer tip of snout than base of caudal.

Color olivaceous, silvery; an indistinct silvery band; one or two black humeral spots; no caudal spot; fins all plain.

Taken only in Pacific Coast streams.

***Hemigrammus minutus* sp. nov.**

Type No. 7572, F. M. N. H.; length 75 mm.; Rio Agua Clara, C. Z., Panama.

Head $3\frac{3}{8}$; depth $2\frac{3}{8}$; D. 10; A. 22; scales 36.

Body compressed, dorsal and ventral outlines about evenly convex; mouth small, the maxillary reaching to near middle of the eye, its length $2\frac{1}{3}$ in head; eye $2\frac{1}{2}$ in head; snout $3\frac{1}{2}$; suborbital 4 in head; dorsal fin pointed, its first rays $3\frac{1}{3}$ in body; base of anal $3\frac{1}{4}$.

Color olivaceous, silvery; a faint silvery lateral band; one or two faint humeral spots; no caudal spot; fins all plain.

Taken in a few streams in Canal Zone on the Atlantic side of the Isthmus.

Deuterodon atracaudata sp. nov.

Type No. 7573, F. M. N. H.; length 114 mm.; Rio Frijoles, C. Z., Panama.

Head 4; depth 3; D. 8; A. 27; scales 36.

Body rather elongate, much compressed, ventral region rounded; mouth small, the lower jaw scarcely included; maxillary reaching slightly past anterior margin of orbit, $2\frac{1}{3}$ in head; eye small, $2\frac{1}{8}$ in head; snout $3\frac{1}{4}$ in head; dorsal over anterior part of anal, its origin nearer base of caudal than head; base of anal $3\frac{1}{4}$ in body.

Color olivaceous, silvery, a faint silvery band; a humeral spot; black caudal spot extending on outer rays of caudal fin; other fins plain.

Creagrutus notropoides sp. nov.

Type No. 7574, F. M. N. H.; length 143 mm.; Rio Indio, Panama.

Head 4; depth 4; D. 9; A. 14; scales 35.

Body robust, little compressed, in general form and appearance much like *Notropus blennioides*; snout blunt; mouth small, the lower jaw included; eye rather large, $2\frac{1}{2}$ in head; snout $3\frac{3}{4}$; dorsal fin over ventrals, its origin nearer tip of snout than base of caudal; pectorals $4\frac{2}{3}$ in body, their tips reaching base of ventrals; tips of ventrals reaching anal; lateral line not quite complete.

Color olivaceous, sides with a narrow silvery band; a black humeral spot; no caudal spot; fins all plain.

Taken in swift water in the upper Chagres and tributaries.

Eleotris latifasciatus sp. nov.

Type No. 7575, F. M. N. H.; length 160 mm.; Rio Cardenas, Panama.

Head $3\frac{2}{3}$; depth $3\frac{1}{8}$; D. V, 9; A. 10; scales 37.

Body robust, not much compressed; profile evenly convex; top of head flat; interorbital 3 in head; mouth small, maxillary scarcely reaching past anterior margin of orbit; teeth in bands, none canine-like; eye $3\frac{1}{2}$ in head; snout $4\frac{1}{2}$; cheeks and opercles scaly; dorsal spines flexible, longest about $\frac{1}{3}$ length of head; ventrals separate, their tips nearly to origin of anal; pectorals broad, of 13 rays, about 4 scales between dorsals; caudal rounded, its length equals length of head.

Color dark olivaceous, sides with a black lateral band; its width about equals diameter of eye; a light band of nearly same width above this; base of caudal rays with an oblong black blotch; fins nearly plain.

A few specimens taken in fresh water streams on the Pacific slope of the Isthmus near Panama City.

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NEW SPECIES OF FISHES
FROM COSTA RICA

BY

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CHICAGO, U. S. A.

September, 1912.

NEW SPECIES OF FISHES FROM COSTA RICA.

BY SETH EUGENE MEEK.

During the month of April last I collected fishes in some of the rivers of Costa Rica. The following paper gives an account of those species which appear to be undescribed.

In making this collection of fishes I wish to acknowledge the aid received from agents of the United Fruit Company, and from Dr. Alfaro and Prof. Tristan of San Jose.

A complete account of the collection will be published in the near future.¹

***Astyanax robustus* sp. nov.**

Type No. 7582, F. M. N. H.; length 132 mm.; Virginia, Costa Rica.

Head 4.1 to 4.4; depth 2.8 to 3.0; D. 1, 9; A. 2, 27; scales $7\frac{1}{2}$, 37, $6\frac{1}{2}$.

Body robust, moderately compressed, the caudal peduncle especially deep; profile slightly convex; top of head convex; fontanelle large, extending from anterior margin of the orbit to nape; margin of upper lip slightly below the level of middle of the eye; lower jaw slightly the longer, the lip thick; maxillary to anterior third of orbit, its length 2.3 to 2.4 in head; diameter of eye 3.0 to 3.5; snout 4.2 to 4.6; cheek 2.6 to 2.8; maxillary teeth 4-4, the cusps 3 to 5; premaxillary teeth in 2 series, the outer 4-4, each of 3 to 5 cusps; inner series 5-5, similar to the outer but slightly larger; lower jaw with teeth in one series, the anterior teeth large 4-4, with 3 to 5 cusps, the lateral teeth 6-6 smaller and subcontinuous, the anterior ones usually with 3 cusps, the posterior ones of one cusp; gill rakers 7+9; a few near each end with their tips branched; dorsal fin behind ventrals, its origin nearer tip of snout than base of caudal by about a distance of diameter of eye; base of anal 3.0 to 3.2 in body; pectoral of 12 rays, its length 5.1 to 5.5; ventral 7.4 to 8.2, its rays 8; caudal peduncle 1.6 to 1.8 in head; lateral line complete; vertebrae 11+22=33.

Color dark brown, little silvery, fins in life with red or yellowish red, the body more or less tinged with the same color; all of the fins dusky.

¹ Issued September 18, 1912.

Description from specimens 120 to 140 mm. in length, Virginia River. Eggs small, one female contained about 7,000 eggs.

Cheirodon eigenmanni sp. nov.

Type No. 7583, F. M. N. H.; length 67 mm.; La Junta, Costa Rica.

Head 4.2 to 4.4; depth 2.5 to 2.6; D. 1.9; anal 2, 29 to 31; scales 46 to 48; 17 or 18 between dorsal and ventrals.

Body elongate, much compressed; profile evenly convex; top of head convex; fontanelle large; margin of upper lip slightly above level of middle of eye; mouth rather large; jaws subequal; maxillary to first third of eye, its length 2.3 to 2.4 in head; diameter of eye 2.6 to 2.9; snout 3.5 to 3.7; entire edge of maxillary toothed, 2-2 anterior ones denticulate, the remaining 6-6 canine; premaxillary teeth 5-5, denticulate, in one series; teeth of lower jaw denticulate, in one series of 6-6, these followed by 2-2 canine teeth; gill rakers 6+8; dorsal fin high its longest rays about 2.8 in body; base of anal 2.5 to 2.7; pectorals 4.3 to 4.7; ventrals 4.3 to 4.5, their tips reaching past origin of anal; caudal peduncle 2.1 to 2.2 in head, lateral line present on about 10 scales.

Color silvery, a black spot about half as large as eye mostly above and near termination of lateral line; lateral band very narrow anteriorly, becoming darker and broader and ending in an elongated black caudal spot which extends to end of middle caudal rays.

Named for Dr. C. H. Eigenmann, who has done more than any one else to increase our knowledge of the Characins, the most interesting family of fishes in the fresh waters of the Americas.

Gambusia umbratilis sp. nov.

Type No. 7584, F. M. N. H.; length 51 mm.; Guapilis, Costa Rica.

Head 4.1 to 4.5; depth 3.6 to 3.7; D. 1.7; A. 2.6; scales 7-28.

Body elongate, profile slightly convex, mouth small, the lower jaw the longer; outer series of teeth the larger; snout short, 4.2 to 4.7 in head; eye 2.5 to 2.8; gill rakers 15; pectoral 1.2 to 1.3; origin of dorsal slightly in advance of anal, midway between base of caudal and eye. Anterior anal rays the longest, 1 2 to 1.3 in head; caudal peduncle 1.4 to 1.6 in head.

This description from females 40 to 58 mm., two males 46 mm. have head 4.0; depth 3.7; eye 2.4 in head, snout 3.8; caudal peduncle 1.4; modified anal reaching slightly more than half way to base of caudal, .73 in head.

Color dark olivaceous, 6 to 10 dark bars on posterior part of the body much narrower than the interspaces; dorsal fin with a broad black bar near base and a second one at tip.

Gambusia turrubarensis sp. nov.

Type No. 7576, F. M. N. H.; length 61 mm.; Turrubares, Costa Rica.

Head 4.0 to 4.3; depth 3.3 to 3.6; D. 1, 6 or 7; A. 2, 6 or 7; scales 7-28.

Body elongate, profile convex; mouth small, with small lateral cleft; outer series of teeth the larger; eye 2.9 to 3.1 in head; snout 4.2 to 4.4; pectoral about as long as head; anal fin rounded, its longest rays 1.2 to 1.3 in head; origin of dorsal over last rays of anal, its distance to base of caudal 2 or nearly so, in its distance to tip of snout; gill rakers 21; caudal peduncle 1.3 to 1.4 in head (in females 55 to 76 mm.) one male (36 mm.) has head 3.9; depth 3.5; eye 2.6; snout 5; modified anal nearly reaching caudal, 2.4 in body, or nearly twice the length of the head.

Color (both sexes) olivaceous, sides with about 8 or 9 narrow dark bars on anterior three fourths of the body, fins all plain dusky.

Gambusia parismina sp. nov.

Type No. 7578, F. M. N. H.; length 52 mm.; Parismina, Costa Rica.

Head 3.5 to 3.8; depth 4.2 to 4.5; D. 1, 6 or 7; A. 2, 7; scales 8-28.

Body elongate, moderately compressed; top of head flat; mouth small, its gape extending $\frac{2}{3}$ distance to eye; lower jaw slightly the longer; upper jaw protractile; teeth fixed, in bands, the outer the larger; eye 2.6 to 2.7 in head; snout 3.6 to 3.8; gill rakers 12; pectoral 1.2 in head, of 12 rays, slightly below axis of the body; anal long, its first rays longest, their tips beyond tips of last ray when the fin is deflexed, its longest ray 1.3 in head; dorsal small, its margin rounded, its origin behind last anal ray, its distance from caudal 2.3 in its distance from tip of snout; the fin being wholly on posterior third of the body; caudal peduncle 2 in head.

Color dark olivaceous, dorsal with 2 faint dark cross bars, a large black spot with light margin at base of caudal; base of anal with a large black spot.

This species has the general aspect of *Rivulus*. One female contained 13 eggs, some with eye spots and a few with well-formed young. The species is viviparous, but our collection contains no males.

Poecilia pittieri sp. nov.

Type No. 7580, F. M. N. H.; length 68 mm.; La Junta, Costa Rica.

Head 4.1 to 4.4; depth 2.6 to 2.8; D. 1, 8; A. 2, 6 or 7; scales 8-28.

Body robust, compressed; mouth small, the teeth in narrow bands, the outer series the larger; lower jaw weak; mouth small; eye 2.5 to 2.8 in head; snout 3.4 to 3.8; pectoral 1.0 to 1.1; dorsal fin in advance of

anal, its origin midway between base of caudal and eye; origin of anal under about fourth anal ray, its free edge rounded, longest rays 1.1 to 1.2 in head; caudal peduncle deep, 1.1 to 1.2 in head.

Color dark olivaceous, the center of each scale lighter, a black blotch (♀) about twice as large as eye above origin of anal; color of male similar except posterior half of body with 7 dark cross bars (37 mm.) becoming faint in larger specimens.

Described from several females 43 to 65 mm. The males much resemble in general form the females. Specimens 45 to 53 mm. show following measurements: Head 3.9 to 4.0; depth 2.5; eye 2.7 in head; snout 4.2; pectoral 1.0, caudal peduncle 1.0; modified anal long and slender, its tip reaching base of caudal, its length .56 in head.

Alfaro gen. nov.

This genus belongs to the subfamily Tomeurinae* in having the lower row of scales on each side with their inner surfaces together forming a knife-like edge behind the anal fin; the dorsal fin is wholly on the posterior third of the body; the 2 first rays of the anal are elongate and modified, but less so than in other viviparous genera in this family, which have the elongate anal.

I dedicate this genus to Dr. A. Alfaro, Director of the National Museum of Costa Rica and the best known scientist of the Republic.

Alfaro acutiventralis sp. nov.

Type No. 7579, F. M. N. H.; length 75 mm.; Guapilis, Costa Rica.

Head 4.2 to 4.3; depth 3.4 to 3.7; D. 1, 6 or 7; A. 1, 8 or 9; scales 32 to 34.

Body elongate, much compressed, profile from dorsal to nape straight, a slight angle at nape; top of head flat, covered with scales; mouth rather large, its gape half way to eye; teeth fixed in both jaws, in bands, those of the upper jaw subequal, the outer series of lower jaw enlarged; lower jaw the longer; premaxillary very protractile; maxillary small, its tip reaching below anterior margin of the orbit; eye 2.7 to 3.1 in head; snout 2.7 to 2.8; dorsal fin posterior, its distance from base of caudal about 2.3 in its distance from tip of snout; pectoral broad, of 13 rays, situated on axis of body, its length 1.2 to 1.3 in head; anterior rays of anal fin long, falcate, longest .9 to 1.0 in head; ventrals short, its rays 6; gill rakers 17 or 18; lateral line on row of scales above pectoral for 7 or 8 scales, then on the row below to base of caudal; many of the scales on the posterior half of the body with a small pore, peritoneum dusky, alimentary canal short; vertebrae 20 + 15 = 35.

* Eigenmann, Mem. Car. Mus., vol. v, 460, 1912.

Color olivaceous, no spots or bars; vertical fins slightly dusky. One female 90 mm. in length contained 142 eggs. None of the eggs showed eye spots.

This description is based on several specimens 50 to 90 mm. in length. Several males 46 to 62 mm. show head 3.8 to 3.9; depth 3.1 to 3.6; eye 2.8 to 3.1 in head; snout 2.9 to 3.2; pectoral 1.3 to 1.4; modified anal 1.0 to 1.1. The anal fin is forward and contains rays 1, 6; the two anterior branched rays form the modified portion of the fin. The dorsal fin of the males is not enlarged as is usually the case in the viviparous species of this family.

It inhabits rocky streams.

***Cichlasoma tuba* sp. nov.**

Type No. 7581, F. M. N. H.; length 222 mm.; Victoria, Costa Rica.

Head 3.3 to 3.6; depth 2.5 to 2.9; D. XVI, 13 or 14; A. IV, 9; scales 33.

Body elongate, compressed, the anterior profile convex; mouth small the margin of the upper lip on level with upper third of base of pectoral; upper jaw the longer; teeth with blunt tips, more conspicuous in larger specimens; lips thick, in some specimens developed as fleshy lobes, fold of lower lip free; maxillary not reaching eye, its length 3.0 to 3.5 in head; eye 4.2 to 4.8; snout 2.2 to 2.5; preorbital 3.8 to 4.0; postorbital 2.4 to 2.6; gill rakers short and blunt, 3+9; origin of dorsal fin slightly behind pectorals, its spinous portion low, the fourth or fifth spine 3.0 to 3.9 in head; anal base 4.6 to 5.1 in body, its spines 4, very exceptionally 3 or 5; second spine 2.7 to 3.1 in head; pectorals short 4.1 to 4.6 in body; ventrals 4.2 to 5.0; caudal peduncle 1.9 to 2.1; 4 scales between the lateral line and the middle of the dorsal; caudal fin lunate, the dorsal and anal rays not produced, their tips scarcely to base of caudal.

Color dark olivaceous, sides with 6 to 8 vertical bars, the first one near tip of pectoral, soft dorsal and caudal with faint spots. Taken in clear running water.

***Cichlasoma spilotum* sp. nov.**

Type No. 7586, F. M. N. H.; length 148 mm.; Victoria, Costa Rica.

Head 3.3 to 3.5; depth 2.3 to 2.6; D. XIX or XX, 9 or 10; A. VIII or IX, 7; scales 33 to 35.

Body elongate, compressed, profile steep, snout blunt; mouth small, subinferior, the margin of the upper lip on level with upper third of base of pectoral; fold of lower lip broadly interrupted in the middle; maxillary not reaching vertical from anterior margin of the eye, its

length 3.3 to 3.5 in head; diameter of eye 3.4 to 3.9; snout 2.2 to 2.4; preorbital 3.2 to 3.7, postorbital 2.5 to 2.7; pectoral 1.1 to 1.2; ventral .7 to .9; base of anal .9 to 1.0. Caudal peduncle 2.2 to 2.4; spinous dorsal rather high, the 6th spine 1.9 to 2.2 in head; the last dorsal spine 1.5 to 1.6; last anal spine 1.5 to 1.7; gill rakers short, 9, dorsal, anal and ventrals with their rays produced; caudal fin emarginate; soft dorsal with scales on interradiial membranes.

Color olivaceous, sides with 6 or 7 indistinct cross bars. A longitudinal dark lateral band about as wide as eye, a large black spot on side and a smaller one at base of caudal; vertical fins usually with many black spots.

This species resembles *C. balteatum* but differs in having a shorter head and smaller eye, and longer dorsal and anal spines.

Neetroplus fluviatilis sp. nov.

Type No. 7585, F. M. N. H.; length 116 mm.; Costa Rica River near Guapilis, Costa Rica.

Head 3.3; depth 2.6; D. XVII or XVIII, 9; A. VI, 6; scales 34.

Body elongate, compressed, profile very convex; mouth small, sub-inferior, the lower jaw the shorter, teeth compressed; preorbital very deep, equaling the postorbital, 2.6 in head; eye 3.9; snout 2.2; inter-orbital very convex; scales on breast, nape, and along each side of dorsal fin, very small; pectoral fins 1.4 in head; ventrals slightly longer than head; dorsal fin low, the last spine 2.2 in head, the 6th spine 3.1, last anal spine 2.2; base of anal 1.2 in head; caudal peduncle 2.2 in head, gill rakers very blunt, 3+6; caudal fin rounded.

Color dark olivaceous, 6 or 7 faint dark bars on the sides. Known from the type and one other specimen (105 mm.) from Costa Rica River near Guapilis.

Gobiesox costaricensis sp. nov.

Type No. 7577, F. M. N. H.; length 62 mm.; Zent, Costa Rica.

Head 2.7; depth 5.6; D. 6; A. 4.

Body broad, depressed anteriorly, teeth incisor, their edges entire; dorsal and anal fins small, the latter under posterior half of the former. Head broader than long, width of mouth about $\frac{1}{2}$ width of head.

Color olivaceous, with 4 or 5 darker bars on back extending on sides. Caudal barred, a black spot at base of anterior rays of dorsal.

The following are measurements (mm.) of the specimens obtained:

	Zent.	Zent.	Turrubares	Turrubares
Total length	62	50	43	42
Length of body	50.4	41	35	35.2
Length of head	19	14.7	12	11.5
Depth	9	6.5	6	6.1
Width of head	19.4	15.7	12.7	12.5
Width of mouth	12.3	8	6.7	6.4
Interorbital width	5.6	3.7	3.8	3.8
Diameter of ventral disc	18.5	15.4	13.4	13.4

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NEW SPECIES OF FISHES FROM PANAMA

BY

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CHICAGO, U. S. A.

March, 1913.

NEW SPECIES OF FISHES FROM PANAMA.*

BY SETH E. MEEK AND SAMUEL F. HILDEBRAND.

The fishes described in the following pages were collected by the authors in the fresh waters of Panama, while engaged in field work on the Biological Survey of the Canal Zone; the ichthyological work of which is being conducted coöperatively by the Smithsonian Institution, the Field Museum of Natural History and the Bureau of Fisheries. A complete account of all the fishes collected during the past two years on this survey is in the course of preparation.

Family SILURIDÆ.

***Felichthys amblops* sp. nov.**

Type No. 7576, F. M. N. H.; length 111 mm.; Rio Tuyra, Marriganti, Panama.

Head 3.8 to 4.2; depth 4.4 to 4.8; D. I, 5; A. 15 to 17.

Body elongate, rather robust anteriorly; head short, bluntish; jaws sub-equal; width of head 1.0 to 1.2 in its length, its depth 1.2 to 1.5; width of mouth 1.7 to 2.0 in head; eye 4.0 to 4.3; interorbital 1.4 to 1.6; dorsal fin nearer tip of snout than adipose fin, its distance from tip of snout 2.8 to 3.0 in body; last dorsal ray to adipose fin 2.7 to 3.1; dorsal spine rugose on anterior margin, smooth behind, its length 1.3 to 1.6 in head; pectoral spine strong, rough on outer margin, the inner with strong retrorse teeth, its tip nearly reaching ventrals, its length .9 to 1.2 in head; ventrals 1.7 to 2.0 in head; caudal fin forked.

Color dark above, lighter below, top of head marbled with black; a dark blotch on shoulder extending a short distance on side.

Tuyra River basin.

***Megalonema punctatum* sp. nov.**

Type No. 7577, F. M. N. H.; length 142 mm.; Rio Tuyra, Boca de Cupe, Panama.

Head 3.80; depth 5.35; D. I, 6; A. 10.

Body elongate, the dorsal region elevated; profile slightly convex; mouth sub-inferior, $\frac{2}{3}$ of band of premaxillary teeth exposed; band of teeth in lower jaw about $\frac{1}{2}$ width of the premaxillary band; maxillary barbels reaching end of shortest caudal rays; eye 4.15 in head; snout 2.30; interorbital 3.86; dorsal rather high, its spine 1.20 in head; first dorsal ray 1.04; last dorsal ray 2.82; longest dorsal ray not reaching adipose fin; depth at origin of adipose fin 2.04 in head; depth of caudal peduncle 5.50; base of adipose fin 1.41 in head; pectoral spine slightly roughened on outer margin, its inner margin with 24 rather strong retrorse teeth, its length 1.28 in head; humeral process scarcely reaching middle of pectoral spine, its length 2.47 in head; caudal fin deeply forked.

Color light silvery below, darker above; sides and top of head with many small black spots.

Tuyra River basin.

Megalonema robustum sp. nov.

Type No. 7578, F. M. N. H.; length 290 mm.; Rio Tuyra, Marriganti, Panama.

Head 3.8; depth 4.4; D. I, 6; A. 10.

Body elongate, robust, profile nearly straight; dorsal region elevated; mouth sub-inferior, about half of band of premaxillary teeth exposed; band of teeth of lower jaw nearly as wide as premaxillary band; maxillary barbels reaching to or slightly past middle of adipose fin; eye 5.0 to 5.6 in head; snout 2.3; interorbital 3.0 to 3.4; dorsal fin rather high, its spine 1.1 to 1.2 in head; first dorsal ray .9 to 1.1; last dorsal ray 2.8; longest dorsal ray not reaching adipose fin; base of adipose fin 1.2 in head; depth at origin of adipose fin 1.5 in head; depth of caudal peduncle 3.1 to 3.2; pectoral spine roughened on outer margin, the inner with 32 rather small retrorse teeth, its length 1.1 in head; humeral process 2.3 in head, not reaching middle of pectoral spine.

Color dark olivaceous above, silvery below; sides and head without spots.

Tuyra River basin.

Family PYGIDIIDÆ.

Pygidium striatum sp. nov.

Type No. 7579, F. M. N. H.; length 84 mm.; Rio Cana, Cana, Panama.

Head 5.3 to 6.3; depth 7.4 to 8.2; D. 8; A. 6.

Body elongate, compressed; top of head flat; width of head 1.2 to 1.7 in its length; interorbital 3.6 to 4.5 in head; eye 7.5 to 9.3; snout 2.2 to 2.5; gill openings extending forward nearly to opposite eye; pectorals short, the first ray slightly produced, its length 1.0 to 1.3 in head; maxillary barbels reaching to base of pectorals; origin of dorsal over or slightly behind tips of ventrals; origin of ventrals midway between tip of snout and tip of caudal; origin of dorsal in advance of anal, its last ray over middle of anal; length of caudal peduncle 1.1 to 1.4 in head, its depth 1.6 to 1.7; caudal fin truncate to slightly rounded.

Color light olive, a dark band from upper angle of opercle to middle of base of caudal, above this a second similar band; back with black spots, each about twice diameter of eye; similar spots sometimes on lower part of sides, these most numerous on the largest specimens; occasionally portions of the lateral bands are more or less broken up into spots and blotches.

Tuyra River basin.

Family LORICARIIDÆ.

Ancistrus planiceps sp. nov.

Type No. 7580, F. M. N. H.; length 198 mm.; Rio Tuyra, Boca de Cupe, Panama.

Head 2.7 to 2.8; depth 6.2 to 6.6; D. I, 8; A. I, 3; lateral scutes 24 to 26.

Body depressed anteriorly, rounded to compressed posteriorly; width of head 1.2 to 1.3 in its length; depth of head 2.4; eye 7.4 to 8.5; interorbital 2.3 to 2.4; mandibular ramus 6.5 to 8.0; snout 1.6 to 1.8 in head; head without ridges, the median portion of the snout elevated; sides of snout margined with bristles; interoperculum movable, armed with about 28 spines, capable of being everted and nearly concealed under edge of operculum, the longest spine 3.5 to 4.2 in head; scutes spinulose, not carinated; 6 scutes between dorsal and adipose fins, 11 between anal and caudal; supraoccipital scute bordered by median scute and 2 lateral ones; lower surface of head and abdomen naked; first dorsal ray 1.1 to 1.4 in head; base of dorsal 1.7 to 1.8, equalling its distance from adipose fin; pectoral spine extending to distal fourth of ventral, its length .9 to 1.0 in head; caudal obliquely truncate; depth of caudal peduncle 3.6 to 4.0 in head, its depth in its length 3.1.

Color dark, uniform, fins all spotted with blue to bluish white; abdomen and under side of head with or without light spots.

Tuyra River basin.

Acanthicus canensis sp. nov.

Type No. 7581, F. M. N. H.; length 76 mm.; Rio Cana, Cana, Panama.

Head 2.7 to 2.8; depth 6.0 to 7.0; D. I, 8; scutes 22 or 23.

Body elongate, depressed; head evenly convex from snout to nape, its width .9 to 1.1 in head, its depth that of body, 2.3 to 2.6 in head; eye 7.0 to 8; interorbital 3.2 to 3.6; snout 1.5 to 1.7; mandibular ramus 3.4; interopercular spines present, not entirely retractile under opercle, the longest spine 1.5 to 2.1 in head, its tip nearly reaching middle of pectoral spine; 5 to 7 of spines of interopercle longest, the remainder, about 10, very short; abdomen and under side of head naked; first dorsal ray 1.5 to 1.7 in head; base of dorsal 1.4 to 1.6 in head; anal fin and adipose fin absent; pectoral spine reaching from about first fourth to first half of ventrals, its length .9 to 1.2 in head; depth of caudal peduncle 2.9 to 3.2 in head; caudal obliquely truncate; scutes spinulose, not keeled.

Color dark olivaceous, lighter below; all of the fins with dark spots on rays, these forming indistinct bars; interradiial membranes plain.

Tuyra River basin.

Loricaria capetensis sp. nov.

Type No. 7582, F. M. N. H.; length 164 mm.; Rio Capeti, Panama

Head 4.7; depth 12; D. 7; A. 6; scutes 19 + 11.

Body elongate, moderately depressed, the dorsal region not elevated; width of head 1.4 in its length, its depth 2.6 to 2.7; eye 6 in head, the orbital notch present; interorbital 5.1 to 5.3 in head; snout rounded, the profile from interorbital to its tip straight, its length 1.9 in head; upper lip with a fringe of blunt tentacles; the lower lip broad, papillose, with marginal fringe; top of head strigate, a slight double occipital keel, the two portions meeting at the apex; the two nuchal plates each with a pair of keels; lateral keels moderately strong, not completely united on posterior part of the body; abdomen with 2 or, irregularly 3 rows of plates on its middle, these separated from the lateral ones by a broad naked strip; between the pectorals the median strip is wider and broken up into several smaller plates; anal plate in contact with 3 plates, the anal buckler composed of about 12 plates, first dorsal ray .9 in head; pectorals reaching to about first fourth of ventrals, 1.2 in head; ventrals 1.3; width at anal 4.8 to 5.4 in its distance from base of caudal; upper lobe of caudal greatly produced, its length in the type 115 mm.

Color brownish, back with 4 or 5 cross bands; fins spotted, the spots

confined mostly to the rays and forming cross bars, most numerous and distinct on the caudal fin; a broad dark bar under eye and a narrow one on anterior portion of interorbital.

Tuyra River basin.

Loricaria tuyrensis sp. nov.

Type No. 7583, F. M. N. H.; length 350 mm.; Rio Tuyra, Boca de Cupe, Panama.

Head 4.4 to 4.7; depth 9.5 to 11.5; D. I, 7 or 8; A. I, 5; scutes 20 or 21 + 10 to 12.

Body elongate, depressed; width of head 1.2 to 1.3 in its length; depth of head 2.5; eye 6 to 8 in head; interorbital 4.6 to 4.8; snout 1.7 to 1.8; teeth 9 or 10 in upper jaw, 13 or 14 in the lower; lips with large papillæ, the upper fringed with a few blunt tentacles, the lower broad, its surface with papillæ and with fringed margin; top of head covered with short spinules; temporal and occipital plates each with one keel; predorsal plate without keel, the other plates between dorsal and head each with a pair of keels; lateral keels separate throughout their length; under surface of head naked, the plates on abdominal area extending forward nearly to gill opening; median abdominal plates in two series; the abdominal region entirely scaled; anal plate in contact with 3 or 4 plates, anal buckler usually with 12 to 14 plates; pectoral spines reaching slightly beyond base of ventrals, length of first ray 1.2 to 1.3 in head; first dorsal ray .9 to 1.0 in head; width of body at anal 1.7 in head, 3.9 to 4.1 in distance from anal to caudal; upper caudal ray produced, its length in type 145 mm., more than half length of caudal peduncle.

Color dark brownish above, slightly lighter below; fins indistinctly spotted, caudal irregularly barred, the spots or dark markings on fins present on both the rays and the interradial membranes.

Tuyra River basin.

Oxyloricaria dariensis sp. nov.

Type No. 7584, F. M. N. H.; length 245 mm.; Rio Tuyra, Boca de Cupe, Panama.

Head 4.5 to 5.0; depth 9.0 to 10; D. I, 7 or 8; A. I, 5; scutes 15 or 16 + 17 or 18.

Body elongate, depressed, the dorsal region somewhat elevated; width of head 1.7 to 1.9 in its length; depth of head 2.5 to 2.7; eye 7 to 9 in head, without orbital notch; interorbital 3.2 to 3.6 in head; snout depressed, somewhat attenuated, its length 1.6 to 1.7 in head; teeth

cardiform, about equal in both jaws; lower lip broad, papillose; top of head smooth; lateral keels very weak, completely united posteriorly; abdomen with 3 series of plates between the lateral ones; anal plate in contact with 3 plates; dorsal fin high and pointed, its first ray 0.7 to 0.8 in head; pectoral spines reaching from about first fourth to first half of ventral, .9 to 1.2 in head; width of body at first anal ray 5.0 to 5.8 in length of caudal peduncle; males with bristles on sides of head; both lobes of caudal produced into long filaments.

Color dark brownish, a dark band on each side from snout to caudal, wider and better defined on sides of head and body, becoming faint or disappearing on caudal portion of the body; top of head with a few irregular dark streaks; under side yellowish, with darker median line on caudal peduncle, and more or less mottled with darker laterally; first 2 or 3 rays of dorsal fin black or marbled with black, rest of dorsal, pectorals and ventrals with black spots, these usually present on anal also; a black band on each lobe of the caudal.

Pacific slope of eastern Panama.

***Oxyloricaria citurensis* sp. nov.**

Type No. 7585, F. M. N. H.; length 194 mm.; Rio Cupe, Cituro, Panama.

Head 4.5 to 5.1; depth 8 to 10.0; D. I, 7; A. I, 5; scutes 16 or 17 + 13 or 14.

Body elongate, moderately depressed; depth of head 2.3 to 2.5 in its length, width 1.4 to 1.5; eye 6.8 to 8.3; interorbital 3.3 to 3.6; snout rounded, its length 1.7 to 1.9 in head; teeth cardiform, about equal in both jaws; lower lip broad, with papillæ; top of head smooth, lateral keels weak, completely united posteriorly; abdomen with 6 or 8 rows of plates between the lateral ones; anal plate preceded by three plates; dorsal fin high, pointed, its first ray 0.8 to 1.0 in head; pectoral spines reaching about first fourth of ventrals, 1.1 to 1.2 in head; ventrals 1.1 to 1.2; width of body at first anal ray about 4.1 to 4.6 in caudal peduncle; upper lobe of caudal produced; sides of head without bristles or with very short ones.

Color dark grayish brown, top of head and body with faint dark spots, a few dark spots on dorsal, caudal and pectoral fins; under surface light with yellowish tinge.

Tuyra River basin.

Family CYCLOPIDÆ.

Cyclopium pirrense sp. nov.

Type No. 7586, F. M. N. H.; length 130 mm.; Rio Cana, Cana, Panama.

Head 3.3 to 3.6; depth 5.0 to 6.0; D. I, 5; A. I, 5.

Body robust, compressed posteriorly; head depressed, broad, its width equaling its length; anterior teeth of upper jaw pointed, those of the lower bicuspid; snout 1.8 to 2.0 in head; interorbital 3.4 to 4.1; origin of dorsal over ventrals, its distance from tip of snout 2.2 to 2.4 in body; first dorsal ray with its tip produced, its length 1.1 to 1.4 in head, the tips of first dorsal rays reaching slightly past those of the last rays when the fin is deflexed; pectoral spines produced, their tips reaching to or past middle of ventrals, their length .7 to .9 in head; ventrals 1.0 to 1.2; adipose fin long, without trace of spine; caudal peduncle deep, 1.7 to 1.9 in head; last anal ray to caudal 1.5 to 1.7 in head; caudal emarginate, the outer rays produced.

Color brownish mottled with darker; base of anal and dorsal black; a faint black bar at base of caudal rays; base of first rays of anal usually with a black spot.

Tuyra River basin.

Family CHARACIDÆ.

Parodon dariensis sp. nov.

Type No. 7587, F. M. N. H.; length 140 mm.; Rio Cupe, Cituro, Panama.

Head 4.4 to 4.5; depth 4.3; D. I, 10; A. I, 8; scales 36.

Body elongate, robust, the dorsal region elevated; mouth inferior, transverse; the teeth of upper jaw 3-3 or 4-4, pointed or incisor, their edges nearly smooth to finely denticulated; eye 4.4 to 5.0 in head; snout 3.0; interorbital 2.6; dorsal fin with its margin convex or nearly straight, its origin about midway between tip of snout and posterior margin of adipose fin; snout to dorsal 2.1 in body; pectoral broad, of 15 rays, its length .95 in head; ventrals 1.1 in head; base of anal 2.8 to 3.1; depth of caudal peduncle 1.8 to 1.9; caudal fin forked.

Color olivaceous, the dorsal region very dark; sides with two black lateral bands, each as wide as eye, these partly broken into confluent black spots; dorsal and anal fins each with 2 black bars; caudal with

two oblique black bars on each lobe; pectorals and ventrals nearly black mesially.

Tuyra River basin.

Brycon argenteus sp. nov.

Type No. 7588, F. M. N. H.; length 230 mm., Rio Aruza, Aruza, Panama.

Head 3.7 to 4.0; depth 3.2 to 3.6; D. 10; A. 24 to 26; scales 42 to 45.

Body elongate, moderately compressed; the profile nearly straight; mouth large, the upper jaw slightly the longer, margin of lower lip between the first and second rows of premaxillary teeth; eye 3.2 to 3.5 in head; snout 3.8 to 4.2; maxillary 2.2 to 2.4; maxillary teeth 16 or 17 on each side; gill-rakers 9 + 12 or 13; origin of dorsal slightly behind that of ventrals; pectorals 1.5 in head; caudal peduncle 2.7 to 2.9.

Color silvery, darker above; sides without lines or bands; a large black spot on caudal peduncle extending on base of caudal rays.

Pacific slope of eastern Panama.

Brycon petrosus sp. nov.

Type No. 7589, F. M. N. H.; length 285 mm.; Upper Chagres, Panama.

Head 3.7 to 3.9; depth 3.5 to 3.7; D. 9 or 10; A. 30 to 32; scales 52 to 58.

Body elongate, robust, moderately compressed; profile concave; mouth large, the upper jaw the longer, the second row of teeth at margin of lower lip; eye 3.6 to 4.0 in head; snout 3.4 to 3.6; maxillary reaching nearly to middle of eye, its length 2.1 to 2.3 in head; maxillary teeth 12 or 13 on each side; gill-rakers 10 to 12 + 12 or 13; origin of dorsal slightly in advance of middle of ventrals, about midway between base of caudal and nostril; pectorals 1.4 in head; depth of caudal peduncle 2.8 to 2.9 in head.

Color uniform silvery; sides without dark lines or bands; a large caudal spot extending on base of caudal rays.

Chagres River basin.

Ræboides macrolepis sp. nov.

Type No. 7590, F. M. N. H.; length 56 mm.; Rio Cupe, Boca de Cupe, Panama.

Head 4.3 to 4.4; depth 3.4 to 3.8; D. I, 7 or 8; A. II, 49 to 54; scales 48.

Body elongate, much compressed; profile nearly straight; back not

much elevated; mouth small, maxillary short, 3.2 to 3.5 in head, its tip barely reaching past front of eye; jaws with a single series of weakly tricuspid teeth, about 9 + 9 in each jaw; maxillary with 5 pointed teeth; eye 2.6 to 2.8 in head; snout 4.8 to 5.2; dorsal fin high, its longest ray about equals head; origin of dorsal behind front of anal, nearer base of caudal than the tip of the snout; pectoral 1.1 to 1.2 in head; caudal peduncle 2.3 in head; lateral line developed on 8 or 10 scales.

Color olivaceous, a broad silvery band; no spots on sides or on base of caudal.

Tuyra River basin.

Creagrutus simus sp. nov.

Type No. 7591, F. M. N. H.; length 57 mm.; Rio Cupe, Cituro, Panama.

Head 3.6 to 3.8; depth 3.3 to 3.4; D. I, 8 or 9; A. II, 13 or 14; scales $5\frac{1}{2}$ -35-4 $\frac{1}{2}$.

Body elongate, moderately robust; snout blunt, the lower jaw the shorter; eye 2.5 to 2.6 in head; snout 3.4 to 3.7; cheek about 3.1; maxillary nearly to middle of eye, its length 2.5 to 2.7 in head; gill-rakers 5 + 9; dorsal over or slightly behind ventrals, its origin nearer posterior end of adipose fin than tip of snout; anal short, its base 5.5 to 5.8 in body; pectorals 1.3 in head; ventrals 1.6; least depth of caudal peduncle 2.0 to 2.3 in head.

Color olivaceous, sides with broad silvery band; a humeral spot; no caudal spot.

This species differs from *C. notropoides* in being less robust, more compressed, and having a slightly larger eye.

Tuyra River basin.

Family GYMNOTIDÆ.

Stenarchus rostratus sp. nov.

Type No. 7592, F. M. N. H.; length 126 mm.; Rio Grande, Cana, Panama.

Close to *S. brasiliensis* Reinhardt, with snout 2.66 in head; depth 1.29; depth of head 1.63; depth of head in front of eye 3.18; eye 9.8; angle of mouth under front of eye; 14 or 15 scales between lateral line and middle of back; anal rays 172.

Color uniform brown; a yellow stripe from snout on upper part of head and back, disappearing on posterior fourth of body.

Family PÆCILIIDÆ.

Rivulus brunneus sp. nov.

Type No. 7593, F. M. N. H.; length 41 mm.; Toro Point, Canal Zone, Panama.

Head 3.4 to 3.6; depth 4.7 to 4.8; D. 8 or 9; A. 12 to 14; scales 38 to 40.

Body robust; head rather broader than deep; diameter of eye 3.2 to 3.4 in head; origin of dorsal over posterior third of anal; last ray of anal about opposite sixth ray of dorsal; origin of dorsal to base of caudal 2.5 in its distance from eye, about midway between tip of caudal and anterior margin of opercle; pectoral 1.4 to 1.5 in head, their tips not reaching ventrals.

Color brownish, sides slightly speckled with darker; tip of anal rays black; a black stripe from under side of caudal peduncle to end of lower caudal rays, in some specimens the upper caudal rays with a similar bar, these not prominent in the smaller specimens; caudal and dorsal with few faint spots. In life the upper parts of the body grayish with shades of pink; belly pale with shades of pink, fins all reddish; base of caudal and anal deep red.

Atlantic slope of central Panama.

Gambusia cascajalensis sp. nov.

Type No. 7594, F. M. N. H.; length 55 mm.; Rio Cascajal, Porto Bello, Panama.

Head 3.7 to 3.8; depth 3.7 to 3.8; D. I, 6; A. II, 7; scales 8-26.

Body elongate, compressed; the dorsal region slightly elevated; mouth small, the gape extending about $\frac{1}{3}$ distance to eye; lower jaw the longer; the teeth in both jaws in several series, the outer slightly enlarged; snout 3.1 to 3.2 in head; eye 2.9 to 3.1; origin of dorsal over last anal rays, its distance from base of caudal 1.9 to 2.1 in its distance from tip of snout, about midway between tip of caudal fin and eye; anal falciform, its anterior rays the longer, their length about 1.2 in head, their tips reaching beyond tips of last rays when the fin is deflexed; ventrals reaching nearly to anal; caudal fin rounded; gill-rakers 12; caudal peduncle 1.8 in head, 13 scales before dorsal fin.

Color olivaceous; base of anal and anterior rays black, tip of dorsal rays black; a broad dark curved bar at base of caudal rays, rather indistinct in some specimens.

Rio Cascajal, Atlantic slope of Panama.

Gambusia latipunctata sp. nov.

Type No. 7595, F. M. N. H.; length 39 mm.; Arrijan, Panama.

Head 3.8 to 3.9; depth 3.4 to 3.6; D. I, 7 or 8; A. II, 6 or 7; scales 7-32.

Body elongate, robust; dorsal region scarcely elevated; mouth moderate, the gape about half way to eye; lower jaw the longer; teeth in jaws in several series, the outer enlarged; snout 3.4 to 3.9; eye 2.7 to 3.1; origin of dorsal over middle or anterior $\frac{1}{3}$ of anal, its distance from base of caudal 1.8 in its distance from tip of snout, about midway between tip of caudal and anterior margin of eye; anal falcate, its anterior rays 0.9 to 1.1 in head; ventrals scarcely reaching anal; gill-rakers 12; caudal peduncle 1.6 to 1.7 in head; caudal rounded, width of head 1.5 in its length.

Color olivaceous, the margin of the scales darker; sides with 10 to 15 spots along the side (specimens under 40 mm.), forming a broken lateral band in large specimens, vertical diameter of each spot about twice its horizontal diameter; anal with a black spot at base of rays extending on longest rays; dorsal with dark spots across its middle.

Streams of the Pacific slope of Panama in and near the Canal Zone.

Gambusia cana sp. nov.

Type No. 7596, F. M. N. H.; length 39 mm.; Rio Satiganti, Cana, Panama.

Head 3.9 to 4.2; depth 3.8 to 4.0; D. I, 5 or 6; A. II, 6; scales 8-30.

Body elongate, robust; dorsal region little elevated; mouth moderate, its gape nearly half way to eye; teeth in several series, the outer enlarged; snout 3.7 to 4.0 in head; eye 3.0 to 3.3; origin of dorsal over last rays of anal, its distance from base of caudal 1.8 to 1.9 in its distance from tip of snout, about midway between tip of caudal and snout; anal fin with the first rays not falcate, their tips reaching beyond tips of last rays when fin is deflexed; longest anal ray 1.0 to 1.1 in head; ventrals not reaching anal; caudal fin truncate or slightly rounded; caudal peduncle 1.4 to 1.6 in head; gill-rakers 12; 17 scales before dorsal fin.

One male (25 mm.) has head 4.25; depth 4.10; modified anal .65 in head, its tip reaching about halfway to base of caudal.

Color ♀ nearly uniform olivaceous; on some specimens faint traces of broad dark bars on posterior half of body; margin of scales dark; dorsal dark at base; a black spot on preanal region, scarcely extending on base of anal fin; males with a few faint cross bars on posterior half of sides; sides with a black spot.

In general appearance this species resembles *G. episcopa*, the dorsal fin is more posterior, the head much shorter, and the dorsal and anal fins smaller.

Pacific slope of eastern Panama.

***Gambusia darienensis* sp. nov.**

Type No. 7597, F. M. N. H.; length 35 mm.; Rio Capeti, Panama. Head 4.0 to 4.2; depth 3.5 to 3.6; D. I, 6 or 7; A. II, 6 or 7; scales 8-30.

Body elongate; the dorsal region little elevated; mouth small, the gape extending about $\frac{1}{3}$ distance to eye; teeth in several series, the outer enlarged; snout 3.7 to 3.8 in head; eye 3.0 to 3.2; origin of dorsal behind anal fin, its distance from base of caudal 2.3 to 2.4 in its distance from tip of snout, about midway between tip of caudal and opercle or posterior margin of eye; anal fin with margin nearly straight, the tip of first rays scarcely reaching those of last rays when the fin is deflexed; longest anal rays 1.2 to 1.3 in head; ventrals reaching anal; caudal fin rounded; caudal peduncle 1.4 to 1.5 in head; gill-rakers 13; 18 scales before dorsal fin.

One male (29 mm.) has head 3.9; depth 4.4; snout 3.6 in head; eye 3.4; modified anal .75, its tip reaching about $\frac{2}{3}$ distance to base of caudal fin.

Color ♀ olivaceous, uniform, the margin of the scales lighter; ♂ with about 20 narrow vertical dark bars on sides behind pectoral fin, sides without dark spots, otherwise like the female.

The caudal fin is more rounded on this species than in any of the others. It is especially characterized by its small dorsal fin which is well posterior of the anal fin. The tips of first rays of the anal fin do not reach tips of last rays when the fin is deflexed.

Tuyra River basin.

Family CICHLIDÆ.

***Cichlasoma umbriferum* sp. nov.**

Type No. 7598, F. M. N. H.; length 195 mm.; Rio Cupe, Cituro, Panama.

Head 2.3 to 2.6; depth 2.4 to 2.6; D. XVII, 11; A. VI, 8; scales 33.

Body elongate, rather robust; anterior profile evenly convex to eye, straight or slightly concave on snout; lower margin of upper lip on level with lower portion of eye and upper edge of base of pectoral; jaws

subequal, upper jaw with 2 anterior canines and 2 others slightly smaller on each side; lower jaw with canine on each side, between which the upper canines bite; lips well developed, the margin of the lower one free; mouth large, terminal, the posterior end of maxillary exposed, extending slightly past anterior margin of orbit, its length 2.3 to 2.6 in head; eye 3.8 to 4.4; snout 2.7 to 3.0; preorbital 5.1 to 7.0; postorbital 2.4 to 2.6; dorsal fin rather low, its last spine 2.5 to 3.0 in head; last anal spine 2.7 to 2.9; base of anal fin 3.9 to 4.1 in length of body; ventral fins reaching slightly past origin of anal; pectoral 3.7 to 3.9 in body; ventral 3.3 to 3.7; caudal peduncle 2.6 to 2.7 in head; caudal fin rounded; 3 rows of scales between origin of soft dorsal and lateral line; gill-rakers very short, 3 + 8.

Color dark olivaceous, without conspicuous dark bars (except in young up to about 50 mm.); a black lateral band from eye to base of caudal, on posterior part of body this band above lateral line ending in a dark caudal spot; vertical fins with small light spots.

Tuyra River basin.

***Cichlasoma tuyrense* sp. nov.**

Type No. 7599, F. M. N. H.; length 220 mm.; Rio Tuyra, Boca de Cupe, Panama.

Head 2.8 to 3.2; depth 1.9 to 2.1; D. XVI or XVII, 11 or 12; A. VI, 7 or 8; scales 38.

Body deep, compressed, upper part of profile convex, slightly concave above orbit; lower margin of upper lip below orbit and above base of the pectoral; jaws subequal, none of the teeth enlarged, all pointed; lips normal, the lower with a frenum; mouth small, terminal, maxillary not reaching orbit, its length 3.6 to 3.9 in head; eye 3.3 to 4.0; snout 2.8 to 3.0; preorbital 4.1 to 4.5; postorbital 2.3 to 2.4; dorsal fin rather high, its last spine 1.9 to 2.2 in head; last anal spine 1.8 to 1.9; base of anal 3.5 to 3.7 in body; pectoral reaches front of anal, 3.1 to 3.4 in head; ventrals reaching slightly beyond front of anal, 2.7 to 3.4 in body; caudal peduncle 2.1 to 2.4 in head; caudal fin rounded; 5 rows of scales between anterior part of soft dorsal and lateral line; gill-rakers very short, 2 + 8 on first gill arch; basal portion of soft dorsal and anal with scales.

Color olivaceous, sides with seven distinct dark cross bars, the middle portion of each bar a black blotch; a small dark spot at base of caudal; sides with dark dots forming lines along the rows of scales, these becoming larger and more distinct in the larger specimens.

Bayano and Tuyra river basins.

Cichlasoma calobrense sp. nov.

Type No. 7600, F. M. N. H.; length 215 mm.; Rio Calobre, Panama.

Head 2.6 to 2.8; depth 2.2 to 2.4; D. XVI or XVII, 10 or 11; A. VI, 6 to 7; scales 33.

Body elongate, compressed; profile straight to slightly convex above, straight or slightly concave from orbit to snout; lower margin of upper lip below orbit and slightly below upper edge of pectoral; jaw subequal; a few anterior teeth in each jaw slightly enlarged; lips rather thick, the lower with free margin, the fold broad; mouth large, terminal, the maxillary reaching nearly to anterior margin of orbit, its length 2.8 to 3.1 in head; eye 3.4 to 4.2; snout 2.5 to 2.9; preorbital 3.6 to 4.2; postorbital 2.5 to 2.8; dorsal fin rather high, the longest spine 2.3 to 2.5 in head; last anal spine 2.2 to 2.5; base of anal 4.0 to 4.4 in body; ventrals reaching slightly past front of anal, 3.2 to 3.6 in body; caudal peduncle 2.6 to 2.7 in head; caudal fin rounded; 2 rows of scales between anterior part of soft dorsal and lateral line; gill-rakers very short, 3 + 11 on first gill arch; soft dorsal and anal fins with their middle rays produced.

Color olivaceous, with 6 or 7 well defined dark cross bars; a black caudal spot in upper half at base of caudal rays; vertical fins with light and dark spots; sides with or without small dark spots.

Bayano and Tuyra river basins.

Neetroplus panamensis sp. nov.

Type No. 7601, F. M. N. H.; length 104 mm.; Rio Mandingo, Bas Obispo, Canal Zone, Panama.

Head 3.0 to 3.3; depth 2.0 to 2.2; D. XVI or XVII, 9; A. VI or VII, 6 or 7; scales 29.

Body elongate, compressed, robust anteriorly; profile convex, above becoming nearly straight; margin of upper jaw below level of lower margin of eye and just above upper margin of base of the pectoral; jaws subequal; teeth compressed, incisor-like; lips normal, the lower with a frenum; mouth terminal, small, the maxillary not reaching eye, its length 3.4 to 3.7 in head; eye 3.3 to 3.4; preorbital 3.7 to 4.3; postorbital 2.4 to 2.7; snout 2.5 to 2.9; dorsal fin rather high, longest spine 2.2 to 2.6 in head; longest anal spine 2.2 to 2.5; base of anal fin 3.6 to 3.8 in body; pectoral not reaching vent, its length 3.2 to 3.5 in body; ventrals reaching past origin of anal, 2.6 to 2.9 in body; caudal peduncle 1.9 to 2.1 in head; caudal fin rounded; 2 rows of scales between first dorsal ray and lateral line; gill-rakers 2 + 6; scales on base of soft dorsal and anal.

Color olivaceous; sides with 7 or 8 indistinct, irregular, dark bars, or indistinct black blotches; a dark blotch at base of caudal; vertical fins without spots.

Chagres River basin.

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NEW PERUVIAN MAMMALS

BY

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CHICAGO, U. S. A.

May 31, 1913.

NEW PERUVIAN MAMMALS

BY WILFRED H. OSGOOD.

The mammals described below are those obviously new from a collection made during the past year in northern Peru by Mr. M. P. Anderson and myself. Doubtless there are further novelties, but since it is the first considerable collection of middle Andean mammals brought to the United States, this is not readily ascertained. A complete report on the entire collection is in preparation but its publication is necessarily delayed. Knowledge of South American mammals as yet is so imperfect that no general monographic work has been done and in many groups there is much confusion. Year by year, however, the task of settling individual problems becomes simpler and it is to be hoped that the day is not very remote when some of the important general questions of distribution and relationship may be studied with accurate and sufficient data.

Peramys peruvianus sp. nov.

Type from Moyobamba. Peru. No. 19362 Field Museum of Natural History. Male adult. Collected July 21, 1912, by W. H. Osgood and M. P. Anderson.

Characters. Size small; coloration dark and rich; hair short and close, 4-5 mm. long on back; head, shoulders, and back Vandyke brown, darkening to blackish seal brown on rump; sides of belly and entire inguinal region drabbish or broccoli brown; median throat, chest, and anterior part of abdomen light buff to bases of hairs; chin brownish drab; arms, legs, and feet slightly darker than body.

Skull small, light, and devoid of angularity; interorbital region smoothly rounded with only a slight postorbital protuberance; nasals moderately expanded posteriorly, ending far back of premaxillæ; last upper molar greatly compressed.

Measurements. Type: Total length 173; head and body 118; tail vertebrae 55; hind foot 16. Skull of type (lacking posterior half of braincase): Zygomatic breadth 15.3; nasals 14.5 x 3.8; interorbital constriction 5.7; palate 15.2; front of canine to back of M⁴ 12.4. Skull

of female topotype: Greatest length 26.9; basilar length 24.5; zygomatic breadth 14; nasals 11 x 3.2; interorbital constriction 5.6; palate 13.9; front of canine to back of M^4 11.1.

Remarks. This species appears to have no very close relative unless it be *Peramys adustus* of eastern Colombia which, although about the same size, is evidently much paler in color and lacks the extensive buffy pectoral area. Both the type and the one topotype obtained are imperfect, having been injured by ants while lying dead in the traps, the latter so badly that its mutilated body was preserved in alcohol.

Marmosa madescens sp. nov.

Type from Tambo Ventija, 10 miles east of Molinopampa, Peru. Altitude about 9000 ft. No. 19689 Field Museum of Natural History. Adolescent male. Collected June 15, 1912, by W. H. Osgood and M. P. Anderson.

Characters. A medium-sized species of very dark color and unbeaded skull, probably allied to *M. incana* and *M. fuscata*. Upper parts rich dark brown; back Prout's brown shading to Vandyke brown on sides; frontal and interorbital region slightly paler brown; eye ring black, its anterior extension brownish; hairs of cheeks, chin, throat, breast, midventral and inguinal region self-colored creamy buff; hairs of sides of throat and belly and inner sides of arms and thighs creamy apically and broadly slaty basally; midventral area of self-colored hairs occupying about one-fifth the transverse extent of the abdomen; tail thickly clothed with fine short hairs except the distinct scaly prehensory pad; upper side of tail dusky brownish except a short variable white tip; under side of tail irregularly whitish for distal two-thirds of its length, the remainder sooty; front of arms and legs brown; feet and toes whitish at least laterally.

Skull rather elongate; supraorbital and temporal ridges only faintly indicated; nasals slender and slightly expanded posteriorly.

Measurements. Type: Total length 259; head and body 120; tail 139; hind foot 19. Skull of type: Greatest length 32.2; basal length 30.9; zygomatic breadth 15.7; least interorbital breadth 6.5; nasals 14.7 x 3.5; palate length from gnathion 17.9; front of canine to back of M^4 13.5; combined length of M_s^{1-3} 6.

Remarks. Although comparison of actual specimens has not been possible, it is evident that this species has its nearest relationship with *M. incana* and *M. fuscata*. It differs from *fuscata* at least in the color of its underparts and doubtless other characters will be found upon comparison of specimens.

Marmosa musicola sp. nov.

Type from Moyobamba, Peru. No. 19354 Field Museum of Natural History. Adult female. Collected July 30, 1912, by W. H. Osgood and M. P. Anderson.

Characters. Allied to *Marmosa quichua* but larger, with a longer tail; blackish eye ring produced forward nearly or quite to end of nose; skull with well-developed angular postorbital processes. General color of upper parts between cinnamon and russet, finely punctulated with dusky; frontal and interorbital region very slightly paler than back; eye ring sharply defined black extending forward to base of whiskers or to end of nose; under parts rich creamy buff or ochraceous buff, the hairs self-colored on the chin, middle of throat, breast, and a narrow midventral line — elsewhere with slaty bases; outer side of hind leg dusky brownish to tarsal joint; hind feet buffy whitish on inner half, pale hoary brownish on outer half; front of forelegs and at least middle of fore feet brownish; tail brownish, faintly and irregularly paler on under side.

Skull rather short, broad, and deep; braincase large; supraorbital ridges beaded and forming a slight shelf, produced into distinct angular postorbital processes; temporal ridges slightly developed; nasals moderately but rather abruptly expanded.

Measurements. Average of four adults from the type locality: Total length 288 (271-306); head and body 115 (102-129); tail vertebrae 173 (169-175); hind foot 18.4 (17-20). Skull of type: Greatest length 33.1; basal length 31.9; zygomatic breadth 18.3; breadth across postorbital processes 7.4; least interorbital breadth 5.7; nasals 14 x 4.4; palate length from gnathion 18.1; front of canine to back of M⁴ 12.3; combined length Ms¹⁻³ 5.4.

Remarks. This species seems to have no nearer relative than *M. quichua*, with which it agrees in its general coloration, but it is distinguished by its larger size, its lack of a white tip to the tail, and especially by its angular postorbital processes.

Metachirus andersoni sp. nov.

Type from Yurimaguas, Peru. No. 19655 Field Museum of Natural History. Adult male. Collected Sept. 11, 1912, by M. P. Anderson.

Characters. A richly colored species of the *opossum* group. Median upper parts from nose to end of hairy part of tail rich brownish black; shoulders and sides of body and rump grizzled and slightly tinged with buffy; front of forelegs and thighs buffy gray; fore and hind feet brownish

black; toes white; postocular spots buffy white sharply contrasted with surrounding black; under parts wholly ochraceous buff, the hairs mostly self-colored except on the sides of the neck and sides of belly where they have pale drab bases; dark and light areas of scaly part of tail about evenly divided.

Skull large and very elongate; nasals pointed behind and extending far beyond the posterior border of the lacrymal (in type, nearly to plane of postorbital processes); jugal not greatly expanded.

Measurements. Type and adult female paratype, respectively: Total length 572, 553; head and body 284, 275; tail 288, 278; hind foot 40, 35. Skull of type: Greatest length 78.8; zygomatic breadth 37.9; interorbital constriction 9.3; width across postorbital processes 13.5; nasals 39.6 x 10; breadth of braincase 21.3; palate length from gnathion 45.3; front of canine to back of M^4 31.2; M^1 to M^3 11.6.

Remarks. This handsome species is evidently widely different in color from any previously described. Doubtless its nearest relative is *M. opossum* of Guiana and Brazil from which it is easily distinguishable by its broad and sharply defined black dorsal stripe and its richly buffy under parts.

***Metachirus canus* sp. nov.**

Type from Moyobamba, Peru. No. 19347 Field Museum of Natural History. Male, young adult. Collected Aug. 4, 1912, by W. H. Osgood and M. P. Anderson.

Characters. A pale gray species allied to *M. grisescens* of west central Colombia, but differing in having a bicolor tail, more blackish upper parts and paler under parts. Upper parts uniform peppery gray, the hairs tipped with silvery and dusky brownish; head dark brown more or less sprinkled with silvery; under parts pale cream buff, stronger anteriorly, becoming more whitish posteriorly; gray of sides encroaching largely on belly; feet pale drab proximally, white distally; toes white; slightly less than distal half of tail white, remainder blackish.

Skull of medium size; nasals decidedly shorter than in *M. grisescens* and abruptly terminated after their moderate posterior expansion; premaxillae short, scarcely exceeding posterior plane of canine; palate highly fenestrate posteriorly; maxillary end of jugal broad and deep, its lower border practically parallel with the alveolar boundary of the maxillary; occipital condyle decidedly projected beyond inion; last upper molar trilobate in form, not so regularly triangular as in related species.

Measurements. Type: Total length 568; head and body 275; tail

293; hind foot 45. Skull of type: Basal length 67.5; occipito-nasal length 66.5; interorbital constriction 18.9; nasals 28.8 x 7.2; palate length from gnathion 40.2; front of canine to back of M^4 20.3; M^1 to M^3 11.6.

Remarks. *M. canus* is markedly different from all the known forms of the *opossum* series except *M. grisescens* from which it differs in having the usual white-tipped tail and in having all its paler markings less suffused with fulvous. It is perhaps the palest member of the genus, whereas *M. andersoni*, found at no great distance, is the most richly colored.

Oryzomys pollius sp. nov.

Type from Tambo Carrizal, mountains east of Balsas, Peru. Altitude about 5000 ft. No. 19765 Field Museum of Natural History. Adult female. Collected May 18, 1912, by W. H. Osgood and M. P. Anderson.

Characters. A large, long-tailed species, of a grayish type of coloration strongly suggesting various United States species of *Neotoma*. Upper parts smoke gray tinged with fawn mesially and mixed uniformly with dusky; under parts grayish white, the hairs with slaty bases except on the chin; eyelids blackish; ears thinly haired, blackish; hands and feet, with carpal and tarsal joints, white; tail very finely annulated and clothed with fine short hairs, white below and on sides, dusky above.

Skull rather elongate; rostrum broad and heavy but relatively long; nasals long but broad; supraorbital edges elevated and trenchant, continuous with parietal ridges to occipito-squamosal suture; palate with deep lateral channels running from the anterior foramina to the posterior lateral pits which are exceptionally large and deep; anterior palatine foramina very large, extending posteriorly nearly to plane of middle of first molar; mesopterygoid fossa obtusely pointed anteriorly, extending slightly beyond the posterior plane of the last molar; molar teeth of moderate size and normal pattern.

Measurements. Very old female: Total length 352; head and body 164; tail 188; hind foot 30. Type: Total length 337; head and body 157; tail 180; hind foot 30. Skull of type and very old female, respectively: Greatest length 34.7, 37; basilar length 27.1, 29.3; zygomatic width 17.8, 19.3; least interorbital width 5.2, 5.8; nasals 14.2 x 4.2, 15.1 x 4.7; interparietal 10.2 x 3.4, 9.8 x 4.3; anterior palatine foramina 8.3 x 3, 9 x 3.7; postpalatal length 12.5, 13.5; upper toothrow 5.6, 5.4.

Remarks. This species is not closely related to any with which I have been able to compare it, and of the numerous descriptions of species in this genus I do not find any which seem to indicate that it has received

a name. For convenience it might be compared to *O. xanthæolus* which is only slightly smaller but that species has the usual more or less fulvous coloration and the skull has a different palatal and interpterygoid region, a shorter rostrum, and various minor characters not shown by the present species. *O. baroni* appears to be a slightly differentiated subspecies of *xanthæolus*.

***Cavia atahualpæ* sp. nov.**

Type from Cajamarca, Peru. Alt. 9100 ft. No. 19480 Field Museum of Natural History. Female adult. Collected April 14, 1912, by W. H. Osgood and M. P. Anderson.

Characters. Size large; color dark; allied to *C. culleri* but much darker; general color of upper parts evenly grizzled cinnamon and blackish, the bases of the hairs broadly dark drab (15–20 mm.) followed by two or more annulations of cinnamon and blackish; numerous very fine and wholly blackish hairs more or less exerted especially on the rump where they are 20–50 mm. long; sides and lateral under parts only slightly paler than back; midventral region wood brown or pale cinnamon to ochraceous buff somewhat broken by drab basal color on belly, clearer and more dominant in pectoral and inguinal regions; throat mixed cinnamon and blackish scarcely different from upper parts; chin and submaxillary region buffy; fore and hind feet grizzled pale drab; ears thinly haired, blackish, not contrasted with surrounding parts; no definite eye ring.

Skull similar to that of *C. culleri*, but audital bullæ somewhat larger.

Measurements. Type (♀): Total length 275; hind foot 48. Topotype (♂): Total length 243; hind foot 46. Skull of type: Greatest length 60; basilar length 48.3; zygomatic breadth 33; nasals 19.8 x 8.6; diastema 16.2; palatal foramina 6; length of toothrow (alveoli) 14.6.

Remarks. As represented by a specimen from Arequipa, *Cavia culleri* is decidedly paler than the present species. This difference exceeds possible individual variation. Four specimens were secured at Cajamarca and all are uniformly dark colored, although one immature example shows somewhat more buffy or ochraceous on the under parts than the adults. Various cranial differences are noticeable but the only one which is sufficiently marked to give promise of being more than an individual peculiarity is that of the size of the audital bullæ.

***Akodon mollis orophilus* subsp. nov.**

Type from six miles west of Leimabamba, Peru (in mountains near

headwaters of Utcubamba River). No. 19724 Field Museum of Natural History. Adult male. Collected May 26, 1912, by W. H. Osgood and M. P. Anderson.

Characters. Similar in color and character of pelage to *Akodon mollis allorum*, but averaging slightly larger and more fulvous and having marked cranial characters. Skull compressed and attenuate anteriorly; nasals slender and elongate; zygomatic plate short, having its anterior edge convex and receding from the base; braincase broader and more smoothly rounded than in *mollis* and *allorum*; temporal ridges practically obliterated.

Measurements. Type: Total length 192; head and body 107; tail 85; hind foot 23. Skull: Greatest length 26.8; basal length 24.5; zygomatic breadth 13.3; interorbital breadth 4.9; nasals 10.8 x 2.8; palatine foramina 5.8; diastema 6.8; upper molar series 4.4.

Remarks. From examination of an extensive series of specimens representing localities from the Pacific coast to the lower slopes of the eastern Andes of northern Peru, it is evident that *Akodon mollis* is divisible into four easily recognized forms. The division is primarily by cranial characters and secondarily by color. Typical *mollis* of the coast region and *allorum* of the western Andes differ somewhat in color and pelage but have the same type of skull as contrasted with *orophilus* of the central Andes and *orientalis* of the upper montagna region, these latter being likewise differentiated by color and dimensions. Ecuadorean specimens of *allorum* are not at hand, but the statement in the original description¹ that they are cranially "as in true *mollis*" is taken as sufficient evidence that they do not differ from specimens from the western Andes of Peru (Cajamarca, Otuzco, etc.).

***Akodon mollis orientalis* subsp. nov.**

Type from Poco Tambo, between Chachapoyas and Rioja, Peru. Altitude about 6000 ft. No. 19855 Field Museum of Natural History. Adult female. Collected June 29, 1912, by W. H. Osgood and M. P. Anderson.

Characters. Similar in cranial characters to *A. m. orophilus* but larger, longer-tailed, and much darker in color. Upper parts deep mummy brown in general appearance, the hairs annulated with dark umber and tipped with blackish; under parts heavily washed with tawny russet; tail and feet entirely blackish. Skull of the same general form and having the slender rostrum and short receding zygomatic plate as in *orophilus*, but braincase slightly broader and more ample.

¹ Thomas, Ann. & Mag. Nat. Hist., (3), xi, p. 404, April, 1913.

Measurements. Type: Total length 201; head and body 116; tail 85; hind foot 24. Skull: Zygomatic breadth 13.8; breadth of braincase 13; interorbital breadth 5.5; nasals 10.6 x 3.4; palatine foramina 5.7; diastema 7; upper molar series 4.6.

Remarks. This form is readily distinguished by its wholly black tail and feet, the other forms of *A. mollis* having grayish feet and a bicolored tail. These characters are seen in their incipiency in specimens from localities immediately west of Poco Tambo and evidence of the gradation from one form to the other is practically complete. At Poco Tambo the conditions are those of typical montagna with dense humid forests, but relatively cool climate.

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AN ANNOTATED LIST OF FISHES KNOWN
TO OCCUR IN THE FRESH WATERS
OF COSTA RICA

BY

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CHICAGO, U. S. A.

March 30, 1914.

AN ANNOTATED LIST OF FISHES KNOWN TO OCCUR IN THE FRESH-WATERS OF COSTA RICA.

BY SETH EUGENE MEEK.

The following paper is based on a collection of fishes made by myself during April, 1912, and on a number of small collections made from time to time by Dr. Anastasio Alfaro, Director of the National Museum of Costa Rica. In the list of localities under each species Dr. Alfaro's name follows those localities where specimens were collected by him.

The following is a list of localities arranged according to river basins. The figures give in meters the approximate altitude of each locality.

Rio Reventazon Basin, Atlantic;— La Junta (65); Chitaria (340); El Guayabo (360); Turrialba (621); Tucurrique (941); Juan Viñas (1000); Rio Iroquois (?); Quebrada de los Negros (?).

Rio San Juan Basin, Atlantic;— Costa Rica River, one half day's ride from Guapilis (100).

Rio Colorado Basin, Atlantic;— Guapilis (250); Virginia (350).

Rio Parismina Basin, Atlantic;— Parismina (240).

Rio Matina Basin, Atlantic;— Zent (20); Cuba River near Zent (20); La Victoria (50).

Rio Tárcoles Basin, Pacific;— El Sardinal, Santa Clara (60); Rio Turrubales (200); Orotina = Santo Domingo (250); Turrúcares (300); Rio Siquiáres (500); Irazú (1100+); Tiribi (1160); San José (1165); Rio María Aguilar (1165); Patarrá (1180); Tobosí (1200); San Isidro (1260); Pacaca (1500).

Rio Diquis Basin, Pacific;— Rio Grande de Térraba (367); Buenos Aires de Térraba (389); Boruca (563).

Rio Ballena Basin, Pacific;— Ballena (100); Rio Ballena (100).

Rio Tempisque, Pacific;— Las Cañas (50); Higuerón (50); Las Lajas, Taboga (50); Vol. Tenorio (?).

Rio Jesus María Basin, Pacific;— Jesus María at mouth of Rio Machuca (50); Orotina, Rio Machuca (250).

Rio Guacimal Basin, Pacific;— El Sardinal, Santa Clara (60).

Pacific;— Sumbres (?); Paso Agres (?); Brazo Seco (?); Punta Arenas (3); Tivives (10).

While collecting fishes in Costa Rica I was much aided in way of transportation by the United Fruit Company. I also received many courtesies from its agents at Limón, Zent, Victoria, and San José, also from Mr. Zeledon at Parismina.

Prof. Tristan of San José accompanied me to Orotina and the Rio Turrubales; Dr. Alfaro assisted me in collecting near San José. He also arranged for me transportation to Orotino and return, besides giving me the services of his assistant, Mr. Jesus María Moran, while I was on the western slope of Costa Rica. Dr. Alfaro permitted me to examine all of the fresh-water fishes from Costa Rica which he had collected from time to time in the past.

The following is a list of localities where collections were made by me in Costa Rica in April, 1912:

La Junta, small stream near station	April 7
Guapilis, Rio Guapilis	" 8
Virginia, Rio Virginia	" 9
Parismina, Rio Parismina	" 10
Zent, Rio Zent and Rio Cuba	" 12
La Victoria, Rio Zent and tributaries	" 13
Zent, Rio Zent	" 15
San José, Rio María Aguilar	" 18
San José, Rio Torres	" 19
Orotina, Rio Machuca	" 20
" Rio Turrubales	" 21
" Rio Grande	" 22
Jesus María, Rio Jesus María and Rio Machuca	" 23
San José, Rio Tiribi	" 26

Costa Rica is a well watered country. The sides of the tall volcanoes are furrowed by many small streams which unite, forming near their bases large rivers. The Reventazon from its source to beyond La Junta is a raging torrent; the same is true of the Rio Tárcoles opposite on the Pacific side. The smaller streams visited by me on the north slope of Volcano Turrialba flowed with considerable current over rocky or gravelly bottoms. There were only occasional stretches where the bottom was smooth enough to permit successful seining. The Rio Zent had much less current with a gravelly and sandy bottom. In the foot hills above La Victoria there were cascades and rapids. The Rio Cuba flowed, where visited, through a marshy region in a deep channel. In all of these streams the water was clear.

On the Pacific slope the streams are much the same as those on the

Atlantic. It was impossible to use a seine in the main channel of the Rio Tárcoles and so our collecting was confined to small bayous and cutoffs along the main stream. The Rio Machuca is a swift stream with many rocks and occasionally level stretches. Rio Turrubales has a moderately swift current and a sandy and gravelly bottom. Much the same conditions exist in the Rio Jesus María, only the current is less swift.

Family **Siluridæ.**

Rhamdia rogersi (Regan).

Pimelodus rogersi Regan, Ann. & Mag. Nat. Hist., 1907, 259 (Irazú, Costa Rica).

Rhamdia regani Meek, Pub. Field Mus., Zoöl. Ser., VII, 1907, 144 (Turrialba and Rio Tiribi, San José, Costa Rica).

Rhamdia brachycephala Meek (not Günther?), Pub. Field Mus., Zoöl. Ser., VII, 1907, 144 (Turrialba, Costa Rica).

Rhamdia rogersi Regan, Biol. Cent. Amer., 1907, pl. 23, fig. 1, 136.

This species is very abundant in the streams about San José, and appears rather common in the upland streams tributary to the Reventazon. It remains hidden under stones, and in other hiding places during dry weather. After a few rains in the latter part of April and in May they come out in large numbers in grassy places, where they are easily caught, and sold in the San José market. In the San José valley this is the only fish which grows large enough to be regarded as a food fish.

The species varies somewhat. Some of the larger ones are more slender than the others, and the occipital process may be long and narrow to rather robust. It is very probable that the species of *Rhamdia* in Central America have been unduly multiplied. This is due to the fact that they are subject to more variation than has been suspected and to the difficulty in securing sufficient material to study these variations. I have spent many hours in attempting to get these fishes from their hiding places in streams where I had reason to believe they were plentiful, with little or no results. I have never collected in the tropics in the rainy season when they are said to be abundant in shallow water. This species is very much like *Rhamdia brachycephala* Günther, and may prove to be identical with it.

Turrialba (17), 75 to 175 mm. (Alfaro); El Guayabo (8), 78 to 180 mm. (Alfaro); Chitaria (1), 135 mm. (Alfaro); Rio Tiribi (3), 114

to 140 mm. (Alfaro); San José (2), 91 and 108 mm. (Alfaro); Rio María Aguilar (8), 93 to 135 mm. (Alfaro); Rio Tiribi, San José (79), 45 to 160 mm. (Alfaro); Tiribi (19), 70 to 150 mm. (Alfaro); Patarrá (2), 80 to 130 mm.; San José, April 26 (79), 50 to 150 mm.

Rhamdia heteracantha Regan.

Rhamdia heteracantha Regan, Biol. Cent. Amer., 1907, 134 (Juan Viñas, Costa Rica).

Parismina (5), 125 to 205 mm.

Rhamdia underwoodi Regan.

Rhamdia underwoodi Regan, Biol. Cent. Amer., 1907, 135, pl. 23, fig. 4 (Juan Viñas, Costa Rica).

Costa Rica River (1), 155 mm.; Chitaria (1), 83 mm. (Alfaro); Tobosí (9), 68 to 105 mm. (Alfaro).

Rhamdia nasuta Meek.

Rhamdia nasuta Meek, Pub. Field Mus., Zool. Ser., VII, 1909, 207 (Buenos Aires de Térraba, Costa Rica).

Buenos Aires de Térraba (1), 125 mm.; Las Lajas, Taboga (17), 50 to 125 mm. (Alfaro).

Rhamdia wagneri (Günther).

Pimelodus wagneri Günther, Fishes Cent. Amer., 1869, 474 (Pacific and Atlantic Rivers of Panama).

Rhamdia wagneri Regan, Ann. & Mag. Nat. Hist., 1908, 457 (Rio Ballena).

This species was not obtained by me.

Arius evermanni Gilbert and Starks.

Arius evermanni Gilbert and Starks, Mem. Cal. Ac. Sci., 1904, 32, pl. 5, fig. 10 (Panama Bay);—Regan, Ann. & Mag. Nat. Hist., 1908, 457 (Rio Ballena).

This species more properly belongs to the salt-water fauna. Individuals of this and related species, however, often ascend streams to some distance, but probably not beyond the limits of tide water.

Family **Cyprinidæ.****Carassius auratus** (Linnæus).

Introduced species, which has escaped from aquaria.

Pacific side (1), 124 mm.; San José (in captivity) (1), 112 mm.

Family **Characidæ.****Astyanax æneus costaricensis** var. nov.

Astyanax ærstedii Meek, Pub. Field Mus., Zool. Ser., VII, 1907, 145
(Turrialba).

Tetragonopterus æneus Regan, Ann. & Mag. Nat. Hist., 1908, 455,
part (Rio Iroquois, Costa Rica).

Astyanax æneus (Günther) is very variable and when studied in more detail will, no doubt, be found to comprise a number of fairly well marked varieties. Specimens examined by me from both sides of Guatemala appear to be the same, *Astyanax a. microphthalmus* (Günther). In these the inner premaxillary teeth are 5-5, though occasionally these are 4-5. The maxillary teeth are 2-2, but these are sometimes 1-2 or 2-3. The anal rays range from 26 to 30. In form those from any one locality vary greatly, some being slender, others comparatively deep. Specimens from Lake Managua, Nicaragua, resemble those from Guatemala, except that the snout averages a little shorter and slightly blunter, the inner row of premaxillary teeth is 5-5, except occasionally 4-5. There are also a few more teeth on the maxillary; these are usually 2-3, but are occasionally 3-3 or 3-4. The anal rays average a little less, ranging from 25 to 29. This form is the *Astyanax ærstedii* (Kroyer) and the *Astyanax nicaraguensis* Eigenmann and Ogle.

In Costa Rica there are two well-marked varieties or species. Those from the Atlantic slope resemble the preceding forms, in that the inner premaxillary teeth are 5-5 (occasionally 4-4 or 4-5). The maxillary teeth are 2-2; these occasionally vary from 0 to 3; the anal rays vary from 28 to 31 (*Astyanax a. costaricensis* Meek).

Specimens from the west side of Costa Rica have the inner maxillary teeth 4-4, occasionally 4-5; the anal rays vary from 26 to 31. The form from the west side of Costa Rica differs rather more from the other forms than they do from each other (*Astyanax albeolus* Eigenmann).

The following table gives the counts of anal rays of a number of specimens:

Number of anal rays	25	26	27	28	29	30	31
<i>Astyanax æneus microphthalmus</i> (Günther)							
El Rancho, Guatemala (Atlantic)		1*	5	9	7	4	
San José del Idolo, Guatemala (Pacific)		1	7	7	9	4	
Lake Amatitlan, Guatemala (Pacific)		3	10	9	3		
<i>Astyanax æneus ærstedii</i> (Kroyer)							
Lake Managua, Nicaragua (Atlantic)	3	7	8	6	2		
<i>Astyanax albeolus</i> Eigenmann							
Jesus María, Costa Rica (Pacific)		2	6	10	6	2	1
Orotina, April 20, Costa Rica (Pacific)			4	9	10	4	
Turribales, Costa Rica (Pacific)		3	4	14	12	9	2
<i>Astyanax æneus costaricensis</i> Meek							
Guapilis, Costa Rica (Atlantic)					3	1	2
Parismina, Costa Rica (Atlantic)				1	7	8	4
Zent, April 15				9	11	4	2

* The figures in the columns give the number of specimens counted.

La Junta (39), 45 to 80 mm.; Guapilis (5), 75 to 125 mm.; Parismina (22), 80 to 125 mm.; Costa Rica River (2), 65 to 112 mm.; Cuba River (5), 82 to 105 mm.; Zent, April 12 (48), 55 to 100 mm.; Zent, April 15 (62), 56 to 120 mm.; La Victoria (22), 70 to 120 mm.; Chitaria (2), 85 to 95 mm. (Alfaro).

Astyanax albeolus Eigenmann.

Astyanax ærstedii Meek (not Kroyer), Pub. Field Mus., Zool. Ser., VII, 1907, 145, part (Rio Siquiaries* & Rio Machuca, Costa Rica).

Astyanax albeolus Eigenmann, Bull. Mus. Comp. Zool., 1908, 97 (Rio Machuca and Rio Siquiaries,* Costa Rica).

Astyanax æneus Meek, Pub. Field Mus., Zool. Ser., VII, 1907, 145 (Rio Siquiaries* and Pacific Side, Costa Rica).

Tetragonopterus æneus Regan (not Günther), Ann. & Mag. Nat. Hist., 1908, 456, part (Rio Grande de Térraba, Costa Rica).

Turribales (52), 45 to 115 mm.; Jesus María (48), 75 to 110 mm.; Orotina, April 20 (70), 50 to 145 mm.; Orotina, April 22 (160), 35 to 120 mm.; Rio Machuca (2), 115 and 118 mm. (Alfaro); Siquiaries (1), 86 mm. (Alfaro); Pacific Side (1), 83 mm. (Alfaro); Sumbres (10),

* Misspelled Siquiaries.

85 to 130 mm. (Alfaro); Paso Agres (1), 100 mm. (Alfaro); Turrubales (5), 75 to 115 mm. (Alfaro); Rio Higuera (48), 45 to 103 mm. (Alfaro); Las Cañas, Taboga (50), 30 to 40 mm. (Alfaro).

***Astyanax regani* Meek.**

Astyanax regani Meek, Pub. Field Mus., Zoöl. Ser., VII, 1908, 207 (Las Cañas, Costa Rica, Pacific Slope).

This species is nearest to *A. albeolus*. It differs in being more slender and more robust anteriorly. The snout is blunter and more decurved, the fins slightly shorter. In this species the anterior dorsal rays are shorter than the head, in *A. albeolus* they are as long as, or even longer than, the head. *A. regani* also has a shorter anal base.

Las Cañas, Costa Rica (type), 135 mm. (Alfaro); Pacific Side, Costa Rica (1), 100 mm. (Alfaro); Turrúcares (3), 95 to 110 mm. (Alfaro).

***Bryconamericus scleroparius* (Regan).**

Tetragonopterus scleroparius Regan, Ann. & Mag. Nat. Hist., 1908, 455 (Rio Iroquois).

Bryconamericus peruanus ricæ Eigenmann, Bull. Mus. Comp. Zoöl., 1908, 106 (Chitaria, Costa Rica).

Astyanax robustus Meek, Pub. Field Mus., Zoöl. Ser., X, 1912, 69 (Virginia River, Costa Rica).

This species varies considerably. The young, usually the smaller specimens up to 70 mm., have a higher and more pointed dorsal, the free edge of the fin being straight or slightly convex. The caudal lobes are pointed, and the color silvery (*B. scleroparius* (Regan) and *B. p. ricæ* Eigenmann). The larger specimens (140 mm.) have a much more robust body, the caudal peduncle being very broad; the dorsal fin is shorter, and the free edge convex. The caudal lobes are very short and rounded. The color of the large specimens is very dark, with a reddish tinge in life (*Astyanax robustus* Meek). The faint humeral spot on the young apparently disappears with age. Caudal spot scarcely defined in the large specimens, but present in the smaller ones, extending on the rays to the end of the caudal fin. Inner premaxillary teeth 4-4, the outer 5-5.

La Junta (5), 76 to 100 mm.; Virginia (50), 75 to 143 mm.; Parismina (30), 80 to 130 mm.; Zent, April 12 (8), 85 to 115 mm.; La Victoria (6) 95 to 120 mm.; Guapilis (27), 85 to 122 mm.; Chitaria (3), 82 to 95 mm. (Alfaro).

Bryconamericus terrabensis sp. nov.

Tetragonopterus emperador Regan (not Eigenmann & Ogle), Ann. & Mag. Nat. Hist., 1908, 456 (Rio Grande de Térraba, Costa Rica).

I did not obtain any specimens of this species. It differs from the eastern form chiefly in the smaller scales.

Carlia gen. nov.

Type *Cheirodon eigenmanni* Meek.

Body elongate, compressed; top of head convex; fontanelle large; mouth rather large, the maxillary not reaching posterior margin of the eye; entire edge of maxillary toothed, 2-2 anterior ones denticulate the remaining 6-6 canine, about equally spaced; premaxillary teeth 5-5, denticulate, in one series; teeth of lower jaw denticulate, in one series of 6-6, the last one on each side slightly longer than the others, these followed by 2-2 canine teeth; dorsal fin pointed, high.

I placed the type of this genus provisionally in the genus *Cheirodon* because of the similarity of its anterior teeth to those of that genus. I am indebted to Dr. Eigenmann for suggesting to me that it should be the type of a new genus, being close to *Rhoadsia* Fowler, and to whom I dedicate the genus.

Carlia eigenmanni (Meek).

Cheirodon eigenmanni Meek, Pub. Field Mus., Zool. Ser., x, 1912, 70 (La Junta, Costa Rica).

La Junta, Costa Rica (6), 60 to 65 mm.

Six specimens only of this interesting species were taken at La Junta.

Brycon guatemalensis Regan.

Brycon guatemalensis Regan, Biol. Cent. Amer., 1908, 168 (Rio Chisoy, Rio Usumacinta, Rio Motagua, and Lake Izabal, in Guatemala).

The dark edges of some of the scales forming irregular dark vertical streaks are very prominent on all Costa Rica specimens obtained by me.

This species is quite abundant in the deeper portions of the large streams. The larger specimens are very difficult to capture without the use of dynamite.

Costa Rica River (15), 175 to 365 mm.; La Victoria (8), 105 to 225

mm.; Zent, April 12 (20), 85 to 140 mm.; Zent, April 15 (4), 75 to 135 mm.; Parismina (22), 40 to 235 mm.

Brycon striatulus Kner.

Chalcinopsis striatulus Kner, Sitzgsb. Bayer. Ak., 1863, 226 (Rio Chagres, Panama).

Brycon striatulus Regan, Biol. Cent. Amer., 1908, 169 (Juan Viñas and El Pozo del Rio Grande, Costa Rica).

I did not obtain any specimens of this species in Costa Rica. This species differs from the preceding in having 70 to 75 scales in the lateral series instead of 52 to 56, the number for the preceding species. In general appearance the two species are alike; neither of the two species of *Brycon* listed here have yet been taken on the Pacific side of Costa Rica.

Ræboides guatemalensis (Günther).

Anacyrtus (Ræboides) guatemalensis Günther, Cat., v, 1864, 347 (Huamuchal, Guatemala; Rio Chagres, Panama).

Ræboides guatemalensis Meek, Pub. Field Mus., Zoöl. Ser., VII, 1907, 145 (Santo Domingo, Costa Rica);— Regan, Biol. Cent. Amer., 1908, 174 (Juan Viñas, El Pozo del Rio Grande, Costa Rica).

This species, though widely distributed in Central America, is not very abundant in Costa Rica.

Parismina (1), 94 mm.; La Junta (2), 75 and 90 mm.; Zent, April 12 (12), 73–87 mm.; Zent, April 15 (6), 58–92 mm.; Guapilis (1), 63 mm.; Santo Domingo (1), 90 mm. (Alfaro); Higuerón (18), 50 to 86 mm. (Alfaro); Machuca (1), 107 mm. (Alfaro).

Family **Pœciliidæ**.

Haplochilus dovii Günther. White Eye.

Haplochilus dovii Günther, Cat., vi, 1866, 316;— Günther, Trans. Zoöl. Soc., 1868, 481, pl. 82, fig. 5 (Punta Arenas, Costa Rica).

Fundulus dovii Regan, Biol. Cent. Amer., 1907, 80 (Punta Arenas, Costa Rica).

Dr. Alfaro informs me that this fish is known as White Eye, and is used for bait by fishermen in and near Punta Arenas.

Tivives (1) 155 mm. (Alfaro); Rio Higuerón (4), 140 to 180 mm. (Alfaro). Brazo Seco (8), 125 to 145 mm. (Alfaro).

Rivulus isthmensis Garman.

Rivulus isthmensis Garman, Mem. Mus. Comp. Zool., 1895, 140 (Rio San José, Costa Rica);—Regan, Biol. Cent. Amer., 1907, 82;—Regan, Ann. & Mag. Nat. Hist., 1912, 503.

Rivulus flabellicauda Regan, Ann. & Mag. Nat. Hist., 1907, 64 (Juan Viñas, Costa Rica);—Regan, Biol. Cent. Amer. 1907, 81, pl. 4, fig. 6 (Juan Viñas and San José, Costa Rica);—Regan, Ann. & Mag. Nat. Hist., 1912, 500 (Costa Rica).

The fact that I had collected so many specimens of this species near San José, and found none to agree with the description of *Rivulus isthmensis*, led me to suspect that but one species was found there. I sent a few specimens to Mr. Garman and asked him to compare them with his types of *R. isthmensis*. This he kindly did and informed me that they were the same. He states in his letter to me that “32 (the scale count for the lateral line) is in all likelihood an error for 42.”

San José, April 26 (20), 50 to 70 mm.; San José, April 19 (3), 51 to 60 mm.; Tucurrique (1), 62 mm. (Alfaro); San José (2), 75 mm. (Alfaro); Tobosí (16), 48 to 60 mm. (Alfaro); El Guayabo (3), 54 to 63 mm. (Alfaro).

The following species of *Pæciliidæ* belong to the subfamily *Pæciliinæ*, which comprises those species in which the anterior rays of the anal fin are considerably elongated and modified into an intromittent organ. Mr. Regan of the British Museum has recently published (Ann. & Mag. Nat. Hist., 1913, 977-1118) a revision of this family, basing his classification chiefly on the modified anal fin of the male. Although my manuscript was practically ready for publication when I received Mr. Regan's paper, I have changed it so far as it relates to the species here listed of this subfamily to conform to his classification. The males of many of the species of *Pæciliinæ* are so small, and so few in collections, that the study of the group is even more difficult than with the old classification. It is generally considered that the males of *Gambusia* and related genera are less numerous than the females, because they are taken in comparatively few numbers by collectors. This is, however, practically accounted for because of their small size, which enables them to pass easily through the mesh of the average collecting net which would easily retain the female.

I give here a key to the genera of this subfamily treated of in this paper, which is taken from the one published by Mr. Regan:

a. Lower edge of caudal peduncle sharp, without a median series of

- scales; bones of the lower jaw firmly united; teeth conical or villiform. *Alfaro.*
- aa. Lower edge of caudal peduncle rounded, or obtuse, with a median series of scales.
- b. Ventral fins similar in both sexes; first produced ray of anal fin of male without long processes or appendages.
- c. Anal fin of male short, ending in a small retrorse hook formed by second and third produced rays; teeth conical or villiform, not movable. *Brachyrhaphus.*
- cc. Anal fin of male ending in a more or less distinct antrorse hook; the anterior branch of the second produced ray curved forward.
- d. Mouth moderate, with distinct lateral cleft; teeth conical or villiform, not movable.
- e. Dorsal rays 7 to 12; origin of dorsal behind that of anal; extremity of anal fin of male supported equally by third and anterior branch of second produced rays. *Priapichthys.*
- ee. Dorsal rays 11 to 17; origin of dorsal in advance of that of anal; extremity of male anal fin a strong hook and formed by the unsegmented end of the anterior branch of the second ray. *Pseudoxiphophorus.*
- dd. Mouth small, transverse; teeth oar-shaped, movable; extremity of anal fin of male supported equally by first and anterior branch of second produced rays; first ray not serrated. *Paciliopsis.*
- bb. Ventral fins enlarged in the males, the second ray longest; first prolonged anal ray bearing a small antrorse spine at or near its end; last bearing a pair of processes directed outwards and towards the base of the fin. *Mollienisia.*

The following is a key to the species *Paciliinae* listed here and is based mostly on characters of the females:

- a. Dentary bones firmly united; teeth not movable; alimentary canal shorter than the body.
- b. Lower edge of caudal peduncle sharp, without a median series of scales. *Alfaro cultratum.*
- bb. Lower edge of caudal peduncle rounded or obtuse, with a median row of scales.
- c. Origin of dorsal well behind that of anal.
- d. No caudal spot; middle half of sides with 5 to 8 narrow vertical lines; D. 7. A. 9 or 10. *Priapichthys turrubarensis.*
- dd. A prominent caudal spot; no dark bars on sides; D. 7 or 8; A. 8 or 9. *Priapichthys parismina.*

- cc. Origin of dorsal slightly behind to well in advance of anal.
- e. Origin of anal under or slightly in advance of dorsal; origin of dorsal fin nearer tip of caudal than snout.
- f. Anal with a black blotch at base of anterior 5 rays to tip of third ray; dorsal rays 9 or 10. *Priapichthys olomina.*
- ff. Anal without dark blotch at base of anterior rays; dorsal rays 10 to 12. *Priapichthys annectens.*
- ee. Origin of anal below middle of dorsal; dorsal rays 11 or 12; an interrupted dark lateral stripe. *Pseudoxiphophorus terrabensis*
- eee. Origin of anal below anterior fourth of dorsal; origin of dorsal nearer tip of snout than end of caudal.
- g. A series of short, dark, vertical bars along the middle of the side; dorsal with 2 or 3 series of dark spots. *Brachyrhaphis rhabdophora.*
- gg. A few faint, narrow, dark bars on posterior half of body; basal third of dorsal black. *Brachyrhaphis umbratilis.*
- aa. Dentary bones not firmly united, teeth movable; alimentary canal longer than the body.
- h. Origin of the dorsal fin nearer tip of caudal than end of snout.
- i. Origin of dorsal behind that of anal, nearer tip of caudal than end of snout, midway between anterior margin of eye and tip of caudal fin; origin of anal in advance of dorsal; anal rays 10. *Paciliopsis retropinna.*
- ii. Origin of dorsal over or before that of anal.
- j. Origin of dorsal midway between base of caudal and anterior margin of the eye; modified anal of the male twice the length of head. *Paciliopsis pittieri.*
- jj. Origin of dorsal midway between base of caudal and middle of opercle; scales with darker centers; modified anal of male short, its length less than that of head.
- k. Base of dorsal rays without definite black spot; dorsal rays 9 to 11, the free edge convex. *Mollienisia sphenops.*
- kk. A black spot at base of dorsal rays; dorsal rays 8 or 9; free edge of dorsal straight or slightly convex. *Mollienisia s. tropica.*
- hh. Origin of dorsal midway between end of snout and posterior edge of caudal fin, behind that of anal; anal rays 8. *Mollienisia elongata.*

Alfaro Meek.

Petalosa Regan, Ann. & Mag. Nat. Hist., 1908, 458 (type *Petalosa cultratum* Regan).

Alfaro Meek, Pub. Field Mus., Zoöl. Ser., x, (September) 1912, 72
(type *Alfaro acutiventralis* Meek).

Petalurichthys Regan, Ann. & Mag. Nat. Hist., (November) 1912,
494 (substitute for *Petalosa* preoccupied in *Coleoptera*).

This paper by Regan, in which he first established the genus *Petalosa*, was overlooked by me in preparing an account of the new species collected by myself in Costa Rica in 1912, which resulted in my proposing the name *Alfaro* for this peculiar and interesting form. This name, however, preceded the substitute proposed by Mr. Regan after he discovered that *Petalosa* was preoccupied in *Coleoptera*.

***Alfaro cultratum* (Regan).**

Petalosa cultratum Regan, Ann. & Mag. Nat. Hist., 1908, 458 (Rio
Iroquois, Costa Rica).

Alfaro acutiventralis Meek, Pub. Field Mus., Zoöl. Ser., x, 1912, 72
(Guapilis, Costa Rica).

Petalurichthys cultratum Regan, Ann. & Mag. Nat. Hist., 1912, 494
(name only).

Alfaro cultratum Regan, Ann. & Mag. Nat. Hist., 1913, 981 (Costa
Rica).

Taken only among the rocks in clear rocky streams. One other species of this genus is known from Brazil.

Guapilis (38), 30 to 80 mm.; Parismina (36), 45 to 80 mm.; La Junta (9), 35 to 70 mm.; Virginia (15), 45 to 80 mm.

***Priapichthys turrubarensis* (Meek).**

Gambusia turrubarensis Meek, Pub. Field Mus., Zoöl. Ser., x, 1912,
71 (Turrubales, Costa Rica).

Priapichthys turrubarensis Regan, Ann. & Mag. Nat. Hist., 1913,
992.

Very abundant.

Orotina, April 22 (65), 25 to 65 mm.; Turrubales (89), 30 to 70 mm.;
Jesus María (37), 30 to 70 mm.; Rio Higuieron (48), 45 to 60 mm.
(Alfaro).

***Priapichthys parismina* (Meek).**

Gambusia parismina Meek, Pub. Field Mus., Zoöl. Ser., x, 1912, 71
(Parismina).

Priapichthys parismina Regan, Ann. & Mag. Nat. Hist., 1913, 992.
This species is easily distinguished from the other Costa Rica

Priapichthys by the large black caudal spot.

Parismina (28), 37 to 55 mm.

***Priapichthys olomina* sp. nov.**

Gambusia terrabensis Meek (not Regan), Pub. Field Mus., Zool. Ser., VII, 1907, 146 (Las Cañas, Alajuela, Costa Rica).

Type No. 7827, F. M. N. H.; length 50 mm.; Orotina, Costa Rica. Head 3.7 to 4.0; depth 3.2 to 3.3; D. 9 or 10; A. 8 or 9; scales 28.

Body robust; top of head flat; snout equal to or shorter than eye, its length 3.3 to 3.7 in head; diameter of eye 3.0 to 3.6; interorbital 1.7 to 1.8; pectoral not reaching ventrals, 1.3 in head; depth of caudal peduncle 1.5 in head; anal fin of male reaching $\frac{2}{3}$ distance to caudal fin, its length 4 in body.

Greenish olive, edges of scales black; side with a row of small quadrate spots which disappear in some large examples; posterior $\frac{2}{3}$ of body with narrow vertical bars, interradiation membranes of dorsal black; anal with a black blotch at base of anterior 5 rays extending to tip of third ray; caudal sometimes with a black bar near its tip.

This species is very abundant in the valley of the Rio Grande de Tárcoles.

Orotina, April 20 (135), 25 to 50 mm.; Turrubales (3), 40 to 50 mm.; Pacaca (3), 26 to 48 mm. (Alfaro); Pacific Side (16), 20 to 60 mm. (Alfaro).

***Priapichthys annectens* (Regan).**

Gambusia annectens Regan, Ann. & Mag. Nat. Hist., 1907, 259 (Carillo, Juan Viñas and Irazú, Costa Rica);—Regan, Biol. Cent. Amer., 1907, 97, pl. xiv, figs. 5 and 6 (Carillo, Juan Viñas and Irazú, Costa Rica);—Meek, Pub. Field Mus., Zool. Ser., VII, 1907, 145 (Turrialba; San José; Quebrada de los Negros; San Isidro; Pacific Side).

Priapichthys annectens Regan, Ann. & Mag. Nat. Hist., 1913, 992 (Costa Rica).

This species is more abundant in the streams about San José than any of the species of fishes found there.

Rio María Aguilar (16), 32 to 60 mm. (Alfaro); San José (27), 26 to 49 mm. (Alfaro); Quebrada de los Negros (24), 35 to 62 mm. (Alfaro); San Isidro (2), 43 mm. (Alfaro); Tucurrique (5), 38 to 60 mm. (Alfaro); Tobosí (2), 30 mm. (Alfaro); San José, April 26 (180), 30 to 70 mm.;

San José, April 19 (100), 28 to 70 mm.; San José, April 18 (150), 30 to 65 mm.; Parismina (24), 35 to 75 mm.; Guapilis (6), 35 to 45 mm.

Pseudoxiphophorus terrabensis (Regan).

Gambusia terrabensis Regan, Ann. & Mag. Nat. Hist., 1907, 260 (Rio Grande de Térraba);—Regan, Biol. Cent. Amer., 1907, 97, pl. XII, fig. 7 (Rio Grande de Térraba, Costa Rica).

Pseudoxiphophorus terrabensis Regan, Ann. & Mag. Nat. Hist., 1913, 993 (Rio Grande de Térraba, Costa Rica).

I did not obtain any specimens of this species.

Brachyrhaphis rhabdophora (Regan).

Gambusia rhabdophora Regan, Ann. & Mag. Nat. Hist., 1908, 457 (Volcano of Tenorio, and Rio Grande de Térraba, Costa Rica).

Brachyrhaphis rhabdophora Regan, Ann. & Mag. Nat. Hist., 1913, 997 (Costa Rica).

None of this species was taken by me.

Brachyrhaphis umbratilis (Meek).

Gambusia umbratilis Meek, Pub. Field Mus., Zoöl. Ser., 1912, 70 (Guapilis, Costa Rica).

Virginia (22), 30 to 52 mm.; Guapilis (60), 38 to 49 mm.

Pæciliopsis retropinna (Regan).

Pæcilia retropinna Regan, Ann. & Mag. Nat. Hist., 1908, 458 (Boruca, Costa Rica).

Pæciliopsis retropinna Regan, Ann. & Mag. Nat. Hist., 1913, 997 (Costa Rica).

No specimens were secured by me.

Pæciliopsis pittieri (Meek).

*Pæcilia pittieri** Meek, Pub. Field Mus., Zoöl. Ser., x, 1910, 71 (La Junta, Costa Rica).

Pæciliopsis pittieri Regan, Ann. & Mag. Nat. Hist., 1914, 997.

This species was taken in swift rocky streams on the Atlantic side. It is not so abundant as the preceding. The long, modified anal of the

*This species was named for Dr. Henry Pittier, who has done very much to advance our knowledge of the natural history of Costa Rica.

male easily distinguishes this species from the *Mollienisia s. tropica* found in the same region. The specimens collected by me are as follows:

La Junta (14), 38 to 70 mm.; Parismina (11), 58 to 70 mm.; Guapilis (18), 27 to 63 mm.; Virginia (4), 35 to 55 mm.

Mollienisia sphenops (Cuvier & Valenciennes).

Pæcilia sphenops Cuvier & Valenciennes, Hist. Nat. Poiss., XVIII, 1846, 130, pl. 526 (Vera Cruz, Mexico);—Regan, Biol. Cent. Amer., 1907, 102, pl. XIII, figs. 3-7, part.

Mollienisia sphenops Regan, Ann. & Mag. Nat. Hist., 1913, 1012 (part).

This species is widely distributed and varies greatly. The original types were taken at Vera Cruz, Mexico, probably in the salt-water pools there where it is very abundant, and where it grows comparatively large. I did not do any collecting in salt water in Costa Rica, and so did not obtain any specimens, but presume those occurring there are the same as those taken at Vera Cruz, Mexico.

Mollienisia sphenops tropica (Meek).

Platypæcilia tropicus Meek, Pub. Field Mus., Zoöl. Ser., VII, 1907, 146 (Turrialba, Costa Rica).

Pæcilia tenuis Meek, Pub. Field Mus., Zoöl. Ser., VII, 1907, 147 (Rio María Aguilar, Costa Rica).

Pæcilia tropica Regan, Biol. Cent. Amer., 1908, 191; Regan, Ann. & Mag. Nat. Hist., 1908, 459 (Rio Iroquois).

Pæcilia sphenops Regan, Biol. Cent. Amer., 1907, 102, part (San José, Costa Rica);—Regan, Ann. & Mag. Nat. Hist., 1908, 458 (Volcano of Tenorio).

Pæcilia spilonota Regan, Ann. & Mag. Nat. Hist., 1908, 460 (San José, Costa Rica).

Pæcilia caucana Regan (not Steindachner), Biol. Cent. Amer., 1908, 190, pl. 13, fig. 2 (San José and Rio María Aguilar, Costa Rica).

Pæcilia caudata Meek, Pub. Field Mus., Zoöl. Ser., VII, 1909, 209 (Turrubales, Costa Rica).

Mollienisia sphenops Regan, Ann. & Mag. Nat. Hist., 1913, 1012 (part).

The inland or fresh-water forms of this species or variety found in Costa Rica are very variable, and as a result several species have from time to time been described. The upland forms in general are smaller

than those found in the larger streams in or near the lowlands. Without the opportunity of examining material from the salt or brackish water of Costa Rica, and after comparing the material at my command with specimens from the salt water at Vera Cruz, Mexico, it seems best to recognize these inland forms as a variety or subspecies of the preceding.

The females and many of the males of these inland forms usually have a black spot at the base of the middle dorsal rays, the free margin of the dorsal is straight or slightly convex, and the caudal fin is subtruncate, and in these respects this subspecies presents a few trifling differences from the species. On many specimens from salt and brackish water some of the scales have a dark spot which forms lines along the rows of scales. These spots are not present on the specimens from the uplands and are scarcely present on some from the larger lowland streams. In both the species and subspecies some of the larger males have a very high dorsal fin. On many of the males, especially from the larger streams, the basal half of the caudal is black, or with black blotches; on some of these the basal half of the dorsal is also black. In general, the upland specimens are more uniform in coloration than those from the lowland streams.

Patarrá (17), 52 to 80 mm. (Alfaro); Rio María Aguilar, San José (8), 48 to 80 mm.; Rio Tiribi, San José (275), 30 to 70 mm.; Rio Grande. Orotina, April 22 (29), 28 to 80 mm.; Rio Machuca, Orotina (20), 30 to 60 mm.; Turrubales (75), 30 to 90 mm.; Jesus María (2), 43 mm.; Virginia (5), 45 to 72 mm.; Zent, April 12 (20), 37 to 92 mm.; La Victoria (24), 28 to 105 mm.; La Junta (24), 60 to 110 mm.; Parismina (11), 43 to 90 mm.; Guapilis (35), 44 to 95 mm.; Turrubales (3), 64 to 78 mm. (Alfaro); Rio María Aguilar, San José (20), 30 to 60 mm. (Alfaro); Chitaria (1), 53 mm. (Alfaro); Turrialba (1), 50 mm. (Alfaro); Tucurrique (4), 65 to 120 mm. (Alfaro); Tiribi (2), 64 to 70 mm. (Alfaro); Las Lajas, Taboga (12), 35 to 45 mm. (Alfaro); Rio Higuerón (30), 37 to 83 mm. (Alfaro).

Family Mugilidæ.

Joturus pichardi Poey. Bobo.

Joturus pichardi Poey, Mem., II, 263, 1861 (Cuba);— Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 821 (Costa Rica);— Meek, Pub. Field Mus., Zool. Ser., VII, 1907, 148 (Reventazon River; El Sardinal, Santa Clara, Costa Rica).

Xenorhynchichthys stipes Regan, Ann. & Mag. Nat. Hist., 1908, 461
(Rio Iroquois).

The young of this species has two oblique black bands on each lobe of the caudal and two similar ones on the soft dorsal and anal fins. Large examples, 270 mm. and up, are darker in color, the fins being the color of the body except lighter on distal portion. These larger examples have a prominent tubercle on the upper edge of the snout, which is probably used to turn stones to obtain crustaceans and insects upon which they feed. These fishes are abundant in the rocky streams of Costa Rica, and especially so at the foot of rapids and waterfalls. They are difficult to capture except with the use of dynamite. The white employees of the United Fruit Company regard this species as the best food fish found in the Costa Rica rivers. It is reported to reach a length of 3 feet, but the largest obtained by us at La Victoria were about 2 feet in length. These largest specimens I did not preserve. The specimens, large and small, examined by me have teeth on the vomer, palatines and pterygoids. Mr. Hildebrand kindly examined the type of *Joturus stipes* Jordan and finds teeth also on the palatines. This species varies greatly especially with age. It is generally known throughout Central America as Bobo.

Victoria (5), 55 to 320 mm.; Virginia (1), 110 mm.; Zent, April 12 (14), 90 to 150 mm.; Zent, April (5), 78 to 120 mm.; Rio Reventazon (1), 300 mm. (Alfaro); El Sardinal, Santa Clara (1), 270 mm. (Alfaro).

Agonostomus monticola (Bancroft).

Mugil monticola Bancroft, in Griffith's Ed. Cuvier's Animal Kingdom, 1836, 367, pl. 36 (West Indies).

Agonostomus masutus Regan, Biol. Cent. Amer., 1906, 68, pl. x, fig. 4 (Juan Viñas, Costa Rica).

Agonostomus percoides Regan, Ann. & Mag. Nat. Hist., 1908, 461
(Rio Iroquois).

These fishes inhabit clear running water and are usually most abundant in swift currents where there are many rocks. They are very timid, retreating under rocks or overhanging banks when in the least disturbed. In general, the smaller specimens have thin lips and a terminal or subterminal mouth. Apparently with age the lips thicken and the lower jaw shortens and becomes subinferior. It is very probable that most, if not all, of the American species referred to this genus are the same, the variations being due to age and probably to sexual differences. The larger specimens are very difficult to collect except with

the use of dynamite. In Costa Rica this species and *Joturus pichardi* are regarded as excellent food fishes.

Virginia (4), 55 to 185 mm.; Parismina (8), 50 to 95 mm.; Zent, April 15 (9), 67 to 120 mm.; Zent, April 12 (26), 90 to 185 mm.; La Victoria (7), 58 to 225 mm.; Costa Rica River (5), 211 to 236 mm.; La Junta (2), 47 to 87 mm.; Orotina, April 20 (4), 75 to 165 mm.; Jesus María (7), 70 to 160 mm.; Turrubales (21), 60 to 128 mm.; Turrialba (1), 98 mm. (Alfaro); El Sardinal, Santa Clara (1), 235 mm. (Alfaro).

Family Syngnathidæ.

Siphostoma elcapitanense Meek and Hildebrand sp. nov.

Head 9.0; depth 3.0; D. 33; rings 14+38; dorsal on 0+9 rings; body slender, the angles not prominent; anal fin wanting; snout equal to postorbital part of head.

Color, grayish brown mottled with pearly spots.

This species occurs in the streams on the west slope of eastern Panama. It will be described in more detail in an account of the Fishes of Panama, by Meek and Hildebrand. Type locality, El Capitan, Panama.

Jesus María (1), 85 mm.; Turrubales (1), 110 mm.

Family Atherinidæ.

Menidia chagresi Meek and Hildebrand sp. nov.

Head 4.4 to 5.0; depth 6.1 to 6.9; D. III or IV-1, 7 to 9; A. 1, 20 to 23; scales 42 to 44.

Body elongate, the ventral region moderately compressed, but without an edge; mouth rather small, the lower jaw the shorter; teeth in jaws in villiform bands, the outer series in the upper jaw enlarged; scales with entire edges, except a few in front of dorsal and on median line of the back slightly crenate; soft dorsal and anal without scales.

Color, greenish above, paler below; sides with a conspicuous bluish black band. Type locality, Gorgona, Canal Zone.

A more complete description of this species will appear in an account of the Fishes of Panama, by Meek and Hildebrand.

Zent, April 12 (30), 60 to 80 mm.; Parismina (5), 65 to 70 mm.

Family **Centropomidæ.****Centropomus pectinatus** Poey.

Centropomus pectinatus Poey, Mem., II, 12, 1860 (Havana and Cienfuegos);—Regan, Biol. Cent. Amer., 1906, 46.

Centropomus medius Regan, Biol. Cent. Amer., 1906, 47.

Mr. Regan regards *C. pectinatus* Poey and *C. medius* Günther as closely related but different species, the former occurring on the Atlantic side, the latter on the Pacific. The studies of Mr. Hildebrand and myself, of a considerable amount of material from both coasts of Panama, leads us to consider that but one species exists. In the streams in Costa Rica I obtained this species only on the Pacific side.

Jesus María (17), 93 to 285 mm.; Rio Grande, Orotina (1), 290 mm.

Centropomus undecimalis (Bloch).

Sciæna undecimalis Bloch, Ausl. Fisch., VI, 1792, 60, pl. 203 (Jamaica).

Centropomus undecimalis Regan, Biol. Cent. Amer., 1907, 49.

This species occurs only on the Atlantic side of tropical America.

Zent, April 12 (3), 183 to 193 mm.

Centropomus robalito Jordan and Gilbert.

Centropomus robalito Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 462 (Mazatlan; Acapulco);—Regan, Biol. Cent. Amer., 1907, 51.

This species occurs only on the Pacific side of tropical America.

Jesus María (2), 211 to 227 mm.

Family **Lutianidæ.****Neomænsis argentiventris** (Peters).

Mesoprion argentiventris Peters, Berlin. Monatsbr., 1869, 704 (Mazatlan).

This species is more often taken in fresh and brackish water than in the sea.

Jesus María (1), 223 mm.

Family **Carangidæ.****Caranx latus** Agassiz.

Caranx latus Agassiz, Pisc. Bras., 1829, 105 (Brazil).

One specimen of this species was taken in swift clear water at the foot of rapids, with *Joturus*, *Agonostomus*, and *Brycon*.

Zent (1), 180 mm.

Family **Liognathidæ.****Gerres brevimanus** Günther.

Gerres brevimanus Günther, Proc. Zool. Soc. Lond., 1864, 152
(Chiapas, Guatemala).

The members of this family are marine, although some few species ascend rivers to some distance above tide water.

This species was very abundant in the Rio Jesus María.

Jesus María (21), 50 to 245 mm.

Encinostomus californiensis (Gill).

Diapterus californiensis Gill, Proc. Ac. Nat. Sci. Phila., 1862, 245
(Cape San Lucas).

Jesus María (6), 63 to 120 mm.

Family **Cichlidæ.**

The Cichlids; Mojarras.

In Costa Rica thirteen species of cichlids have been taken. It is probable that others known from Nicaragua also occur in the lower courses of the rivers of Costa Rica, which flow into Lake Nicaragua and its outlet, the Rio San Juan. The cichlids occupy a position in the fresh-waters of tropical America quite similar to that of the sun-fishes in the eastern half of temperate North America. In general form they are much alike, and so far as known have in general much the same habits. Some species, like many of the genus *Lepomis*, have

very small mouths; while others, like *Cichlasoma dovii*, much resemble our black basses. No one has tested the game qualities of the cichlids, but a few that I have caught in Lake Managua on a baited hook certainly put up a good fight. As food fishes they rank well with our sunfishes, and in the markets of the larger cities on the lakes in Nicaragua they are offered for sale.

These fishes are the most important food fishes of the fresh-waters of Central America. The Bobo (*Joturus*) and the Trucha (*Agonostomus*) are perhaps better flavored, but they are usually difficult to capture and more limited in their distribution, occurring usually only in swift running water. The large characins are too full of bones, and the catfishes (*Rhamdia*) are too small and too few in number to be of any special commercial importance, although their flesh is of excellent flavor. It would seem that the larger cichlids are deserving of considerable attention. They are hardy and some of the larger species would, no doubt, do well to domesticate as pond fishes.

The significance of the thickened lips in some species, as well as the hump developed on the nape of others, is not well understood. The genus *Cichlasoma* has been broken up into a number of genera, most of which are scarcely of importance sufficient to be retained as subgenera.

The following is a key to the species of *Cichlasoma* known to occur in the fresh-waters of Costa Rica:

- a. Mouth large; a few of the anterior teeth enlarged and canine-like; lower jaw the longer.
- b. Anal spines 4 to 6; pectoral fin short, about $1\frac{2}{3}$ in head; fold of lower lip free; dorsal XVIII to XIX, 12 or 13. *dovii*.
- bb. Anal spines 7 to 9; pectoral fin $1\frac{1}{3}$ in head; fold of lip free; dorsal XVII to XVIII, 9 or 10. *friedrichsthalii*.
- aa. Mouth smaller, no enlarged canine-like teeth in either jaw; jaws equal or the lower one the shorter.
- c. Fold of lower lip free.
- d. Free fold of lower lip broad, the lips usually thick, sometimes developed as fleshy median lobes; dorsal XVI, 13 or 14; anal IV to V, 9; caudal fin emarginate; pectoral not reaching anal; sides with dark bars; vertical fins with dark spots. *tuba*.
- dd. Free fold of lower lip narrow, without fleshy median lobes; dorsal XVI to XVII, 11 to 13; anal VI to VIII, 7 to 9; caudal fin rounded; vertical fins without dark spots. *citrinellum*.
- cc. Fold of lower lip interrupted at the symphysis.
- e. Lower lip forming broad lateral folds; dorsal XVI, 11; anal V, 8 to 9; caudal fin slightly rounded; sides with 5 to 6 dark cross

- bars; light blue spots on body, soft dorsal, anal and caudal fins.
altifrons.
- ee. Lower lip not forming broad lateral folds.
- f. Caudal fin subtruncate or rounded; sides without well defined lateral blotch.
- g. Anal spines 8 to 10; pectoral reaching past first anal spines; dorsal XVII to XVIII, 8 to 10; anal VIII to X, 7 to 8; body with about 7 dark bars; vertical fins without spots. *spilurum.*
- gg. Anal spines 4 to 7.
- h. Anal spines 6 to 7; teeth conical, and pointed at all ages.
- i. Spinous dorsal low, the middle ones about 4 in head; pectoral not reaching front of anal; dorsal XVII to XVIII, 10 or 11; anal VI to VII, 8 to 9; sides with 7 cross bars and a broken lateral band; vertical fins with few pale spots. *alfari.*
- ii. Spinous dorsal higher, the middle spines about 3 in head; pectoral reaching front of anal.
- j. Caudal peduncle without a large dark blotch; dorsal XVII to XVIII, 10 to 11; anal VI to VII, 8 or 9; sides with 7 dark bars and a broken lateral band; vertical fins with pale spots. *lethrinus.*
- jj. Caudal peduncle with a large dark blotch; dorsal XVI to XVII, 12 to 14; anal VI to VII, 9 to 10; depth 1.7 to 2.0. *maculicauda.*
- hh. Anal spines 4 to 5; teeth more or less compressed at base, the tips pointed or truncate; pectorals not reaching anal.
- k. Dorsal rays 11 to 12; dorsal XVII to XVIII, 11 to 12; anal V, 8 to 9; sides with broad cross bars, none of the scales with black spots; vertical fins with dark spots. *underwoodi.*
- kk. Dorsal rays 9 to 10; dorsal XVII to XVIII, 9 to 10; anal IV to V, 6 to 7; sides with faint cross bars, some of the scales with black spots forming broken lines along the rows of scales; no spots on vertical fins. *punctatum.*
- ff. Caudal fin emarginate or slightly forked, sides with a well-defined lateral blotch.
- l. Snout pointed, mouth terminal, the profile nearly straight; pectoral reaching first anal spine; dorsal XVII, 10 or 11; anal VII, 8 or 9. *rostratum.*
- ll. Snout rounded, mouth subinferior, profile convex; dorsal XIX to XX, 10 to 11; anal VIII to IX, 7 to 8; pectorals not reaching front of anal; a black spot on middle of the side below lateral line; vertical fins with numerous white spots. *spilotum.*

Cichlasoma dovii (Günther).

Heros dovii Günther, Proc. Zool. Soc. Lond., 1864, 154 (Lake Nicaragua);—Günther, Fishes of Cent. Amer., 1866, 461, pl. 73, fig. 4 (Lake Nicaragua).

Color variable, sides with vertical bars irregular and not well defined in the larger specimens; usually a dark spot on each scale on lower part of the body, these forming broken stripes along the rows of scales; anal spines 6 or 7; vertebræ 15 + 19 = 34. This species grows larger than any other cichlid found in Costa Rica. It is the largest and most important food fish in the lakes of Nicaragua as well.

Parismina (1), 130 mm.; Costa Rica River (2), 215 to 240 mm.; Zent, April 12 (8), 115 to 290 mm.; Zent, April 15 (11), 50 to 160 mm.; La Victoria (13), 45 to 250 mm.; Rio Higuerón (11), 43 to 115 mm. (Alfaro).

Cichlasoma tuba Meek. Tuba.

Tomocichla underwoodi Régan, Ann. & Mag. Nat. Hist., 1908, 463 (Rio Iroquois) (preoccupied).

Cichlasoma tuba Meek, Pub. Field Mus., Zool. Ser., x, 1912, 73 (La Victoria).

By the people at La Victoria this species is known as Tuba. The dentition of this species varies considerably. In the smaller specimens examined by me the anterior teeth are conical or nearly so. In most of the larger specimens these teeth are more or less flattened at the base, their tips being truncate or slightly rounded. There is also considerable variation in the thickness of the lips; in some specimens, usually the smaller, the lips are normal; in others they vary from normal to lips similar (though smaller) to those of *Cichlasoma lobocheilus* Günther. Two specimens (170 to 180 mm.) from La Victoria have very thick lips and compressed teeth, while a specimen from Guapilis (195 mm.) has the lips nearly normal and the teeth much less compressed. The teeth in general are more compressed in specimens with the thickest lips, and these are only in the most general way correlated with size. I am inclined to believe that the variation in the dentition is due to age; and the thickened lips are due to age and are also associated in some way with breeding.

The backward position of the ventral fins is not very marked in this species, especially when compared with other slender species of *Cichlasoma*. The species which form the types on which were based the genera *Herichthys*, *Paranetroplus* and *Tomocichla* have a variable and quite

similar dentition, and form a series from the strictly conical teeth of most of the *Cichlasoma* nearly to the strictly compressed incisor teeth of *Neetroplus*. The fact that the dentition of the species listed under these genera vary so greatly, apparently with age, renders this character of little generic or specific value. Vertebræ $16 + 16 = 32$.

***Cichlasoma friedrichsthali* (Heckel).**

Heros friedrichsthali Heckel, Flusfische Brazil, 1840, 381 (Rio San Juan, Nicaragua).

The specimens listed below have 6 with 7 anal spines, 2 with 8, and 6 with 9. The smaller specimens have from 7 to 9 dark lateral bars with a faint broken lateral band; the larger ones have a more prominent lateral band with the bars faint or wanting. Usually a black spot on suboperculum; soft dorsal, anal and caudal fins with dark dots.

La Victoria (1), 128 mm.; Zent, April 12 (5), 62 to 108 mm.; Parismina (3), 60 to 125 mm.; Zent, April 15 (5), 90 to 105 mm.; Parismina (4), 35 to 85 mm.; La Victoria (8), 40 to 220 mm.; Virginia (1), 145 mm.; Zent, April 12 (2), 33 to 170 mm.; Guapilis (6), 111 to 205 mm.; Cuba River (1), 205 mm.; Costa Rica River (2), 205 to 245 mm.

***Cichlasoma citrinellum* (Günther).**

Heros citrinellum Günther, Proc. Zoöl. Soc. Lond., 1864, 153 (Lake Nicaragua).

Cichlasoma citrinellum Regan, Biol. Cent. Amer., 1908, 187 (Juan Viñas, Costa Rica).

I did not obtain any specimens of this species in Costa Rica. It is very abundant in the lakes Nicaragua and Managua and in the smaller neighboring lakes. It is interesting, though rather unexpected, to find this species at an altitude of over 3,000 feet in Costa Rica and not in the streams of the lower lands. No doubt it occurs there but is probably very scarce.

***Cichlasoma altifrons* (Kner & Steindachner).**

Heros altifrons Kner & Steindachner, Sitzb. Ak. Bayern., 1863, 223; — Kner & Steindachner, Abhandl. Ak. Bayern., x, 1866, 11, fig. 1 (Chiriqui, Western Veragua).

Cichlasoma altifrons Regan, Ann. & Mag. Nat. Hist., 1908, 463 (Rio Grande de Térraba, Costa Rica).

I did not obtain any specimens of this species.

***Cichlasoma spilurum* Günther.**

Cichlasoma spilurum Günther, Cat., IV, 1862, 289 (Yzabal & Rio Motagua, Guatemala).

Cichlasoma septemfasciatus Regan, Ann. & Mag. Nat. Hist., 1908, 461 (Rio Iroquois).

The specimens from Turrubales are identical with those taken on the Atlantic Side. Those from the Rio Higuieron are more robust anteriorly, and only the three and anterior bars and the one at the base of caudal are distinct, the others are quite faint. On the middle of the side the three anterior bars form three black lateral blotches. This species is very abundant in the East Coast streams of Costa Rica, but rather scarce on the Pacific Side.

I have compared the specimens listed below with several specimens from the Rio Motagua, Guatemala, and find no specific differences.

Guapilis (48), 45 to 110 mm.; Zent, April 12 (85), 36 to 120 mm.; Parismina (36), 60 to 110 mm.; La Victoria (19), 55 to 120 mm.; Zent, April 15 (11), 45 to 100 mm.; Cuba River (4), 70 to 105 mm.; Turrubales (1), 97 mm.; Turrubales (1) 103 mm. (Alfaro); Rio Higuieron (24), 45 to 95 mm. (Alfaro); Chitaria (2), 50 to 76 mm. (Alfaro).

***Cichlasoma alfari* Meek.**

Cichlasoma alfari Meek, Pub. Field Mus., Zool. Ser., VII, 1907, 148 (Turrialba).

This species has been taken at Turrialba, apparently reaching a higher altitude than any other cichlid in Costa Rica. Vertebræ 12+16 = 28.

Parismina (5), 40 to 165 mm.; Costa Rica River (3), 133 to 178 mm.; Virginia (1), 165 mm.; Guapilis (19), 80 to 175 mm.; Turrialba (4), 60 to 93 mm. (Alfaro); Tucurrique (7), 65 to 135 mm. (Alfaro).

***Cichlasoma lethrinus* Regan.**

Cichlasoma lethrinus Regan, Ann. & Mag. Nat. Hist., 1908, 462 (Rio Iroquois).

This species is close to *Cichlasoma alfari*. It differs from that species in having a slightly deeper body, a larger eye, a straighter profile and higher dorsal spines. The dark bars on side are prominent and the lateral band less defined than *C. alfari*. Vertebræ 13+15 = 28.

Zent, April 12 (63), 40 to 160 mm.; Zent, April 15 (13), 70 to 140 mm.; Parismina (11), 50 to 100 mm.; La Victoria (15), 75 to 150 mm.;

Guapilis (13) 45 to 100 mm.; Chitaria (12), 47 to 92 mm. (Alfaro); Rio Higuera (6), 32 to 136 mm. (Alfaro).

Cichlasoma maculicauda Regan.

Cichlasoma maculicauda Regan, Ann. & Mag. Nat. Hist., 1905, 227 (Lake Yzabal, Rio Motagua, Guatemala; Rio Chagres).

I did not obtain this species in Costa Rica. The fact that it has been found in Guatemala and Panama, and that it is a resident of lowland streams, being occasionally taken in brackish water, it may be expected to occur in some of the lowland streams of Costa Rica. It is one of the best marked of the cichlids, being easily distinguished by the large round black blotch on the caudal peduncle and base of caudal fin.

Cichlasoma underwoodi (Regan).

Herichthys underwoodi Regan, Biol. Cent. Amer., 1906, 30, pl. III, fig. 5 (Costa Rica).

Cichlasoma sieboldii Regan (not Steindachner), Biol. Cent. Amer., 1908, 186 (Costa Rica).

Paraneetroplus sieboldii Regan (not Steindachner), Ann. & Mag. Nat. Hist., 1908, 464 (Rio Grande de Térraba, Costa Rica).

Cichlasoma frontale Meek, Pub. Field Mus., Zoöl. Ser., VII, 1909, 210 (Turrubales, Costa Rica).

In the Turrubales River this species was found to be very abundant. Vertebræ 15 + 16 = 31.

Rio Grande, Orotina (16), 30 to 70 mm.; Turrubales (65), 45 to 225 mm.; Turrubales (5), 128 to 150 mm. (Alfaro).

Cichlasoma punctatum Meek.

Cichlasoma punctatum Meek, Pub. Field Mus., Zoöl. Ser., VII, 1907, 210 (Buenos Aires, Costa Rica).

This species is near the preceding, but differs in color and markings and in fewer soft rays on dorsal and anal fins. The only specimens I have seen are those listed below which were collected by Mr. Carriker. Vertebræ 14 + 17 = 31.

Buenos Aires (12), 85 to 100 mm. (Carriker).

Cichlasoma rostratum (Gill & Bransford).

Heros rostratum Gill & Bransford, Proc. Ac. Nat. Sci. Phila., 1877, 181 (Lake Nicaragua).

Soft dorsal and caudal fins with white spots, these sometimes forming bars. In 1907* I suggested that this species was probably the male of *Cichlasoma longimanus* (Günther). Since I secured only the one form in Costa Rica and find both sexes represented, it is evident that the two species are not the same.

La Victoria (4), 140 to 205 mm.; Zent, April 12 (20), 77 to 200 mm. Zent, April 15 (8), 68 to 98 mm.

***Cichlasoma spilotum* Meek.**

Cichlasoma spilotum Meek, Pub. Field Mus., Zoöl. Ser., x, 1912, 73 (La Victoria, Costa Rica).

This species is known only from material listed below. It is easily distinguished from the other Costa Rica *Cichlasoma* by the decurved profile, small subinferior mouth, and by the prominent black spot on middle of the side below the lateral line. Vertebrae 15+17=32.

La Victoria (11), 95 to 190 mm.

***Neetroplus fluviatilis* Meek.**

Neetroplus fluviatilis Meek, Pub. Field Mus., Zoöl. Ser., x, 1912, 74 (Costa Rica River near Guapilis).

This species resembles in form *Neetroplus nematopus* Günther, from Lake Nicaragua. It differs from that species in a more convex interorbital, a more decurved profile, a more slender body, and in having 6 or 7 faint though well defined dark bars on the sides. The specimens of *Neetroplus nematopus* in this museum from Nicaragua are uniform brownish with a faint dark bar downward and backward from the 9'' and 10'' dorsal spines; a nuchal crest is also developed on some of these specimens 85 mm. in length, and is very prominent on a specimen 135 mm. On the two specimens of *N. fluviatilis* there is no nuchal crest.

Costa Rica River (2), 110 to 123 mm.

***Herotilapia multispinosa* Günther.**

Herotilapia multispinosa Günther, Fishes Cent. Amer., 1869, 453, pl. LXXIV, fig. 2 (Lake Managua).

In general form and appearance this species resembles *Cichlasoma spilurum*, from which it is easily distinguished by its tricuspid incisor-like teeth. Vertebrae 13+15=28.

Zent, April 12 (2), 77 to 135 mm.; Zent, April 14 (1), 80 mm.

* Pub. Field Mus., Zoöl. Ser., VII, 1907, 126.

Family **Pomadasidæ.****Pomadasis croco** (Cuvier & Valenciennes).

Pristopoma croco Cuvier & Valenciennes, Hist. Nat. Poiss., v, 1830, 264 (Martinique).

Pomadasis croco Regan, Biol. Cent. Amer., 1907, 44.

This species inhabits the eastern streams and coasts of tropical America.

La Victoria (15), 87 to 195 mm.; Zent, April 12 (17), 70 to 183 mm.; Zent, April 15 (5), 90 to 200 mm.

Pomadasis bayanus Jordan & Evermann.

Pomadasis bayanus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1906, 33 (Bayano River, Panama);— Regan, Biol. Cent. Amer., 1907, 43.

Pacific Coast streams of tropical America.

Jesus María (4), 87 to 345 mm.

Family **Gobiidæ.**

Nearly all of the members of this family are marine. Some species, however, run into brackish and fresh water, though seldom beyond the influence of the tides; others, as *Conophorus*, *Scycidium* and some species of *Eleotris*, are permanent residents of fresh water.

Philypnus dormitor (Lacépède).

Gobiomorus dormitor Lacépède, Hist. Nat. Poiss., II, 1798, 599 (Martinique).

Philypnus dormitator Regan, Biol. Cent. Amer., 1906, 5.

The dark lateral band is very well marked in specimens up to about 75 mm. In larger specimens (290 mm.) it becomes broken up and fades into the general color of the body. Caudal fin with spots arranged to form 5 or 6 vertical bars; these bars are broader and less numerous than those on the caudal fin of the following species.

Parismina (2), 258 to 400 mm.; La Victoria (7), 65 to 215 mm.; La Junta (1), 285 mm.; Zent, April 12 (5), 125 to 300 mm.; Zent, April 15 (8), 95 to 230 mm.

Philypnus maculatus Günther.

Lembus maculatus Günther, Cat., 1, 1859, 505 (Ecuador).

Philypnus maculatus Regan, Biol. Cent. Amer., 1906, 5;—Regan, Ann. & Mag. Nat. Hist., 1908, 464 (Rio Ballena, Costa Rica).

In this species the lateral band is formed of dark blotches which are in most cases indistinct up to about 170 mm. These spots run together, forming a narrow dark stripe in specimens 200 mm. and larger. The caudal fin in smaller specimens with small spots arranged in about 10 narrow dark vertical bars.

Orotina, Rio Grande (38), 65 to 255 mm.; Turrubales (2), 140 and 160 mm.; Orotina, April 20 (2), 180 and 235 mm.; Jesus María (23), 40 to 130 mm.

Dormitator maculatus (Bloch).

Sciæna maculata Bloch, Ausl. Fische, 1790, 299, fig. 2 (West Indies).

Dormitator maculatus Regan, Biol. Cent. Amer., 1906, 8 (Southern Mexico; Haiti; St. Croix).

This species is very variable, and it seems quite impossible to separate the east and west forms, when a considerable amount of material from both sides is compared. The relation of the east and west forms will be treated of by Meek and Hildebrand in their report on the collections of fishes made by them in Panama.

Jesus María (5), 48 to 82 mm.; Rio Cañas, Taboga (4), 60 to 90 mm.

Guavina guavina (Cuvier & Valenciennes).

Eleotris guavina Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 223 (Martinique).

This species inhabits Atlantic Coast streams from Mexico to Brazil. I did not secure any specimens in Costa Rica. My collecting was done in streams on the eastern side at a greater altitude than this species usually attains.

Eleotris macrolepis sp. nov.

Type No. 7775, F. M. N. H.; length 40 mm.; Jesus María, Costa Rica.

Head 3.15; depth 5.55; D V. 9; A 1-7; scales 33.

Body subterete to slightly compressed posteriorly; head depressed; lower jaw the longer; maxillary reaching to anterior third of eye;

diameter of eye 4.0 in head; snout 4.0; interorbital narrow, concave, its width 7.7 in head; nape naked nearly to spinous dorsal; pectoral fin broad, nearly reaching front of anal; breast and abdomen without scales; caudal fin rounded; gill membranes connected to the isthmus.

Color light olivaceous, the sides reticulated with darker and with 4 or 5 dark lateral blotches, caudal fin barred with darker. Known only from the type.

Eleotris latifasciatus Meek & Hildebrand.

Eleotris latifasciatus Meek & Hildebrand, Pub. Field Mus., Zoöl. Ser., x, 1912, 68 (Rio Cardenas, Panama).

This species had formerly been known only from Pacific streams of Panama.

Jesus María (1), 39 mm.

Eleotris picta Kner & Steindachner.

Eleotris picta Kner & Steindachner, Abhandl. Bayern Ak., 1864, 18, pl. 3, fig. 1 (Rio Bayano near Panama).

Pacific Coast rivers from California to Ecuador.

Rio Grande, Orotina, April 22 (1), 310 mm.; Jesus María (3), 68 to 117 mm.

Chonophorus talasica (Lichtenstein).

Gobius talasica Lichtenstein, Berl. Abhandl., 1822, 273 (Brazil).

Chonophorus banana Regan, Biol. Cent. Amer., 1906, 11.

This species inhabits the East Coast rivers from Mexico to Brazil and the fresh waters of the West Indies.

Guapilis (1), 195 mm.; La Victoria (5), 91 to 210 mm.; Parismina (2), 50 and 107 mm.; Zent, April 12 (11), 75 to 165 mm.; Zent, April 15 (13), 85 to 105 mm.; La Junta (1), 77 mm.

Chonophorus transandeanus (Günther).

Gobius transandeanus Günther, Cat., III, 1861, 62 (Western Ecuador).

Chonophorus transandeanus Regan, Biol. Cent. Amer., 1906, 12 (Western Ecuador);— Meek, Pub. Field Mus., Zoöl. Ser., VII, 1907, 150 (Rio Machuca, Costa Rica).

Awaous nelsoni Evermann, Proc. Biol. Soc. Wash., 1898, 3 (Rosario, Sinaloa, Mexico).

This species inhabits fresh-water streams of the Pacific Slope from Sinaloa, Mexico, to Ecuador.

Turrubales (1), 115 mm.; Orotina (28), 73 to 220 mm.; Jesus María (7), 115 to 120 mm.; Rio Machuca (1), 200 mm. (Alfaro).

Sicydium pittieri Regan.

Sicydium pittieri Regan, Ann. & Mag. Nat. Hist., 1907, 260 (Rio Grande de Térraba, Costa Rica);—Regan, Biol. Cent. Amer., 1908, 185.

Turrubales (1), 62 mm.

Sicydium altum Meek.

Sicydium altum Meek, Pub. Field Mus., Zoöl. Ser., VII, 1907, 149 (Turrialba, Costa Rica);—Regan, Biol. Cent. Amer., 1908, 185.

Males with the high dorsal fins, the longest spines 3 in body. The head of this species is broader and interorbital wider than the preceding. Young individuals (40 mm.) have 7 broad vertical bars on the side, becoming faint on larger (80 mm.) specimens, and three narrow ones on caudal fin. This species is very abundant on the gravelly bottom and on the rocks in clear running water. They rest attached to rocks by the suctorial disk on the pectoral fins.

La Victoria (22), 36 to 84 mm.; Parismina (1), 50 mm.; Zent, April 15 (10), 37 to 80 mm.; Zent, April 12 (5), 53 to 65 mm.; El Guayabo (2), 85 to 98 mm. (Alfaro).

Family **Gobiesocidæ**.

Gobiesox costaricensis Meek.

Gobiesox costaricensis Meek, Pub. Field Mus., Zoöl. Ser., X, 1912, 74 (Zent, Costa Rica).

These small fishes can be seen clinging to rocks in clear water in considerable numbers, but their capture is very difficult. This species is probably a resident of fresh water only.

Zent, April 12 (3), 50 to 61 mm.; Parismina (1), 41 mm.; Turrubales (2), 42 mm.

Family **Pleuronectidæ.****Citharichthys spilopterus** Günther.

Citharichthys spilopterus Günther, Cat., IV, 1862, 421 (New Orleans).

This species is said to vary considerably. The specimen taken in the river at La Victoria has head 3.6; depth 2.0; dorsal rays 60; anal rays 53; scales 53; eye 5.9 in head; maxillary 2.5; pectoral 2.0.

La Victoria (1), 155 mm.

Family **Soleidæ.****Achirus fonsecensis** (Günther).

Solea fonsecensis Günther, Cat., IV, 1862, 475 (Gulf of Fonseca).

Achirus fonsecensis Regan, Biol. Cent. Amer., 1906, 3 (Gulf of Fonseca, and Rio Presidio).

Jesus María (24), 30 to 80 mm.

In the foregoing list there are recorded 71 species of fishes; all except two have been known to occur in the fresh waters of Costa Rica. The two, *Pacilia sphenops* and *Cichlasoma maculicauda*, occur in the brackish and fresh water near the coast from Mexico to Panama, and no doubt are to be found in Costa Rica.

The Characins and the Cichlids are the only families treated of in this paper which belong strictly to fresh water. Of the Characins there are nine species, six occurring on the Atlantic and four on the Pacific side. One species, *Ræboides guatemalensis*, a lowland form, occurs on both sides. It ranges from southern Mexico south into South America. The Cichlids are represented by 15 species; 12 occur on the Atlantic and 6 on the Pacific side, three species being common to both sides. None of the species of these two families is found in the streams about San José; they exceed but little, if any, an altitude of 1000 meters.

The catfishes belonging to the genus *Rhamdia*, a fresh-water group, are represented by 5 species, four occurring on the Atlantic and 3 on the Pacific side, two species being common to both sides; one of these, *R. rogersi*, is quite abundant in the streams forming the head waters of the Rio Tárcoles and the Rio Reventazon, the other, *R. wagneri*, is known only from the lowlands. It no doubt occurs on the Atlantic side of Costa Rica although not yet taken there. The *Paciliidæ* are represented by 14 species, 8 on the Atlantic side and 10 on the Pacific,

4 species being common to both sides. Two of these occur on the divide in upland streams, one from the lowlands to the highest altitude attained in Costa Rica by any fish, while the remaining one is taken in the brackish and salt water near or on the coasts. All except two of the *Pæciliidæ* are viviparous. The one, *Haplocheilus dovii*, nearest to *Fundulus*, has been taken only in salt and brackish water on the Pacific side of Costa Rica, the other *Rivulus isthmensis* occurs in small upland streams. The remaining fishes taken in the fresh waters of Costa Rica belong to families, most of whose members live in salt water. Some of these have become established in fresh water and are properly fresh-water fishes; the others are really salt-water fishes which have been taken occasionally in fresh waters.

The fish fauna of Costa Rica is mostly like that of the Nicaragua Lake region. This relationship will be more marked when the lowland streams of both Nicaragua and Costa Rica will have been more thoroughly explored.

While the fish fauna of Costa Rica is essentially that of South America, it is not likely that its fishes migrated from South America along Panama within recent geological times. Whatever its ancestors may have been, or what may have been their relation with those of South America, we must regard Central America as a somewhat remote center of distribution. From recent studies by Mr. Hildebrand and myself in the region of the Canal Zone, it is quite evident that strictly South American migrants in comparatively recent times did not go far beyond the Canal Zone and that most of these are lowland forms which came from the streams on the Atlantic side of Colombia to the Pacific side after the last gap (Atrato-Tuyra) here between the two oceans was closed. We find *Curimatus*, *Ctenolucius* and *Gasteropelecus* and other Colombian Atlantic forms in streams opposite the Rio Chagres, but not in it. Some Loricarids occur in these streams and also in the Rio Chagres, but these appear to us to have probably crossed from the Pacific side streams to the Chagres and not to have migrated from the rivers of Colombia to the Chagres direct. The distribution of the fresh-water fishes of central Panama will be treated of in detail by Meek and Hildebrand in their report on the fishes of the Biological Survey of the Canal Zone.

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FOUR NEW MAMMALS FROM
VENEZUELA

BY

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CHICAGO, U. S. A.

April 8, 1914.

FOUR NEW MAMMALS FROM VENEZUELA.

BY WILFRED H. OSGOOD.

Among South American mammals obtained in recent years by the Field Museum of Natural History are four from western Venezuela that appear to be undescribed. They are as follows:

Peramys palliolatus sp. nov.

Type from San Juan de Colon, State of Tachira, Venezuela. Altitude 2,500 ft. No. 20524 Field Museum of Natural History. Adult male. Collected Nov. 14, 1913, by M. P. Anderson. Orig. No. 159.

Characters.—Similar in general characters to *Peramys brevicaudatus* but color of under parts entirely rich tawny; hairiness at base of tail reduced to about a half-inch, that of the upper side only slightly exceeding the lower; skull larger and teeth relatively small.

Color.—Median upper parts from end of nose to rump with hairs dull slaty at the base and tipped with yellowish gray, the whole forming a broad grayish dorsal band; sides of face including a narrow line over the eye, sides of body, arms and legs, and entire under parts deep rich ferruginous; hands and feet dusky mixed with ferruginous; scaly part of tail blackish above and below.

Skull.—Similar to that of *P. brevicaudatus* but larger; nasals long and broadly expanded posteriorly; naso-frontal suture emarginate; rather marked postorbital swellings; molariform teeth slightly smaller than in *brevicaudatus*.

Measurements.—Type: Total length 197; head and body 116; tail 79; hind foot 21.5. Skull of type: Greatest length 36; basal length 36; zygomatic breadth 19.8; greatest interorbital breadth 7.5; least interorbital breadth 6.3; length of nasals 17; greatest width of nasals 5.8; palate length from gnathion 20; front of canine to back of M^4 14.4; combined length of Ms^{1-3} 6.5.

Remarks.—This species is not only darker in color than *brevicaudatus* but the hairiness of the upper side of its tail is much less extensive. It is evidently larger and darker than *P. b. orinoci* and *P. b. dorsalis*

and has the under parts more richly colored. For purposes of comparison, a specimen collected by R. H. Becker at Itacoatiara, near Manaos, Brazil, has been regarded as representing true *brevicaudatus*.

Odocoileus lasiotis sp. nov.

Type from Paramo de los Conejos, Sierra de Merida, Venezuela. Altitude 9,000 ft. No. 20198 Field Museum of Natural History. Adult male. Collected Aug. 19, 1912. Received from S. Briceño Gabaldon and Sons.

Characters.—A medium-sized deer with full long pelage (hairs on back and sides 30–50 mm.), densely hairy and relatively short ears, broad heavy tail, and dark grayish coloration with rather extensive blackish brown markings; no metatarsal gland.

Color.—General color of upper parts buffish gray, the hairs broccoli brown or drab with a broad subterminal annulation of buffy and a dusky tip producing a somewhat coarsely peppery appearance; sides of body notably paler than back; a continuous dark brown line from the nose over the head, neck, and shoulders to the middle of the back, widening to cover practically the entire forehead and interorbital region, broadening again over the shoulders and thence gradually merging with lighter toward the tail; sides of head and face grayish finely punctulated; sides of nose dark brown continuous with median dark frontal area and separated from rhinarium and upper lips by a sharply defined line of buffy white; a broad blackish eyering; chin creamy white with a conspicuous blackish brown submaxillary spot on each side separated from the narrowly white throat by a buffy gray continuation from the sides of the face; lower neck and brisket brownish drab only slightly punctulated or lined with whitish; axillary region buffy white continuous with a well defined stripe down the hind side of the foreleg to the “knee” and bordered by pale cinnamon; foreleg mixed drab and cinnamon fawn becoming brighter nearly clear clay color touched with tawny below the “knee”; a well-marked dark brown line from midway of the humerus down the front of the leg to the pastern where it is interrupted by a fulvous area followed by a broad brown spot at the base of the hoofs; belly white, continuous with a sharp stripe down the inner side of each hind leg to a point opposite the hock; remainder of hind legs colored practically like forelegs but brownish stripe less pronounced; ears densely hairy on the outside, dark drabbish bistre distally somewhat more grayish proximally; lower base of ear and one third of lower side white; inside of ear thickly clothed with long creamy white hairs; tail

broad and heavily haired, the hairs at the tip extending 75-85 mm. beyond the vertebræ and those on the sides 70-80 mm.; median upper side of tail Prout's brown, the hairs self-colored on the distal half of the tail, broadly tipped with pale cinnamon on the proximal half and continuous with the color of the back; under side of tail white, the hairs longer than the median dark ones of the upper side.

Skull.—Practically as in *O. savannarum* (= *O. spinosus*); smaller and having decidedly weaker dentition than *O. gymnotis* as represented by specimens from the Maracaibo region, Venezuela.

Antlers.—The antlers of the type are in the velvet and were received attached to the skin, the pedicels having been hacked through with a machete in removing the skin. They are rather small (length on outer curve 320 mm.) and only the right antler is normal, the left having the beam depauperate and shorter than the back tine. The right antler has four points, a strong well-developed subbasal snag (70 mm.), a long slender bez or back tine directed upward and backward (105 mm.), and a short trez (25 mm.) two thirds of the way from the base of the bez to the point of the forwardly directed beam. The burr is heavy and the subbasal snag together with the beam below the bez is highly rugose.

Measurements.—Type (dressed skin, measured dry): Head and body 1460; tail vertebræ 130; hind foot 340; ear from crown 125; ear from notch 110. Skull of type: Greatest length 244; basilar length 220; tip of premaxillæ to end of palate 157; zygomatic width 100; mastoid width 82; interorbital width 63; median length of nasals 72; greatest width of nasals 27.6; width between outer sides of second upper molars 69; length of upper toothrow 71; lower toothrow 72.2.

Remarks.—So far as known, all the deer of the genus *Odocoileus* previously described from northern South America inhabit the lowlands in the arid or semi-arid savannas, regions of light intermittent forest or open grasslands. They are short-haired and largely ochraceous or "reddish" in color and their hoofs are narrow and pointed. The species above described evidently inhabits the paramos and the scattered tongues of forest surrounding them at considerable elevation above the hot regions. Its full long pelage leaves no room for doubt that its habitat is relatively cool and moist. Even if they were abundant, deer would be difficult to obtain in these mountain regions; but it is probable this species is rare, since no specimen of it has been obtained previously, although the Merida region is one from which much natural history material has been sent for a number of years.

Several names have been given to deer of the genus *Odocoileus* from

northern South America, but so far as they can be assigned to definite localities all of them apply to the one or more lowland species generally recognized under the names *gymnotis* and *savannarum*. Among these names is one based on very defective material supposed to have been received from Bogota, Colombia, which is in a highland region, but the material itself offers no evidence to the contrary and all the probabilities favor the view that the animal was actually killed in the lowlands, its horns merely having passed through the highlands in transit to the coast whence they were taken to a European museum.

The status of the various names may be discussed briefly as follows:¹
1833. *Cervus gymnotis* Wiegmann, Isis, p. 963, 1833.

This species is usually credited to Colombia, but its type locality is the Orinoco region, doubtless the savannas on the lower part of the river, for although it is stated in the original description that it came from Colombia this is qualified by the information that its former possessor had received it via St. Thomas (W. I.) from the Orinoco region. For purposes of comparison, specimens from the savannas east of Lake Maracaibo, Venezuela, have been used to represent this species but it is by no means certain that they are identical with the Orinoco animal of which no complete specimens are available.

1846. *Cervus spinosus* Gay and Gervais, Ann. Sci. Nat., Ser. 3., Zool., V, pp. 93-94, 1846.

This name has priority over *savannarum* and, so far as can be judged from the description, was founded upon the same species. It has page priority over *Cervus goudotii* and is antedated only by *C. gymnotis*. Therefore it should be the recognized name of the Guiana deer unless that species proves not to differ from the animal of the lower Orinoco region in which case it would become a synonym of *gymnotis*. The essential part of the original description is as follows: "Ainsi G. Cuvier fait connaître, comme se rapportant au *Cervus virginianus*, des bois envoyes de Cayenne par M. Poiteau; mais il est evident qu'ils sont d'une autre espèce. Ces bois sont petits, épineux à un seul andouiller, etc. Nous signalerons cette espèce à l'attention des zoologistes sur le nom de *Cervus spinosus*."

1846. *Cervus goudotii* Gay and Gervais, Ann. Sci. Nat., Ser. 3., V, p. 94, 1846.

The basis of this name was a small single-branched horn, probably still preserved in the Paris Museum. It was said to have been received from "les régions élevées de la Nouvelle-Grenade." At

¹ For friendly aid in consulting books not contained in Chicago libraries, I am indebted to Mr. N. Hollister of the U. S. National Museum.

the most, this indefinite statement of locality could only mean that the specimen was secured from a native or bought in a shop in the interior of Colombia, probably in Bogota. Deer are exceedingly rare and difficult to obtain in the mountains near Bogota and it is even doubtful whether any except small brockets (*Mazama*) occur there; whereas they are fairly common in the savannas directly east of Bogota along the upper Meta River on Orinoco drainage. A trade route between this region and Bogota has been open for many years and the skins or parts of the lowland animals as well as living animals for pets are constantly carried to Bogota for sale.¹ It is highly probable, therefore, that the type of *Cervus goudotii* came from the upper Orinoco region east of Bogota, Colombia. So far as known, the deer of this region do not differ from those of the lower Orinoco. The name *goudotii* may therefore be regarded as a synonym of *gymnotis*.

1848. *Cervus savannarum* Cabanis and Schomburgk, *Reisen in Brit. Guiana*, III, p. 785, 1848.

Although this name is usually regarded as representing a valid form differing from *gymnotis* at least in certain external characters, it is doubtful if specimens typically representing the two ever have been compared. Two imperfect skulls in the Field Museum obtained by M. P. Anderson and R. H. Becker at Boa Vista, Rio Branco, Brazil, may be considered practically as topotypes of *savannarum*, for Fort San Joaquim (very near Boa Vista) was Schomburgk's headquarters for some time and he has especially mentioned the abundance of deer in that vicinity.

Unfortunately, it seems necessary that the name *savannarum* be superseded by *spinus* which has two years' priority.

1879. *Gymnotis wiegmanni* Fitzinger, *Sitzungsber. K. Ak. Wiss. Wien*, LXXVIII, p. 344, 1879.

A renaming of *Cervus gymnotis* Wiegmann, of which, therefore, it is an absolute synonym.

1879. *Cervus columbicus* Fitzinger, *Sitzungsber. K. Ak. Wiss. Wien*, LXXIX, p. 66, 1879.

Based on a skull and horns described and figured but not named by Pucheran (*Arch. du Mus.*, VI, p. 335, pl. 23, fig. 1, 1852). These were obtained from Bogota, Colombia, by the French traveler and naturalist Roulin. "Bogota" is of course a generalized locality covering the

¹ Dr. F. M. Chapman, who has lately done some thorough ornithological work in the Bogota region, assures me that at present the skins of spotted cats, jaguars, pumas, etc., and certain live birds and mammals offered for sale in Bogota are largely from the eastern savanna or llano region.

whole Bogota region and, as in the case of *C. goudotii*, it may mean that the specimen actually had its source in the savannas east of Bogota near the Meta River. Pucheran's figure, however, shows a pair of horns of somewhat unusual character, not referable with certainty to any known species. The disposition of the name *columbicus*, therefore, awaits competent examination of the type in the Paris Museum.

Rhipidomys fulviventor elatturus subsp. nov.

Type from Paramo de Tama, head of Tachira River, Venezuela. Alt. 7,000 ft. No. 18691 Field Museum of Natural History. Adult male. Collected March 3, 1911, by W. H. Osgood and S. G. Jewett. Original No. 4252.

Characters.—A small *Rhipidomys*, smaller than any previously described species of the restricted genus; general characters and coloration essentially as in *R. fulviventor*, but belly paler, tail shorter, hind foot smaller, and audital bullæ smaller. Upper parts practically uniform tawny ochraceous evenly and finely mixed with dusky; a slight tawny ochraceous line; ears and tail sooty brown; under parts creamy white, lightly washed on the middle of the belly with pale tawny, the hairs, except those of the chin, with dark slaty bases.

Measurements.—Type and adult female topotype, respectively: Total length 225, 225; head and body 108, 108; tail 117, 117; hind foot, with claw 24, 23. Skull of type: Greatest length 28.2; basilar length 21.4; zygomatic breadth 15.6; interorbital constriction 4.3; nasals 11.3x 2.9; interparietal 10.7x3.9; palatine foramina 5.7x2; diastema 7.4; upper toothrow 4.5.

Remarks.—This form is well distinguished from *fulviventor* but in the present unrevised condition of the genus, its relationship is conveniently indicated by the trinomial. Typical examples of *fulviventor* have not been available for use in the present connection and conclusions have been based upon the original description supplemented by specimens from eastern Peru referred to *fulviventor* by Oldfield Thomas.

It is not improbable that the rats of this genus are more restricted within the boundaries of continuously forested areas than those less arboreal in habit. Relatively small discontinuities of forest, therefore, may be locally more effective factors of isolation than temperature and altitude.

Proechimys poliopus sp. nov.

Type from San Juan de Colon, State of Tachira, Venezuela. Altitude 2,500 ft. No. 20525 Field Museum of Natural History. Subadult. Collected Nov. 15, 1913, by M. P. Anderson. Orig. No. 160.

Characters.—A relatively small species with grayish throat, forearms, and fore and hind feet. Size about as in *P. urichi* and *P. ochraceus*; smaller than *P. mincæ* and *P. guairæ*; spines rather weak, about as in *P. urichi*.

Color.—Upper parts dull tawny liberally mixed with black on the head and back, the sides being paler; under parts chiefly white, the middle throat and an irregular line on each side of the belly drab gray only slightly paler than the basal color of the hairs of the sides; front of forearms and forefeet darker drab gray approaching broccoli brown; hind feet grayish drab with a slight touch of whitish on the inner sides; tail very lightly haired, blackish above, yellowish white below.

Skull.—Similar to that of *P. ochraceus* but audital bullæ decidedly smaller, almost as small as in *P. urichi*; palatine foramina rather short and broad leading posteriorly into shallow channels on each side of the palate; zygomata somewhat heavier than in *P. urichi* and nasals shorter; supraorbital ridges relatively weak; parieto-interparietal suture practically obliterated before full maturity; parietals without ridges; teeth about as in *P. ochraceus*, slightly larger than in *P. urichi*.

Measurements.—Type: Total length 363; head and body 223; tail 140; hind foot 46. Skull of type (last molar in place, but not quite high enough to be functional): Greatest length 48.9; basilar length 34.4; zygomatic breadth 24.7; interorbital breadth 11.1; nasals 16.6x 5.1; diastema 10; postpalatal length 18.3; palatine foramina 4.2x3; upper tooththrow 8.7.

Remarks.—The gray forelimbs and feet distinguish this species from all of its congeners to which it is similar in other respects. From *P. canicollis*, which also has gray limbs, it is distinguished by its smaller size, its much darker and more uniform color (that of the head undifferentiated from that of the body), and its cranial characters. *P. mincæ* sometimes has grayish forelimbs, but it is a larger species with wholly white under parts. Actual comparison has been made with topotypical material representing *P. urichi*, *P. ochraceus*, *P. mincæ*, and *P. canicollis*. *P. guairæ* is doubtless related also, but its larger size and white feet distinguish it.

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MAMMALS OF AN EXPEDITION
ACROSS NORTHERN PERU

BY

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CHICAGO, U. S. A.

April 20, 1914.

MAMMALS OF AN EXPEDITION ACROSS NORTHERN PERU.

BY WILFRED H. OSGOOD.

The zoölogical work of the Field Museum in South America in 1912 was largely confined to northern Peru which was crossed from west to east by M. P. Anderson and myself during the months from January to September. Approximately 2,000 specimens of mammals and birds were collected including a gratifying number that fulfill in an important way the objects of the expedition.

Some of the larger mammals, as the Spectacled Bear and the White-lipped Peccary, already have been prepared for exhibition, while other material serves to complete the necessities for certain large habitat groups previously planned. The collection of mammals proves to contain sixteen species and subspecies new to science¹ as well as many species and no less than twelve genera new to Field Museum including some, as *Mesomys* and *Amorphochilus*, which may fairly be called great rarities.

The following account of the mammals obtained by the expedition has been abbreviated by circumstances which have made it necessary to omit certain illustrations and discussion of problems of geographic distribution. As a contribution to the scanty knowledge of the mammals of the region, however, it seems advisable to publish the list in its present form with introductory matter reduced to a brief description of localities.

Although somewhat less so than formerly, it is still necessary in classifying neotropical mammals to consult, either directly or vicariously, the collections of the British Museum. It is with the utmost gratitude, therefore, that I acknowledge the continued assistance of Mr. Oldfield Thomas who has made numerous comparisons for me with species not possessed by any American museum. Thanks are extended

¹ Nine of the new forms have been described in a preliminary paper (Field Mus. Nat. Hist., Pub. 168, Zool. Ser., X, pp. 93-100, May 31, 1913); a tenth was named in a monographic revision by G. S. Miller (Proc. U. S. Nat. Mus., XLVI, pp. 413-416, Dec. 31, 1913); and six are described in the present paper.

also for specimens borrowed from the American Museum of Natural History through Dr. J. A. Allen and from the U. S. National Museum through Mr. Gerrit S. Miller.

The route followed by the expedition was the so-called "Moyobamba route," over which no zoölogist had traveled previously, although the Polish naturalist Stolzmann had covered some parts of it about thirty years before. A preliminary trip was made during March into the mountains east of Trujillo in the vicinity of Otuzco after which the main journey was begun. We left the coast at Pacasmayo going by rail across the arid plain and thence proceeding with mules over the mountains by way of Cajamarca, Balsas, and Chachapoyas to Moyobamba. Thence to Balsapuerto we went on foot over a rough trail with Indian porters or *cargueros* carrying our collections and equipment. The remainder of the journey was by water, from Balsapuerto to Yurimaguas by canoe on the Paranapura River and from Yurimaguas down the Amazon by steamship.

The localities at which collections were made are as follows:

Menocucho, Feb. 21-Mch. 5. A small village at the terminus of a short railway line running eastward from Trujillo a distance of about 20 miles. The region is mostly arid and forbidding but along the banks of a small stream, the Moche River, there is considerable light growth of thorny bushes and small trees while near by are canefields and small gardens under irrigation. Altitude 900 ft. = ¹

Hacienda Llagueda, Mch. 8-Mch. 17. A large hacienda near the headwaters of the southern branch of the Chicama River, owned by Sr. Armas of Trujillo to whom, as well as to his eldest son Don Luis Armas, we were indebted for many favors. This place was reached by trail from Menocucho to Otuzco and thence across the divide separating Otuzco from the drainage of the Chicama. The hacienda occupies both sides of a very steep canyon traversed by a small swift stream. Although there is some open country, uncultivated vegetation is relatively profuse largely on account of fogs which constantly settle in the canyon. The cultivated crops are principally coffee and coca. Altitude 6,000 ft. =

Mountains near Otuzco, Mch. 19-20. The locality to which this phrase refers is near the top of the divide between Otuzco and the Chicama drainage but on the Chicama side overlooking the canyon of Llagueda. Altitude 10,000 ft. =

Trujillo, Mch. 25-26. Small collections made here are from thickets

¹ Altitudes are given on local authority or upon the basis of estimates, since it was our misfortune to lose our aneroid at the very outset.

and weed patches bordering irrigating ditches north of the city and within two miles. Sea level.

Pacasmayo, Mch. 29-Apr. 4. Small swamps and pastures near a permanent stream east of the town furnished a collecting ground. Elsewhere there is practically no sign of life. Sea level.

Cajamarca, Apr. 8-26. The city of Cajamarca is situated on the western edge of a broad, flat valley about 100 square miles in extent. The surrounding mountains are practically treeless and except along small trickling streams, of which there are a few, and about the haciendas, there is little vegetation. The bottom of the valley, which is crossed by one fair-sized stream, is cultivated and partly irrigated, the crops raised being principally alfalfa, barley, wheat, beans, and potatoes. Collecting was confined to the outskirts of the city and to a rather extensive swamp about three miles north. Altitude 9,200 ft.

Hacienda Limon, May 4-13. A hacienda about 10 miles west of Balsas owned and managed by Don Pedro Mejia y Burga. It is situated on one side of a hanging valley surrounded by mountains and sloping gently toward the Marañon. It is traversed by a shallow stream which leaves the valley through a small gap in the mountains at the lower end whence it drops suddenly and almost precipitously about 1,500 ft. to the Marañon River at Balsas. The valley is largely covered with low bushes or thin forest containing occasional trees of fair size. Sugar cane is the principal crop. Altitude 3,000 ft. =

Balsas, May 16. A small village on the Marañon River at the bottom of a deep enclosed canyon. The climate here is very hot and although certain types of vegetation are abundant the conditions are relatively arid. Altitude 1,000 ft. =

Tambo Carrizal, May 18. A dilapidated tambo on the side of the mountains directly east of and overlooking Balsas and the Marañon. A tiny spring here is surrounded by a clump of trees, mostly chirimoyas, and the steep slope below has some moderately extensive thickets of low bushes which the moisture from the spring permits to flourish. Elsewhere conditions are arid with occasional bunches of grass, cactuses, or small bushes. Altitude 5,000 ft. =

Mountains east of Balsas, May 19-23. This designation refers to a locality one day's travel beyond Tambo Carrizal at the edge of timberline and not far below the highest point between Balsas and Leimabamba. The camp was situated in an upward tongue of forest near the head of a small rushing stream. The place is known locally as Jenes. The mountains below are covered on both sides with relatively dense and heavy forest, the climate being more humid than in the

region to the westward. Above this forest was open grassy "jalca."
Altitude 10,000 ft. =

Rio Utcubamba, May 26, 30. Small collections were made May 26 in a swampy mountain glade near the source of a western branch of the Utcubamba about six miles west of Leimabamba. Altitude 8,000 ft. =

Later, on May 30 a stop was made on the bank of the river about 15 miles above Chachapoyas. Altitude 7,500 ft. =

Chachapoyas, June 2-6. Chachapoyas is situated on an open, practically treeless plateau and although some of the neighboring canyons in the mountains are well wooded and apparently well watered, the immediate vicinity of the city is dry and unfavorable for much animal life. Altitude 7,700 ft.

Tambo Ventilla (or Ventija), June 13-19. A much frequented tambo in a mountain valley just below timberline near the source of the Huancachaca River which joins the Utcubamba below Chachapoyas. It is about 10 miles east of Molinopampa and perhaps 20 from Chachapoyas. The region is one of great humidity and relatively low temperatures. Altitude 10,000 ft. =

Tambo Almirante, June 22-24. A tambo situated approximately 40 miles east of Chachapoyas in a small clearing in dense humid forest on the east slope of the high cordillera between Chachapoyas and Moyobamba. The telegraph station of Uchco is situated some six miles below. Altitude 5,000 ft. =

Poco Tambo, June 28-29. A tambo near which are a few small farms surrounded by heavily forested mountains one short day's travel beyond Tambo Almirante. This is near the foot of the Andes and a few miles beyond is the so-called "Bajada de la Ventana" from the top of which one looks over an apparently limitless plain. Altitude 4,000 ft.

Tambo Yaku, July 1-6. A well known tambo on the relatively level plain about 30 miles west of Moyobamba. It is situated at the edge of heavy forest but the vicinity is characterized by large open grassy campos alternating with irregular light forest of small trees and bushes with many heavy growths of brake ferns and club mosses. The village of Rioja is some eight miles to the eastward. Altitude 3,000 ft. =

Moyobamba, July 10-Aug. 11. Moyobamba is situated on a bench just above the bank of the Moyobamba River which at this point is navigable for launches and light draft boats although communication with the Huallaga is broken by rapids farther down stream. The surrounding plain is but slightly broken and the forest is mostly light and bushy with frequent clearings not all of which are artificial. Never-

theless, a rough hilly country separates Moyobamba from Balsapuerto. The climate is warm but not typically tropical and the nights are always delightfully cool. Work here was done chiefly about the flats along the river and in some rather heavy moist forest near the thermal springs a few miles west of the town. Altitude 2,800 ft. =

Balsapuerto, Aug. 19. The hills and mountains are definitely left behind at Balsapuerto. Within a few miles to the westward is mountainous country and distant outlying hills may be seen elsewhere, but in general the region is a flat forested plain. Altitude 700 ft.

Yurimaguas, Aug. 25–Oct. 5. Yurimaguas, situated on the Huallaga River at the mouth of the Paranapura, is well within the Amazonian plain wholly surrounded by unbroken forest. Mr. Anderson collected at three localities within a few miles of the town: Munichis, a small Indian village several miles west; Yane Yaku, a chacra or farm on the Paranapura River about 8 miles from Yurimaguas; and Puerto Arturo, a small place a few miles below Yurimaguas on the Huallaga River. Altitude 600 ft.

Lagunas, Oct. 10–20. A small village on the east bank of the Huallaga River not far above the junction of the Marañon and the Huallaga. It is in the heavily forested rubber district. Collections from this locality were made only by Mr. Anderson. Altitude 500 ft.

Nazareth, Sept. 10. A village at the edge of a rubber forest on the Yavari River some 20 miles above its mouth and opposite the Brazilian village of Remate de Males.

***Peramys peruvianus* Osgood. PERUVIAN PERAMYS.**

Two specimens, Moyobamba.

These were caught in mouse traps in relatively open forest where the undergrowth was limited. Unfortunately, both were attacked and badly mutilated by ants while in the traps. The skin of the type, however, lacks only part of the tail, ears, and feet and therefore sufficiently shows the coloration. The other specimen was preserved in alcohol. This is one of the smaller species of *Peramys* and appears very distinct from any previously described.

***Didelphis marsupialis* Linnæus. LINNÆAN OPOSSUM.**

Two specimens: Moyobamba (1), Yurimaguas (1).

One of these is in the light and the other in the dark phase and both agree in color with corresponding specimens from northeastern Brazil representing typical *D. marsupialis*. The skull of the larger specimen,

from Yurimaguas, has unusually large teeth and certain cranial peculiarities, which, if borne out by a series of specimens, might be regarded as of subspecific importance. In the absence of any such series, the range of typical *marsupialis*, heretofore including only Guiana and Venezuela,¹ may be regarded as greatly extended to include also the whole of northern Brazil to the base of the Andes.

Didelphis marsupialis etensis Allen. ETEN OPOSSUM.

Three specimens: Menocucho (2), Hda. Llagueda (1).

Opossums are generally distributed through the suitable parts of the coast region of Peru, being found in greatest abundance near cultivated areas where they find their favorite fruits more easily obtainable than in wilder parts. Local name *Ouron*.

Didelphis paraguayensis andina Allen. ANDEAN OPOSSUM.

Eight specimens: Hacienda Limon, near Balsas (3 ad. 4 yg.), Rio Utcubamba, 15 miles above Chachapoyas (1).

Two of the adult specimens are more richly colored than descriptions indicate as usual for *D. p. andina*, but in the absence of material for comparison it is not possible to determine whether or not this has particular significance.

Wild fruits, particularly figs, chirimoyas, and grenadillas, were especially abundant in the vicinity of Hacienda Limon furnishing a plentiful and most acceptable supply of food for the opossums. Partly eaten chirimoyas and empty shells of grenadillas were scattered about the ground under the trees in many places. One evening, while we were encamped under a large wild fig tree, partly eaten fruits began to fall into our midst at short intervals, even striking us on the head. The guilty opossum was caught that night near the foot of the tree. The local name *Ouron* in use for opossums on the coast of Peru is replaced in the interior by *Kangaluc*.

Metachirus canus Osgood.

One specimen, the type from Moyobamba, was the only one obtained. This was brought to us by a small boy who said it had been captured in one of the numerous small groves of plantains in the village.

The close relationship of this species to *M. griseescens* is evident and the two may be expected to intergrade.

¹ Cf. Allen, Bull. Am. Mus. Nat. Hist., XVI, pp. 257-259, 1902.

Metachirus andersoni Osgood.

Three specimens were obtained by Mr. Anderson near the Parana-pura River about eight miles from Yurimaguas. As indicated by its dark rich coloration, the species inhabits heavy forest.

Metachirus nudicaudatus tschudii Allen.

One specimen, an immature female, was caught in a banana grove in Moyobamba. It is much darker above than an adult from Chanchamayo, Peru, but the under parts are more whitish. A dark blackish line runs from the forehead to the middle of the back and less distinctly thence to the base of the tail. It may be referred to *M. tschudii* of Allen since it agrees closely with the description of that form and has the blackish median line well marked. This character, however, may be a mark of immaturity.

Marmosa impavida (Tschudi).

Three specimens, Yurimaguas.

The long narrow skull of this species with its slightly beaded and nearly parallel-sided supraorbital edges is very distinctive, but for greater certainty a specimen was submitted to Mr. Thomas who confirmed the identification. In size and color of upper parts, *M. impavida* is not greatly different from *M. musicola* but cranially there are marked distinctions. There is some variation in the color of the under parts, one specimen having the entire lower surface creamy buff to the roots of the hairs, while the other two have a lateral area in which the hairs have slaty bases as described for *impavida*.

Marmosa madescens Osgood.

Four specimens: Tambo Almirante, near Uchco (1), Poco Tambo (1), Tambo Ventija, near Molinopampa (1), Moyobamba (1).

This pretty little opossum inhabits the densest forests of the upper montagna occupying a belt extending from 2,500 feet altitude up to 8,000 feet. Its range appears to meet that of *M. musicola* at Moyobamba where both species were taken but their local habitats are different, that of *madescens* being the forest and that of *musicola* the open fields and cultivated areas. *M. madescens* is the darkest *Marmosa* known to me. Apparently the only species that approach it in this respect are *M. fuscata* of the Sierra de Merida, *M. phæa* of S. W. Colombia, and *M. sobrina* of Ecuador. Judged by the description, *M. sobrina* is somewhat doubtfully distinct from *madescens*.

Marmosa musicola Osgood.

Five specimens, Moyobamba.

This species, which is of a common cinnamon type of coloration, was found only in the gardens and about the houses in the town of Moyobamba. So far as indicated by material at hand, it is somewhat similar to *Marmosa quichua* from which it is amply distinguished by its well-developed angular postorbital processes. Although presenting larger dimensions, it may be allied also to *M. lepida*, a species we were not fortunate enough to obtain although its type locality, Santa Cruz, is but a short distance from Lagunas where Mr. Anderson worked for nearly two weeks.

Marmosa waterhousei Tomes.

Didelphys waterhousii Tomes, Proc. Zoöl. Soc., Lond., pp. 58, 271, 303, pl. LXXVI, 1860 — Gualaquizar, Ecuador.

Didelphys cinerea Thomas, Cat. Marsupialia Brit. Mus., p. 342, 1888.

Marmosa germana Thomas, Ann. & Mag. Nat. Hist., (7), XIII, p. 143, Feb., 1904 — Sarayacu, Ecuador.

Two specimens: Moyobamba (1), Yurimaguas (1).

These were obtained in gardens among the plantains. Neither of them shows any white on the tail. The species is closely allied to *M. cinerea* and probably will prove to be only subspecifically separable from it. Both the original description and the accompanying colored figure of *Marmosa waterhousei* indicate that *M. germana*, later described from a neighboring locality, is a synonym.

Chironectes minimus (Zimm.). WATER OPOSSUM.

An adult female and a small young one were obtained at Moyobamba from a native who said he had killed them with his paddle at an early hour in the morning as he was crossing the river in a canoe. The skull of the adult shows rather marked differences from the figure published by Burmeister (Erlaut. Fauna Bras., pl. XI, fig. 3, 1856), especially in the shape of the nasals. Burmeister's specimen doubtless came from southeastern Brazil ("Neu-Freiburg") and it is scarcely safe to assume that it represents true *minimus* of which the type locality is Cayenne.

Bradypus sp. THREE-TOED SLOTH.

An adult female secured by Mr. Anderson from a native at Yurimaguas is in the collection. The legs, back, and especially the rump

are heavily and almost symmetrically marked with white, the remainder of the pelage being drabish brown, paler on the under parts. The face has the usual white frontal marking and the blackish streak crossing the eye. The chin and throat have numerous hairs broadly tipped with chestnut. The skull differs in many respects from that of *tridactyla* from Guiana and there can be no question of its distinctness. Whether it should be given a new name or not can be determined only by examination of various old types most of which are in European museums and lacking in exact data. Gray's name *blainvillei* has been used for specimens from the Ucayali River¹ probably representing the species to which our specimen belongs, but as the original basis of the name was a skull without definite locality, there is no certainty in its use at present.

Tayassu pecari Fischer. WHITE-LIPPED PECCARY.

Two specimens, Tambo Almirante.

Peccaries range through the heavy forest of the east slope of the eastern cordillera up to an altitude of 6,000 ft. or more. The natives carrying freight between Chachapoyas and Moyobamba generally have with them old fashioned guns mainly in the hope that they may encounter a herd of these animals the flesh of which they highly prize. Perhaps for this reason, we saw but few tracks near the main trail.

Returning to camp one morning during a heavy downpour of rain, I heard a faint sound from a wooded quebrada some distance below me and was just concluding it to be the note of some unknown bird less distant, when a breath of wind brought it more clearly to my ears and I recognized a squealing, piglike quality in it. Going a little nearer, I was no longer in doubt and following the sound, soon worked my way through heavy timber and thick underbrush to the edge of a sharp cut bank which dropped some thirty feet down to the bottom of the practically waterless quebrada. The growling, squealing din was then just below me and added to it was the lively click of snapping tusks — apparently only a family quarrel, but being waged with considerable vigor. For a few seconds I could see nothing but an occasional waving bush. Then I gradually made out the dark bodies of several peccaries moving about on the other side and near the bottom of the quebrada. They were difficult to see since there was a heavy growth of large brake ferns under which they were passing and in the deep shade their blackish bodies gave little contrast to the ground. Picking out two of the largest ones, I dropped them in their tracks and was just aiming at a

¹ Gray, Handlist Edentate, Thick-skinned, and Ruminant Mammals, p. 4, 1873.

third when a wee little one came into the clear and distracted my attention standing on a small flat rock directly below me and whining plaintively. Meanwhile there was much scurrying in the underbrush and the squealing abruptly stopped. Suddenly a half-dozen good-sized ones came up my side of the bank and broke through the bushes not fifteen feet away, making directly toward me. While I hurriedly jammed in fresh cartridges, they took one look at me and immediately veered into cover, evidently having no idea of attacking. The herd numbered about twenty and of these a considerable proportion were not full grown.

The two killed were male and female, adult, but not old and among those indistinctly seen was one apparently somewhat larger. I estimated their weight to be 60 to 75 pounds. The measurements of the fresh specimens are as follows: Total length 1,185, 1,100; height at shoulder 590, 565; circumference of chest 750, 710; shoulder to hip 570, 530; hind foot 235, 220. They had scarcely any fat on them and their skins were thin and easily removed. The meat, which is highly regarded by the natives, was not especially well-flavored and reminded of young venison.

These peccaries, living in the cool rain forests of the eastern slopes of the Andes, are certainly subjected to climatic conditions quite different from those of eastern Brazil and the Amazon valley, but their general characters are not peculiar and material is not available to determine how far they may be distinguished by combinations of slight characters.

Mazama americana (Erxleben).* RED BROCKET.

Two adults, male and female, were obtained at Moyobamba from a native who killed them in late twilight as they came to the edge of his cornfield. Tracks seen near Tambo Yaku probably were of this species and it may range upward to an elevation of four to five thousand feet.

Material from eastern Brazil and Guiana is lacking, but as judged by descriptions, the Peruvian specimens do not differ from typical *americana* in any obvious respect.

Odocoileus peruvianus (Gray). PERUVIAN WHITE-TAILED DEER.

One imperfect skull of a young male with permanent dentition was obtained at Menocucho. Although the animals were not uncommon,

* *M. rufus* of authors; see Thomas, Ann. & Mag. Nat. Hist., (8), XI, p. 585, June, 1913.

efforts to secure complete specimens were not successful. In the immediate vicinity of Menocucho, deer were not abundant since considerable hunting had been done previous to our arrival. They frequent the canefields and are usually hunted with dogs and killed as they break cover to pass from one field to another or to cross one of the open lanes by which each field is subdivided. Deer belonging to this species evidently occur throughout the western ranges of Peru. Tracks were seen at Hacienda Llagueda, in the vicinity of Otuzco, and at Hacienda Limon near the Marañon River. West of the Marañon, tracks were noted occasionally but whether these were of the same species or not is doubtful. At Llagueda a young buck was seen late one evening, as we were returning from an all day's hunt, and but for a fractious saddle mule which backed off the steep side of the trail at a critical moment, a specimen might have been secured.

Cervus brachyceros Philippi (= *Odocoileus philippii* Trouessart) was based on specimens from this part of Peru and probably is a synonym of *O. peruvianus*. Philippi calls it the "Venado de Cajamarca" and distinctly implies a Peruvian origin for it.

Hippocamelus antisimensis (d'Orbigny). PERUVIAN GUEMAL.

The guemal or *taruga*, as it is called in this part of Peru, was not encountered by our party. So far as learned from inquiry, it never has been common in the region and it was only at rare intervals that we met a man who ever had seen one. A few doubtless remain in the higher parts of both the western and the eastern cordillera but at the points we were able to touch not even a track was found.

Sciurus cocalis Thomas.

Two specimens, Yurimaguas.

Although rather more blackish than the type of this species as described by Thomas, these specimens otherwise agree in such detail that there can be little doubt of their identity. Their occurrence at the same locality with *S. tricolor* is the same condition found by Mr. Goodfellow on the Napo River in Ecuador. Evidently they range together over a considerable territory and do not merely overlap, as supposed by Thomas. This is the more interesting since they have so many superficial similarities. In external dimensions, they are practically identical, and each is somewhat variable in color, but certain

constant characters separate them beyond dispute without considering the very marked cranial differences.

Sciurus tricolor Pöppig.

Two specimens: Lagunas, Lower Huallaga River (1), Puerto Arturo, near Yurimaguas (1).

These specimens, especially the one from Lagunas, come from very near Pöppig's type locality. They show an important variation in the color of the under parts, one being white throughout, except on the chin, and the other wholly rich orange rufous. The skulls, as noted by Thomas,* have very long narrow muzzles. This is accompanied by a greatly compressed mandible and extraordinarily broad thin lower incisors. These measure 5.5 mm. in depth and 24 mm. in length of exposed front surface, dimensions which exceed those of any other squirrel known to me.

Mus musculus Linnæus. HOUSE MOUSE.

House mice are common in and about the coast towns. Two specimens from Pacasmayo were preserved.

Epimys alexandrinus (Geoffroy). ROOF RAT.

After sporadic and poorly executed attempts to destroy them, rats are still abundant in the coast towns of Salaverry, Trujillo, and Pacasmayo. The feeling that they are dangerous to the health of the community is growing, however, and the more intelligent people are more and more inclined to make some effort to prevent their spread and increase. Apparently they have not penetrated far into the highlands, for we received no reports of them after leaving the coast until we reached Yurimaguas, where we again found them numerous.

Oryzomys stolzmanni Thomas. STOLZMANN'S ORYZOMYS.

Forty-one specimens: Mountains east of Balsas (1), Tambo Almirante, near Uchco (8), Moyobamba (32).

Huambo, the type locality of *Oryzomys stolzmanni*, is less than 50 miles directly south of Tambo Almirante, on the same slope of the mountains, and at nearly the same altitude. Moreover, the local conditions are much alike at the two places, the forest dense, and the

* Ann. & Mag. Nat. Hist. (7), VI, p. 138, July, 1900.

climate humid.* The probability is great, therefore, that our specimens from Tambo Almirante represent true *O. stolzmanni*, and since the type is imperfect and not fairly comparable with modern specimens, it becomes practically necessary to regard them as that species. A large series from Moyobamba seems referable to the same species, although averaging paler and including some specimens with somewhat whitish under parts. This paleness is perhaps ontogenetic and may be due to the fact that nearly all the specimens from Moyobamba were taken about houses and gardens in the town rather than in the adjoining forest. The published measurements of the type of *stolzmanni* indicate an animal slightly larger than the average in our series, but there is at least one unusually large example among those from Moyobamba which nearly equals it.

The specimens from Tambo Almirante have clear ochraceous buff under parts, lighter toward the chin. The upper parts are somewhat darker and with many fine lines of dusky. Average measurements of four adults are: Total length 214 (205-224); head and body 94 (91-96); tail 120 (111-128); hind foot 23.9 (23.5-24.5).

***Oryzomys stolzmanni maranonicus* subsp. nov.**

Type from Hacienda Limon, near Balsas, Marañon River, Peru. No. 19449 Field Museum of Natural History. Male adult. Collected May 7, 1912, by W. H. Osgood and M. P. Anderson.

Characters.— Similar to *Oryzomys stolzmanni* but paler and having nearly white under parts sharply distinguished from the upper parts. Ground color of upper parts nearly ochraceous with a fine linear mixture of dusky; sides more nearly pure ochraceous; head and face scarcely different from body; under parts soiled whitish, sharply defined, the hairs with slaty bases; feet white; tail above dusky, below whitish for the proximal half, and thence gradually darker to the tip.

Skull practically as in *stolzmanni*, although in the type the brain-case is deeper and more arched.

Measurements.— Type: Total length 215; head and body 92; tail 123; hind foot 24; ear from notch (dry) 14. Skull of type: Basilar length 17.4; zygomatic width 12.6; interorbital constriction 3.8; width

*The following description of Huambo, from Stolzmann's notes, is given by Taczanowski (P. Z. S., p. 4, 1882): "Huambo. 3,700 pieds de altitude. Plantation inhabitée au fond de la forêt vierge, à 10 kilometres de Chirimoto, au bord de la rivière Huambo, qui, comme on le pretend, se rend près de Pachiza au fleuve de Huallaga. C'est une forêt chaude et humide, du caractère des forêts vierges."

of braincase 11.4; post-palatal length 7.1; palatine foramina 4.4 x 1.7; upper toothrow 3.7.

Remarks.— This form has approximately the color of *O. arenalis* with the size and cranial characters of *O. stolzmanni*.

***Oryzomys arenalis* Thomas. DESERT ORYZOMYS.**

Twenty-three specimens: Menocucho (9), Pacasmayo (11), Trujillo (3).

This is one of the smallest known species of *Oryzomys*. It should be compared with *Oryzomys peruvianus* (Peale) from Callao when specimens of that species are obtained. It was found in relatively moist situations at the edge of small swamps or irrigating ditches.

***Oryzomys andinus* sp. nov.**

Type from Hacienda Llagueda, upper Rio Chicama, Peru. Altitude 6,000 ft. No. 19430 Field Museum of Natural History. Male adult. Collected March 12, 1912, by W. H. Osgood and M. P. Anderson. Orig. No. 4525.

Characters.— A medium-sized *Oryzomys* allied to *O. stolzmanni*, but having a much larger foot and a very long tail. Coloration of the normal oryzomyine type; upper parts pale ochraceous darkened by numerous fine dusky lines; a slight ochraceous lateral line; face and head somewhat grayish; under parts creamy white, sharply differentiated, the hairs with slaty bases; ears thinly haired with ochraceous basally and internally, with brownish distally and externally; feet white; tail thinly clothed with very short hairs, brownish above, whitish below for proximal half, gradually becoming dusky toward the tip. Skull similar in general form to that of *O. stolzmanni* but relatively narrower and with smaller teeth and audital bullæ; palatine foramina much compressed; braincase angled and truncate rather than rounded behind; interorbital region and base of nasals slightly concave between sharply angled edges.

Measurements.— Type: Total length 253; head and body 104; tail 140; hind foot 26; ear from notch (dry) 16. Skull of type: Greatest length 26.4; basilar length 20; zygomatic breadth 14; mastoid breadth 11; interorbital constriction 3.8; nasals 10 x 2.8; palatine foramina 4.8 x 1.4; diastema 6.7; width of infraorbital plate 2.6; upper toothrow 3.4.

Remarks.— If, as seems highly probable, specimens from Moyobamba and Tambo Almirante represent typical *O. stolzmanni*, it is plain

that the above-described species requires a name. It inhabits a wholly different region on the west slope separated from the eastern montagna by practically the entire Andean chain. So far as known, it needs comparison only with *O. stolzmanni*, from which its large feet and ears, its very long tail, and its paler under parts at once distinguish it.

***Oryzomys xanthæolus* Thomas.**

Thirty-four specimens: Balsas, Marañon River (1), Hacienda Limon, near Balsas (5), Pacasmayo (7), Menocuchó (13), Trujillo (8).

This rat was common at all localities on the coast where collecting was done. It lives in thickets and weed patches along streams and irrigating ditches. With the exception of *Akodon*, rodents were very scarce in the bottom of the Marañon canyon, and the specimens of this species obtained there are mostly immature and not satisfactorily distinguishable from the typical form of the coast region. Their under parts average more nearly white, but this is a variable feature. The climatic conditions at Balsas are not greatly different from those of the coast, the temperature averaging high and the rainfall being slight. A number of birds and plants not found in the directly intervening country are common to the two regions. Possibly certain points to the northward afford opportunity for the continuous distribution of these and of *O. xanthæolus*. *Oryzomys baroni* from Cajabamba (8,000 ft.) is a very closely related form, at most a highland representative of *xanthæolus*. It was not taken at Cajamarca nor in the Otuzco region, localities more or less flanking Cajabamba and of similar elevation, but collecting conditions are such in these places that it might easily have been missed. It is even possible that *O. baroni* may prove indistinguishable from *xanthæolus*, in which case there would be nothing anomalous in its occurrence in the Marañon valley. The type of *baroni* and one topotype loaned by the American Museum of Natural History through Mr. R. C. Andrews show no important external characters when compared with series of *xanthæolus* from the coast. The skull of the topotype, which is adult with teeth beginning to wear, can be duplicated among coast specimens; but that of the type, a very old female with the crowns of the teeth practically worn away, differs from the coast specimens of similar age in greater size and in rostrum and nasals so much heavier and wider that individual variation cannot safely be taken as a sufficient explanation. Such close relationship, especially in the unwieldy and slightly understood genus *Oryzomys*, seems best indicated by the trinomial *Oryzomys xanthæolus baroni*.

Oryzomys minutus (Tomes). PIGMY ORYZOMYS.

Two specimens, Mountains northeast of Otuzco, near head of Rio Chicama. Altitude 10,000 feet.

These are practically indistinguishable from specimens from the south side of Mt. Pichincha, Ecuador, which may be regarded as probably typical of *O. minutus*. They differ from *O. dryas* mainly in color, being much duller and more grayish above, paler below, and with the ears less blackish, and therefore in less contrast with the surrounding parts. In cranial characters they are closely related only to *O. dryas* and differ from *O. stolzmanni* and allies in having more delicately formed skulls, with very small teeth, a non-projecting zygomatic plate, and a full rounded relatively broad braincase. Whether these characters can be detected in the immature type of *O. minutus* will doubtless remain uncertain until the type can be carefully compared with an ample amount of pertinent material.

Oryzomys dryas Thomas.

Nine specimens: Mountains east of Balsas (3), Tambo Almirante, near Uchco (1), Tambo Ventija, near Molinopampa (5).

These small mice were taken in dense forest where there was great humidity but no very high temperature. In the flesh, they present a very characteristic appearance, somewhat different from the normal "pigmy *Oryzomys*" and resemble rather some of the full-furred *Reithrodontomys* of southern Mexico and Central America. Their soft woolly pelage, richly ochraceous under parts, and sharply contrasted blackish ears amply distinguish them without reference to cranial characters. If not identical with typical *O. dryas* from Ecuador, their departure from it can only be very slight since they conform in every respect to the original description of the species.

The resemblance of this diminutive mouse both externally and cranially to certain species of *Rhipidomys* is noteworthy. Its slender hind foot and its laterally pitted palate are the only obvious objections to stating that it is an exact miniature, for example, of *R. fulviventris*. If it had been chosen as the type of *Oligoryzomys* instead of the typically oryzomyine *O. navus*, some slight grounds might be urged for the recognition of such a subgenus.

Oryzomys laticeps nitidus Thomas.

Twenty-two specimens: Lagunas (3), Moyobamba (11), Poco Tambo (1), Tambo Yaku, near Rioja (6), Yane Yaku, near Yurimaguas (1).

These mice live in dense forest, where they seem to be generally distributed but difficult to obtain in numbers. A line of one hundred carefully set traps in the forest seldom yielded more than two or three specimens. They are limited strictly to the montagna region and our westernmost record for them is Poco Tambo, where one specimen was taken at an elevation of about 4,000 ft.

They present a wide range of color variation, part of which evidently is due to age, for all the individuals of strongly fulvous color are of large size and fully mature. All mature specimens, however, are not of the fulvous type, and it seems probable that there is in this species a limited dichromatism. The length of the tail also is variable and, probably by coincidence, all fulvous specimens have exceptionally long tails.

Oryzomys albigularis (Tomes). WHITE-BREASTED ORYZOMYS.

Eleven specimens: Tambo Almirante, near Uchco (4), Tambo Ventija, near Molinopampa (5), Poco Tambo (2).

The habitat of this rat was found to be the heavy humid forest of the upper montagna from an altitude of about 5,000 ft. at least to 8,000 ft. Here it lives in the densest part of the forest under logs, roots, and débris. In the absence of actual topotypes, our small series may be regarded as representing true *albigularis*, the type of which came from Pallatanga, Ecuador. It is rather darker than any of the closely allied northern forms, the head being especially dark and the tendency to the development of a blackish dorsal area being pronounced. The under parts also are darker, and although some specimens have the white pectoral spot well developed, others, especially the younger ones, lack it entirely and have the whole under parts washed with fulvous. The skulls of the Peruvian specimens are so similar to those of *meridensis* that it is probable that form will eventually be regarded as a subspecies of *albigularis*. The same may be said of *maculiventer*, *pirrensis*, and *devius*. *O. childi*, *O. o'connelli*, and *O. pectoralis* apparently should be regarded as synonyms of *meridensis*. *O. keaysi* differs from *albigularis* more than any of the northern forms and intermediate specimens may not be forthcoming.

Oryzomys polius Osgood. GRAY ORYZOMYS.

Six specimens, Tambo Carrizal, mountains east of Balsas. Altitude about 5,000 ft.

This very distinct species, apparently unrelated to any previously known, is perhaps confined to the lower Marañon valley, like certain

birds and other animals, as, for example, the peculiar thrush *Planesticus maranonicus*. The discovery of such distinct types emphasizes the great imperfection of our knowledge not only of the causes but of the facts of vertebrate distribution in the Andes.

Owing to lack of horsefeed, it was not possible for us to stop at Tambo Carrizal more than one night, and we were fortunate in securing these rats in and about the old tambo itself.

Nectomys fulvinus Thomas. WATER RAT.

Six specimens: Lagunas (3), Yurimaguas (3).

For these very dark richly colored water rats the name *fulvinus* is perhaps as suitable as any other. Without typical specimens of *N. rattus* of the upper Rio Negro and without a definite type locality for *N. fulvinus*, nothing more than a provisional identification can be made. It is reasonably certain, however, that *N. fulvinus* was not from Quito, as thought possible when it was named, since another species, *N. saturatus*, inhabits that region. Our specimens from the Huallaga River increase the probability that *fulvinus* came from well east of Quito. There is considerable color resemblance to *N. melanius* of Guiana, a species not known at the time *fulvinus* was described, so perhaps Guiana as the source of *fulvinus*, a possibility originally dismissed, may need reconsideration.

Neacomys spinosus Thomas. SPINY MOUSE.

Four specimens: Moyobamba (1), Poco Tambo (2), Yurimaguas (1).

Apparently rather rare, this species was only obtained after much trapping in heavy humid forest, where it was found under rocks and logs. The color of the under parts varies from nearly pure white to ochraceous buff, and the belly hairs in some specimens are white to the roots and in others with slaty bases of varying width.

Rhipidomys latimanus Tomes.

Two specimens from Moyobamba are referred to *R. latimanus* by Mr. Thomas. They were obtained in houses in the town. The color is much paler than usual in this genus, the upper parts being a light wood brown tinged with fawn. The type of this species is credited to Pallatanga, in western Ecuador, a locality rather removed from Moyobamba, and it is possible that the original describer may have been misinformed regarding the source.

Rhipidomys fulviventor Thomas. BUFF-BELLIED VESPER RAT.

Five specimens: Mountains east of Balsas at 10,000 ft. (1), 10 miles east of Molinopampa (1), Rio Utcubamba, between Leimabamba and Chachapoyas (1), Tambo Almirante, near Uchco (2).

There is some slight variation in this small series, probably due mostly to age and condition of pelage. Specimens submitted to Mr. Thomas are pronounced almost identical with the type.

Oecomys bicolor (Tomes).

One specimen, Tambo Yaku, near Rioja.

Thomasomys prætor Thomas.

Two specimens: Mountains near Otuzco (1), Hacienda Limon (1).

Although one of these was taken at the edge of timberline and the other well down on the side of the Marañon canyon, they seem to belong to the same species. So far as known to me, they are the only specimens of this species preserved except the type in the British Museum. Mr. Thomas has compared one of them with the type, finding only such differences as are likely to be due to disparity in age, the type not being fully mature. Except for a short hind foot, the description of *Thomasomys pyrrhonotus* agrees fairly well with our specimens.

Measurements of the adult are: Total length 387; head and body 187; tail 200; hind foot 38.

Thomasomys cinereus (Thomas.)

Twenty-three specimens, Mountains east of Balsas. Altitude about 10,000 ft.

The close agreement of these specimens with the original description and the fact that the locality is relatively near that of the type leaves scarcely any doubt of identity with *T. cinereus*, type species of the genus *Thomasomys*. Like its congeners, it inhabits the depths of dense humid forests. In the mountains where we found it, a heavy forest was not well established except in certain narrow canyons where fog and mist frequently settled while the surrounding peaks stood exposed to the sun. In such places, it ranges practically to timberline but never, so far as observed, beyond a growth of heavy moss, ferns, and rank vegetation only to be found in cool shade.

Adults and young differ but little in color and there is no great variation in the color of the upper parts throughout the series except

that due to wear, but the under parts range from dull gray to ochraceous buff. A grayish white spot at the base of the ear is usually evident. Average flesh measurements of ten adults are as follows: Total length 267 (258–284); head and body 134 (128–138); tail 133 (123–148); hind foot 30.2 (29–32).

Thomasomys cinereus ischyryus subsp. nov.

Type from Tambo Almirante, near Uchco, Peru. No. 19803 Field Museum of Natural History. Male adult. Collected June 23, 1912, by W. H. Osgood and M. P. Anderson.

Characters.— Similar to *Thomasomys cinereus* but larger, longer-tailed, and more richly colored; skull with a broader braincase, longer rostrum, and broader interorbital region. Upper parts rich vandyke brown or burnt umber finely sprinkled with sooty, the blackish slate undercolor scarcely showing through; under parts throughout heavily washed with the same deep fulvous brown but without sooty admixture and with the undercolor showing slightly; ears blackish, the hairs near their inner bases with marked whitish roots; fore and hind feet extensively brownish, decidedly more so than in *cinereus*; tail dull brownish above, scarcely lighter below.

Measurements.— Type: Total length 291; head and body 137; tail 154; hind foot 31. Average of six adults: 280 (266–292); 131 (124–137); 149 (140–160); 31. Skull of type: Greatest length 33; basilar length 25.5; zygomatic width 17.1; least interorbital width 6.4; nasals 13.9 x 3.8; interparietal 12.5 x 3.2; palatine foramina 6.7 x 2.3; upper tooth-row 5.1.

Remarks.— Nine of these rats were taken in the forest at Tambo Ventija and four others somewhat farther east and at less elevation at Tambo Almirante. Owing to their greater size in comparison with *T. cinereus*, they were at first thought to represent *T. kalinowskii*. But comparison with the type of that species kindly made by Mr. Thomas shows our specimens to be smaller with smaller narrower teeth and a broader interorbital region. Although well distinguished from *cinereus*, the new form shows such variation that it can scarcely be regarded as more than a subspecies.

An interesting character of this species, shown in less degree by certain others of the same and related genera, is the area of white-rooted hairs about the inner bases of the ears. These hairs are distinctly four-colored, the bases being nearly pure white followed broadly by blackish slate, then narrowly by fulvous brown, and apically by blackish.

The white is thus strongly contrasted but only visible in a prepared specimen on parting the long soft hair. In the living animal it could scarcely be visible under any normal circumstances, and therefore its *raison d'être*, if any, is probably involved in phylogeny.

The group represented by the name *Thomasomys* stands with sufficient distinctness among other South American groups but this distinctness is perhaps less important as a biological fact than the close similarity which exists between this group and the North American generic series *Peromyscus*. Under the limitations of present nomenclature, it is unfortunate that, while the slight distinction is recognized and emphasized, the great similarity is nomenclaturally neglected.

Akodon mollis Thomas.

Forty-six specimens: Menocucho (18), Pacasmayo (21), Trujillo (7).

This is the most common rodent in the irrigated areas of the coast region of northern Peru. It frequents rice and cane fields and the borders of streams and irrigating ditches, showing an obvious preference for moist situations. It is probably more abundant under the conditions of human occupation of the land than it would be in the absence of agricultural practice.

As a species, *Akodon mollis* has continuous distribution from the arid west coast up to an altitude of at least 12,000 feet and thence across the mountains and down into the upper part of the eastern forest or montagna. Speaking generally, there was no point on our route until we reached the Amazonian plain where we did not find some form of this species. Four well-marked subspecies are recognizable. Their more important characters may be summarized as follows:

Rostrum shorter and broader, zygomatic plate upright in front.

Pelage short; color paler *A. mollis*

Pelage long; color darker *A. m. altorum*

Rostrum longer and slenderer, zygomatic plate with receding front edge.

Feet grayish; tail bicolor *A. m. orophilus*

Feet and tail wholly blackish *A. m. orientalis*

Akodon mollis altorum Thomas.

Thirty specimens: Cajamarca (13), Hacienda Limon (4), Hacienda Llagueda (9), mountains near Otuzco (4).

As in the case of typical *mollis*, this form was found principally about

cultivated fields. It differs from *mollis* only in slightly darker color and heavier pelage, characters which often appear slight on comparison of single examples but which are quite obvious when small series are considered. Specimens from Hacienda Limon just west of the Marañon River show slight tendency to development of the cranial characters of the eastern forms *orophilus* and *orientalis*.

Akodon mollis orophilus Osgood.

Fifty-one specimens: Mountains east of Balsas at 10,000 ft. altitude (21), Chachapoyas (1), near Leimabamba (8), Tambo Ventija, near Molinopampa (21).

In the heavily wooded canyons, which increased in number after we crossed the Marañon, this mouse was found associated with *Thomasomys*, *Rhipidomys*, and *Oryzomys albigularis* and it generally outnumbered any of these. It was found also in open swamps at high altitudes living in long grass or rushes quite after the manner of northern voles of the genus *Microtus*. In certain of these places, the labyrinthine runways, open burrows, and fresh grass cuttings so familiar to the northern collector were found in great numbers. In other places, as for example heavy woods or rocky stream beds, the *Akodons* seemed to lead wandering lives and have as retreats only natural openings in or near the ground.

Akodon mollis orientalis Osgood.

Four specimens: Poco Tambo, about 50 miles east of Chachapoyas (3), Tambo Almirante, near Uchco (1).

This is the easternmost form of the *mollis* group. It inhabits the dense, humid, but relatively cool forest which forms the practically unbroken cover of the lower slopes of the eastern Andes. In this region it is possible that its range may overlap that of *Akodon arosus* which is found slightly lower down.

Akodon arosus Thomas.

Ten specimens: Tambo Yaku (3), Moyobamba (7).

This is a species of the heavy eastern forest where it lives in dense vegetation in company with *Oryzomys l. nitidus*. It was not found in abundance, a line of fifty carefully placed traps seldom yielding more than one specimen in a night.

Phyllotis andium Thomas. LEAF-EARED MOUSE.

Sixteen specimens: Cajamarca (8), Hacienda Limon, near Balsas (4), Hacienda Llagueda (2), mountains near Otuzco (2).

In external appearance and in habits, these mice strongly suggest certain species of *Peromyscus* inhabiting western North America. They were found principally in relatively dry and rocky situations and were nowhere abundant.

Average measurements of seven adults are as follows: Total length 232 (211-244); tail 119 (109-131); hind foot 24.8 (24-26.5).

Phyllotis andium stenops subsp. nov.

Type from the Rio Utcubamba, 15 miles above Chachapoyas, Peru. No. 19840 Field Museum of Natural History. Adult male. Collected May 30, 1912, by W. H. Osgood and M. P. Anderson. Orig. No. 4805.

Characters.— Similar in general to the typical form; tail averaging slightly longer; ears darker-colored; nasals and rostral part of skull decidedly narrower. Upper parts ochraceous buff to clay color mixed with dusky to produce a general effect near wood brown; sides of face more or less grayish; under parts washed with creamy or buff; feet white; tail sharply bicolor.

Measurements.— *Type*: Total length 249; head and body 117; tail 132; hind foot 26.5; ear from notch (dry) 18.5. Average of six adults: Total length 236 (222-249); tail 126 (120-134); hind foot 24.7 (24-26.5). Skull of *type*: Greatest length 29.2; basilar length 22.9; zygomatic breadth 14.4; interorbital constriction 4; nasals 11.3 x 3.3; palatine foramina 6.8; diastema 7.6; upper toothrow 4.5; average width of nasals in 8 adults 3.32 (2.9-3.8); average width of nasals in 7 adults of *P. andium* 3.94 (3.7-4.5).

Remarks.— Like the *Akodon* and other rodents, the *Phyllotis* of the eastern cordillera differs in certain slight but constant characters from that of the western cordillera. Eleven specimens from Chachapoyas and vicinity are characterized principally by the narrowness of their nasals as contrasted with *P. andium* from Cajamarca. Both forms differ from *P. haggardi* in greater length of tail.

Phyllotis tamborum sp. nov.

Type from Tambo Carrizal, mountains east of Balsas, Peru. Altitude 5,000 ft. No. 19,838 Field Museum of Natural History. Adult female. Collected May 18, 1912, by W. H. Osgood and M. P. Anderson. Orig. No. 4,745.

Characters.— A relatively small *Phyllotis* with a rather long tail, small ears, and a slender elongate skull. Color about as in *P. andium*; upper parts pale clay color mixed with dusky and toned somewhat by the slaty under color in a specimen not very heavily pelaged; under parts dull white tinged with creamy; feet white; tail bicolor; ears buffish gray. Skull small and slender; nasals long; interorbital space contracted; frontals relatively narrow posteriorly; supraorbital edges slightly rounded, not sharply edged as in *P. amicus*; braincase shallow; interparietal distinctly angled posteriorly; teeth about equal in size to those of *P. amicus*; audital bullæ smaller.

Measurements.— Type: Total length 217; head and body 99; tail 118; hind foot 24; ear from notch (dry) 16. Skull of type: Greatest length 25.6; basilar length 20; zygomatic breadth 12.8; interorbital constriction 3.8; greatest dorsal breadth of parieto-frontal suture 6.7; depth of braincase including audital bullæ 8.5; interparietal 8.8 x 2.7; nasals 10.3 x 2.8; palatine foramina 6.2; diastema 7; upper toothrow 4.1.

Remarks.— The type of this species was obtained at the same locality as the peculiar *Oryzomys polius*. It is smaller than *P. andium* and *P. haggardi* and scarcely exceeds *P. amicus* from which its small ears readily distinguish it. Possibly its nearest relative is *Phyllotis elegantulus*¹ the type of which is supposed to be from Pallatanga, Ecuador, and, although described recently, was collected more than 50 years ago. It is evident, however, that even if liberal allowance be made for the unreliability of measurements taken from an old alcoholic specimen, *P. elegantulus* is still smaller than the species here described, the tail length being given as 70 and the hind foot as 21.

***Phyllotis amicus* Thomas.**

Seven specimens, Menocucho.

This small series was obtained among rocks and thorny bushes a few rods beyond the canefields and irrigated areas. Average measurements of five adults are: Total length 191 (182–198); head and body 82 (74–87); tail 107 (100–112); hind foot (c. u.) 22.2 (22–23); ear from notch (dry) 19.5 (18.5–21).

***Eligmodontia sorella* Thomas.**

Two specimens from an elevation of about 11,000 feet in the mountains directly northeast of Otuzco agree closely with the description of this species except that their skulls have slightly larger dimensions than

¹ Thomas, *Ann. & Mag. Nat. Hist.*, (8), XI, p. 139, 1913.

those given for the type. The type locality, 8 miles south of Huamachuca, is not far from this region which appears to be almost or quite the northern limit of the range of the genus *Eligmodontia*. These mice were caught in tall grass and weeds growing about the bases of rough limestone exposures on the very top of the mountains.

Holochilus sp.

One specimen too young for specific determination was taken at the edge of a grassy opening in the forest at Tambo Yaku. It is of importance, however, since it greatly extends the range of the genus *Holochilus*, heretofore known only from eastern South America.

Sigmodon peruanus Allen.

Four specimens, Pacasmayo.

The reference of these to *Sigmodon peruanus* is provisional. Pacasmayo is situated about halfway between Trujillo, the type locality of *Sigmodon peruanus*, and Eten, the type locality of *S. simonsi*. Our specimens of *Sigmodon* taken there seem somewhat intermediate between the two named forms, but to which they are nearer is uncertain since the type of *peruanus* and only known specimen from Trujillo is so aged and in such poor condition of pelage that no fair comparisons with other existing specimens are possible. The Pacasmayo specimens are slightly larger and darker colored than topotypes of *S. simonsi* but they agree in having distinct buffy eyerings and bicolored tails whereas the type of *peruanus* has only slight indication of an eyering and its tail is a dull buffy brown scarcely darker above than below. It is doubtful if these characters are wholly the result of the age of the type, but in the absence of topotypes, the name *peruanus* may be applied to our specimens. Efforts to obtain topotypes were unsuccessful and although we trapped assiduously at Trujillo for several days, we caught only *Oryzomys xanthæolus* where we hoped for *Sigmodon*. During a much longer time at Pacasmayo, only four specimens were taken and of these only three in traps, the fourth having been killed with small shot as it ran across a sandy space between two thorny bushes.

Dasyprocta fuliginosa Wagler. SOOTY AGOUTI.

An adult male obtained near Balsapuerto seems referable to this species. Others were seen near Rioja and Moyobamba. It is their habit to come out in early evening and sit at the edge of a road or trail

ready at the least alarm to spring back into cover. I saw several in such places quite reminding of rabbits in a northern country.

Proechimys brevicauda (Günther). HUALLAGA SPINY RAT.

Thirty-two specimens, vicinity of Yurimaguas.

This series includes specimens of varying ages from those in the soft sooty juvenal coat to very aged ones with harsh pelage and teeth worn down nearly to the roots. In spite of a color variation, which within its limits ranges freely, the series as a whole presents a general appearance of uniformity. The greatest variation is in the under parts which can scarcely be said to be exactly alike in any two individuals. Fulvous and white are distributed in varying proportions, in general occupying about equal areas of the under parts. The chin and throat with scarcely any exception are fulvous and likewise the sides of the belly. Sometimes the white is reduced to a small pectoral and an inguinal patch or it may cover practically the entire belly and run forward to the middle of the throat.

Chamicuros, the type locality of *brevicauda*, is not far from Yurimaguas, and as was to be expected, Günther's type shows practically complete agreement with our specimens, comparison with which has been made by Mr. Thomas. Average flesh measurements of seven adults are as follows: Total length 372 (335-420); head and body 230 (205-277); tail 141 (130-162); hind foot 49 (46-52).

Mr. Anderson found these rats abundant in the vicinity of Yurimaguas especially in small *chacras* where they were feeding on plantains.

Proechimys sp. SPINY RAT.

Thirteen specimens, Lagunas, Huallaga River.

Although agreeing in size and general cranial characters with *P. brevicauda*, this series as a whole is so markedly different in color that at first glance its distinctness would scarcely be doubted. The general appearance is much the same as that of *P. semispinosus*, the under parts being in every case pure snowy white throughout without any trace of the fulvous so characteristic of *brevicauda*. There is also a soft quality in the pelage which is not shown by the Yurimaguas series of *brevicauda*. When specimens from many more localities are available, it seems probable that a fulvous-bellied and a white-bellied form may be differentiated and some definite range be assigned to each. To attempt to do this now would serve no particular purpose and might cause future confusion.

Proechimys sp. SPINY RAT.

Three specimens from Yurimaguas differ decidedly from the large series from that locality unquestionably referable to *P. brevicauda*. That they merely represent extreme variation is perhaps not impossible, but further collections from the same and the neighboring region may show that they belong to another species. They are characterized by pure white under parts, like the series from Lagunas, but with very long tails, harsh pelage, and largely white hind feet. Two adults measure: Total length 388, 366; head and body 220, 213; tail 168, 167; hind foot 50, 49.

Mesomys ecaudatus Wagner. HEDGEHOG RAT.

Four specimens, Munichis, near Yurimaguas.

In describing *Mesomys stimulax* from the Tocantins, Thomas says: "This is only the fifth recorded specimen belonging to the rare genus *Mesomys*."¹ The total, therefore, is now increased to nine, of which the above small series constitutes nearly half. It is possible that comparison of modern material would make it necessary to use for our specimens Günther's name *ferrugineus*, the type of which came from the same region, but Thomas (l. c.) has concluded, from comparison of Günther's old type with specimens from the lower Amazon, that no separation is justified. The Yurimaguas specimens show only slightly greater measurements than those given for typical *ecaudatus* and there is no appreciable discrepancy in color. The under parts are not quite "uniformly buffy" but the change from the creamy buff of the throat and breast to the rich ochraceous buff of the abdominal region is gradual. Two of our specimens have perfect tails with long pencils at the tip, a third lacks the terminal half of its tail, and the fourth is tailless like the original type of *ecaudatus*.

Flesh measurements of an adult male are: Total length 412; head and body 209; tail 203; hind foot 32. Skull: Greatest length 45.7 (44);² basilar length 35.1 (33); zygomatic breadth 24 (22.5); nasals 13.8 x 4.8 (12.4 x 5); interorbital breadth 11.9 (11); mastoid breadth 20.7 (20); palatal length 15.2 (15.3); diastema 9.4 (9.9); palatal foramina 3.8 (3.8); upper toothrow 7.4 (6.7).

Mr. Anderson found these rats in the hut he was occupying at the small native settlement of Munichis. He was unable to catch them in

¹ Ann. & Mag. Nat. Hist., (8), VII, p. 608, June, 1911.

² Measurements in parentheses are those given by Thomas for a specimen from the lower Amazon.

traps and only secured them by shooting them when they came out and ran about in the candlelight during the evenings. After exhausting the possibilities of his own hut, he tried various others but had no further success.

Cavia atahualpæ Osgood. MOUNTAIN CAVY.

Four specimens, Cajamarca.

Cavies were obtained only at one locality, a swamp on the outskirts of Cajamarca. Although they seemed fairly common in this place, it was difficult to obtain perfect specimens. Most of the area was covered with from one to two feet of water and thickly grown with tall rushes. Near the edges were stretches of soft spongy turf and pools of shallow water covered with floating or partially anchored vegetation. Here the runways of the cavies were found threading the rushes and passing from one relatively dry place to another. A few traps were placed in these runways but seemed to be avoided and no specimens could be secured in this way. But although apparently so shy of traps, the cavies exposed themselves to view with considerable unconcern during a short period just before nightfall, so it was sometimes possible to shoot them. The principal difficulty was to sight one in the thick rushes before it was so near that a charge of shot would ruin it as a specimen.

Signs of cavies were noted also in a grassy swamp near Tambo Ventija east of Molinopampa. All efforts to obtain specimens there were unsuccessful and it was concluded the colony had recently been deserted.

Viscaccia sp. VISCACHA.

Viscachas undoubtedly inhabit many of the higher parts of the mountains we traversed but the region is near the northern limit of their distribution and they are everywhere scarce and difficult to obtain. A few burrows at least lately occupied were found along the highest ridges above Otuzco and Hacienda Llagueda, but traps placed about them remained unsprung. They are said to occur in the mountains surrounding Cajamarca and even in the rocky cliffs along the river in the hot Marañon Valley. West of the Marañon, no reliable reports of their occurrence were obtained.

Sylvilagus capsalis Thomas.

Two halfgrown young, Hacienda Llagueda.

These may be tentatively referred to *S. capsalis* although they are

too young for positive identification. Reports of rabbits were obtained at Llagueda, at Cajamarca, and at Hacienda Limon, but the animals themselves were very difficult to secure. We found no signs of them except in cultivated alfalfa fields, and there repeated efforts to trap or to shoot them were unsuccessful.

***Sylvilagus defilippii* (Cornalia).**

One adult and six young from Moyobamba are in the collection. These agree rather closely with the description of *S. b. inca** except that the ears are only slightly blackish distally and the proximal half of the upper side of the hind feet is rather extensively whitish. The same characters were noted by Cabrera† in specimens from the type region of *S. defilippii* and it is therefore probable that our specimens are nearer to that species than to *S. b. inca* from southeastern Peru.

Rabbits were by no means common at Moyobamba and in the course of several weeks collecting only two were seen. In both cases, this was in bushy thickets near the banks of the river.

***Tremarctos ornatus* (F. Cuvier). SPECTACLED BEAR.**

An adult female was obtained in the mountains about 10 miles northwest of Menocucho. A male accompanying it was wounded but made its escape.††

In this region the spectacled bear inhabits extremely arid mountains which support only a scanty vegetation consisting principally of cactuses and small thorny bushes. These mountains are from 1,000 ft. to 5,000 ft. above sea level and although some of the higher slopes and small canyons support scattered trees and occasional thickets of mixed vegetation, the general character of the region is excessively arid and not greatly different from the desert plain stretching westward to the sea. A fairly common shrub, a species of *Capirras* called *chapote* by the natives, produces a pear-shaped fruit having a hard outer shell enclosing numerous seeds which evidently form the principal food of the bears. The region is for long periods almost waterless and animal life is very limited. Signs of small mammals, except an occasional fox track, were

*Thomas, Ann. & Mag. Nat. Hist., (8), XI, p. 210, February, 1913.

†Trab. del Mus. de Cienc. Nat., Madrid, ser. Zool. No. 9, p. 9, April, 1913.

††A popular illustrated account of the hunt on which these bears were encountered was published in Outdoor World and Recreation, N. Y., XLVIII, pp. 367-370, June, 1913.

wanting, and birds were very scarce, several species of doves being almost the only ones seen.

Although advised by the natives that the early morning was the best time for hunting, we sighted a pair of bears at midday apparently active and feeding in the full glare of the tropical sun. They were on a low bench just above the boulder strewn *playa* or dry stream bed along the opposite side of which we were picking our way at a distance of about half a mile. They might have been overlooked if one of them had not drawn our attention by standing erect. After a rapid chase, during which a couple good dogs were of much assistance, the female bear was killed while the other, presumably a male, was only slightly wounded and made its escape.

From reports received from local sources, it is evident that bears are fairly common in numerous localities in the arid region similar to the one in which we found them. That the bears of this region can be the same species or subspecies as those of the forested regions of eastern Peru does not seem probable, but without specimens of both sexes from both regions the matter remains doubtful.

It is even possible, as suggested by Tschudi,¹ that the original type of *Ursus ornatus* came from this region by way of Trujillo in spite of F. Cuvier's statement that it came from Chile. Certain it is that it must always have been an easy matter to bring living bears into Trujillo, whereas specimens from Chile have been recorded but rarely if at all.

Canis sechuræ Thomas. PERUVIAN DESERT FOX.

Two adult females, Menocucho.

Only lack of time prevented our obtaining a series of this species, for it was fairly common and not difficult to trap. Tracks were seen daily leading up and down the paths about the cane fields, in the sandy stream beds, and occasionally out on the open desert at considerable distance from water. Small ground doves which abound evidently are the favorite prey of the foxes.

Canis culpæus reissi Hilzheimer. NORTHERN CULPEO.

Canis reissii Hilzheimer, Zool. Anzeiger, xxx, p. 116, Apr. 17, 1906 — Type from Quito, Ecuador.

The canids of southern Chile, Patagonia, and Tierra del Fuego have long been known to be of two general types, one small and foxlike, the other larger and more wolflike, although still somewhat smaller than a

¹ Fauna Peruana, pp. 91-92, 1844.

coyote. The smaller animal, currently known as *Canis griseus*, has been reported frequently from localities well to the northward in Chile, Bolivia, and southern Peru and is represented by a desert form, *Canis sechurae*, on the northern coast of Peru; but the larger one, usually called *Canis magellanicus*, has been regarded as chiefly southern in distribution and the most northerly record has been that of the valley of Copiapo in north central Chile where Darwin found it some seventy-five years ago. It was with some surprise, therefore, that I received reports in northern Peru of a *zorro del monte* or *lobo del monte* said to be much larger than the well known small fox of the coast region. Later I saw its tracks in several localities between Cajamarca and Moyobamba and once near Molinopampa at about 9,000 ft. altitude I succeeded in trapping one of the animals only to have it pull out and escape as I approached the trap.

Through the courtesy of Mr. E. W. Nelson, I have been privileged recently to examine a specimen of a small wolf collected for the U. S. Biological Survey in Chosica Canyon, west of Lima, Peru, by Dr. C. H. Tyler Townsend. This specimen appears to represent a slightly differentiated subspecies of the Chilean Culpeo or Magellanic Wolf. It seems probable, moreover, that Hilzheimer's name *Canis reissii* should be used for this northern form although neither description nor figure make this wholly conclusive. If this be the case, it should be called *Canis culpæus reissi* since Molina's name *culpæus*¹ has many years priority over *magellanicus*,² the name current for the southern form. Molina had no type and fails to mention a definite locality but his description is adequate and plainly refers to the animal of central and southern Chile where the vernacular name *culpeu* was and probably still is in use. All authors thus far who have made comparison of the animal of central Chile with that of the extreme south have concluded them to be identical. Therefore, in the absence of evidence to the contrary, it seems necessary to regard *magellanicus* as a synonym of *culpæus*. Gray's type of *magellanicus* was from Port Famine which is on the continental side of the Straits, not on Tierra del Fuego as stated by Mivart.³ The form inhabiting the island of Tierra del Fuego, if distinct from that of the mainland, will take the name *Canis lycoides* Philippi.⁴

As represented by the Peruvian specimen before me, the northern form differs from typical *culpæus* in slightly smaller size, richer color,

¹ Saggio Storia Nat. Chile, p. 293, 1782. I have seen only the second edition and a translation of this work.

² Gray, Charlesw. Mag. Nat. Hist., I, p. 578, Nov., 1837.

³ Monogr. Canidæ, p. 53, 1890.

⁴ Anales. Univ. Chile, p. 4 (author's ed.), Oct., 1896.

and relatively heavier dentition with the last upper molar particularly large and the whole toothrow in consequence more crowded.

Measurements of the skull and teeth are as follows: Occipito-nasal length 137.5; basal length 144.8; basilar length 136; basion to sphenoidium 37.4 (44);* sphenoidium to gnathion 102 (112); zygomatic breadth 82.3 (91); breadth across postorbital processes 37; interorbital constriction 26.7; breadth of braincase 49.5 (51); length of nasals 54 (62); length of palate 77.3 (82); length of Pm.¹ 4.6 (4); Pm.² 9 (8); Pm.³ 10.7 (10); length and breadth Pm.⁴ 17.7 x 8.3 (15 x 7); M.¹ 10.6 x 14.5 (10 x 14); M.² 6.5 x 10.1 (5.5 x 6.5); length of Pm.₁ 4.4 (4); Pm.₂ 9.3 (8); Pm.₃ 10 (10); Pm.₄ 10.9 (11); length and breadth M.₁ 17 x 7 (16 x 7); M.₂ 8 x 5.7 (8 x 4); M.₃ 3.9 x 3.3 (3 x 3).

For the present, I have retained this species and closely allied forms in the genus *Canis*, feeling that this course is desirable until such time as an exhaustive phylogenetic study of all the South American canids is made. An able contribution to this subject has been made recently by Pocock† who points out certain cranial and dental characters distinguishing *Canis antarcticus* from *Canis latrans*.‡ He also demonstrates a degree of similarity between *Canis antarcticus* and *C. thous*. The *thous* group, however, shows similarity to *Urocyon*, and speaking generally it might be said that true *Canis* and *Urocyon* are at opposite ends of a series in which species like *C. antarcticus* and *C. thous* form the intermediate steps. In this series *C. antarcticus* unquestionably falls nearer to true *Canis* than to *Urocyon*. Just where generic and sub-generic divisions should be made, therefore, depends upon more thorough investigation than has yet been made.§

* Measurements in parentheses are those of the type of *C. magellanicus* published by Mivart (Monogr. Canidæ, pp. 55-56, 1890).

† Proc. Zool. Soc. Lond., pp. 382-393, 1913.

‡ Much larger series of the *latrans* group than were available to Pocock bear out his general observations, although occasional skulls show a slightly developed parietal shield quite equal to the condition in certain species of "*Cerdocyon*."

§ While the above is in press, the current (March) number of the Annals and Magazine of Natural History comes to hand with its important discussion of the names of South American Canidæ by Thomas. It is regrettable from the standpoint of those less fortunately situated, that one so eminently competent and so favored with material should not have characterized the various groups otherwise than nomenclaturally, for at least part of them have not been defined zoologically.

The Peruvian specimen mentioned above is doubtless referable to *Pseudalopex culpaeus andina* of Thomas, described as slightly different in color from *P. c. reissi* of Ecuador and probably also of that part of Peru in which our work was done. *P. c. magellanicus* is recognized as a third subspecies and *P. lycoides* of Tierra del Fuego is given specific rank.

Felis onca Linnæus. JAGUAR.

A skull of an adult male secured at Moyobamba shows some characters when compared with specimens from Guiana and northern Brazil. With an equally heavy dentition, the skull has smaller general dimensions but thicker heavier parts. A short broad braincase, heavy post-orbital processes, almost uniformly broad nasals, and small anterior nares are among its peculiarities. When sufficient material is accumulated for revision of the jaguars, it is probable that a race from the eastern base of the Andes will prove recognizable. For such a race, the name *Felis onca peruviana* Blainville may be available.

Jaguars range up to an elevation of at least 7,000 feet in the eastern Andes, but in the region traversed by us they are not particularly common. Tracks were seen at Tambo Yaku and at several points in the forest between Moyobamba and Balsapuerto.

Felis puma Molina. PUMA.

In the mountains of western Peru, the puma is said to be fairly common and as elsewhere strongly addicted to the habit of preying on live stock. Our attempt to secure one at Hacienda Llagueda with a small and scarcely trained pack of dogs was unsuccessful. This was largely on account of the very steep precipitous canyons which were for the most part quite impassable for horsemen. During our stay at Hacienda Limon a sheep was killed by a puma and the carcass was poisoned in the hope of disposing of the offender but without result. In the eastern montagna region from Moyobamba to Yurimaguas we received occasional reports of the puma.

Felis wiedi Schinz. MAXIMILIAN'S TIGER CAT.

One specimen: Moyobamba.

Although slightly immature, this example shows by the reversed fur on the neck and by its dimensions that it represents *Felis wiedi* or a very closely allied form. The fur is long (20-22 mm. on middle of back), thick, and very soft. From the occiput to the shoulders there are but three narrow black lines, the middle one divided posteriorly. The tail has but nine black rings, slightly wider than the fulvous spaces between them. Flesh measurements are: Total length 820; head and body 465; tail 355; hind foot 125.

We had only scattering reports of small cats in the region from Moyobamba westward and saw very few skins in the possession of the natives. From Moyobamba eastward they are more common.

Tayra barbara peruana (Tschudi). TAYRA.

One was seen at Tambo Carrizal east of Balsas May 19. It trotted down a trail carrying a bird in its mouth, its head held high and its whole appearance one of satisfaction and nonchalance. I was standing near the trail without my gun and it did not see me until within a few feet when it dashed off in another direction. Another was seen at Moyobamba by Mr. Anderson under similar circumstances.

Conepatus zorrino THOMAS. SKUNK.

An old male, Menocucho.

The type locality of *C. zorrino* is Eten, a short distance north of Menocucho and less removed from the actual coast, but the fauna of the two places differ but little. The skunk obtained at Menocucho is evidently somewhat larger than the type of *zorrino* and it differs also in the white stripes which do not extend to the base of the tail but stop at the flanks as described for the more southern species, *C. arequipæ*.

Flesh measurements are: Total length 670; head and body 418; tail vertebræ 252; hind foot 85.

Conepatus sp.

An adult female from Hacienda Limon is not definitely identifiable without comparison with types.

Rhynchiscus naso (Wied).

Eight specimens, Nazareth, Yavari River.

The favorite roosting place of these bats is the under side of a tree, stub, or large rock overhanging the water. Such backgrounds blend well with their coloration but are frequently so exposed that at short distances one has no difficulty in distinguishing animal from vegetable. When disturbed they flit away together like a company of butterflies and quickly attach themselves to the nearest similar roosting place, often not flying more than twenty feet. They seem to cling to rather than hang from the nearly perpendicular surfaces and although the head and angles of the wings may be free the abdomen and tail membrane are pressed flatly against the bark or stone. The number found together was from ten to twenty and although specimens were secured only at Nazareth, many were seen along the Parapapura River between Balsapuerto and Yurimaguas.

Noctilio albiventer Spix. COMMON NOCTILIO.

One specimen, Yurimaguas.

This is a dull brownish specimen with the under parts only slightly lighter-colored than the back. In size, it scarcely equals ordinary specimens of *albiventer* from Brazil and it is considerably smaller than the size given for *N. zaparo*, the type of which came from the Napo River in Ecuador not far north of Yurimaguas.

Glossophaga soricina (Pallas). COMMON GLOSSOPHAGA.

Sixteen specimens, all from Moyobamba.

These were mostly brought to us by small boys who found them roosting under the thatch of the village houses. They are essentially like specimens from eastern Brazil.

Glossophaga soricina valens Miller. PERUVIAN GLOSSOPHAGA.

Glossophaga soricina valens Miller, Proc. U. S. Nat. Mus. XLVI, p. 420, Dec. 31, 1913 — Type from Balsas, Peru.

Twenty-nine specimens, Balsas.

Although not seen elsewhere in western Peru, *Glossophagas* were found in great abundance at Balsas roosting under the roof of a church. The building was large and barnlike, simply constructed of rough masonry walls and roofed with small poles which were overlaid with thatch. The interior formed a single rectangular room about 60 ft. long by 25 ft. wide with a raised altar at one end and a plain earth floor extending thence to the door. There were no windows and when the large door was closed only a limited amount of light was admitted through the space between the eaves and the top of the walls. Somewhat to my surprise, requests for the key to the church and permission to shoot in it in the absence of the priest were readily granted and about half the small population of Balsas accompanied us to watch the proceedings. On opening the door, the light streamed in and the roof was seen to be literally covered with bats which immediately began squeaking and shifting their positions. At the first shot, a cloud of them fluttered about the room a moment and then mostly settled again, only a few going outdoors under the eaves. After shooting into various parts of the roof and carefully scrutinizing the remainder, it was evident only one species was present. The total number, as estimated at the time, was not less than 2,000. A larger series of specimens might have been obtained, but some of the people that followed us took advantage

of the occasion to perform their devotions and although I was the only one that seemed to have any idea of desecration, I soon felt like retiring especially since at the last shot I noticed that even as I raised the gun a chola girl had slipped in front of me and as the report rang out she was devoutly kneeling in prayer almost under the muzzle of the gun.

Hemiderma perspicillatum Linnæus. COMMON HEMIDERMA.

Fifty-three specimens: Balsas (1), Moyobamba (51), Tambo Yaku (1).

This very common bat was particularly abundant in the vicinity of Moyobamba and if desired it might have been obtained in much larger numbers. Its usual roosting place is under a thatched roof where it often collects in large numbers in company with *Glossophaga*.

Vampyrops zarhinus H. Allen.

A bat obtained near Yurimaguas is referred to this species since it is slightly larger than *V. z. incarum*.

Artibeus planirostris fallax Peters.

Seventeen specimens, Moyobamba.

This series presumably represents the *A. hercules* of Rehn which Andersen has referred with a slight query to the synonymy of *A. p. fallax*.* It might now be possible to dispose of this name still more definitely if satisfactory material representing typical *fallax* were at hand. As compared with two specimens from Cayenne (*Uroderma validum* of Elliot), the Peruvian bats are slightly larger and decidedly less brownish in color. The skulls measure slightly more than the average given by Andersen but fall a trifle short of his maximum. A larger series of *fallax* would probably show enough variation to cover such differences.

This large *Artibeus* was fairly common at Moyobamba where it was found roosting in mango trees under the protection of their thick heavy foliage.

Desmodus rotundus (Geoff.). VAMPIRE.

Forty-three specimens: Hacienda Llagueda (35), Cajamarca (7), Moyobamba (1).

Blood sucking bats are abundant throughout the greater part of the

*Proc. Zool. Soc. Lond., p. 242, Sept., 1908.

region we traversed. In the *jalcas* at elevations of 10,000 feet or more, we had no evidences of them, but at altitudes between 1,000 ft. and 9,000 ft. they are generally distributed. Certain localities are noted for them and are avoided by mule drivers as much as possible. At Hacienda Llagueda and near Cajamarca, we found them roosting in caves, and old mine shafts or prospect holes. In such places, the ground beneath the suspended bats is usually filthy with accumulated excrement. It sometimes forms great pools of dark brown digested blood more or less watery or viscous in the center and gradually hardened or encrusted at the edges. A very large cave which we examined near Molinopampa must have contained several thousand of these bats and some of the pools of excrement were two to three feet deep.

Our pack mules were constantly subject to attack from bats and the steady annoyance and loss of blood affected their general condition very rapidly. The point of attack was almost invariably at the top of the withers, apparently because this is one of the parts the victim is least able to protect. The wound inflicted shows on examination how effective is the highly developed cutting machine. A small nearly round button of skin about one fourth of an inch in diameter is removed and after the bat has sucked its fill, blood continues to flow for some time, streaking down the animal's sides and even to its forelegs. Just how far an animal might be persecuted is uncertain but it seems quite possible that one weakened or temporarily defenceless might be put to death by its bloodthirsty tormentors. One of our mules was bitten thirteen times in a single night and it was not uncommon for one or more of them to show eight or ten wounds when it was brought in from a night at large. It was noticed that some of the mules were bitten much less frequently than others; in fact, one animal which was easily the most sagacious and always in better condition than the others was practically exempt throughout the trip. That this was due to superior ability to ward off the pests was quite apparent, especially since toward the end of the trip the animals in poorest condition continually suffered more and more than those not so weakened physically from other causes.

On two occasions our men were bitten by bats, once when we were sleeping in the same room with them in a house in Moyobamba, the men in an alcove at one end and ourselves in the main room with doors open for free ventilation. I heard bats flying about during the night but supposed they were the common *Hemiderma* until morning when one of the men came out with a sheepish look on his face and held up his bare foot showing one of the characteristic round punctures on the end

of his great toe. He made light of it and said he had often had the same experience. The wound healed quickly and caused only slight inconvenience. Later, one of our porters or *cargueros* was bitten on the same spot, the great toe, while sleeping in the open air during the journey from Moyobamba to Balsapuerto.

Amorphochilus schnabli Peters.

Two specimens, Hacienda Limon, near Balsas.

Since the publication of the original description of this rare bat by Peters in 1877, no additional records of it have appeared. Its rarity in collections is perhaps due to its habit, as observed by us, of flying at an hour when humans usually are asleep. The two individuals obtained were taken on separate occasions but in each case the hour was approximately three in the morning. Happening to awaken at that time, we heard them flying about our room and quickly closing the doors made them prisoners.

These specimens agree closely with the excellent description and figures published by Peters. The greatest discrepancy is in the color, which he gives as dark cinnamon brown. In a dry skin unaffected by preservative the color of the upper parts is dark smoke gray tinged with drab, the hairs being long (8–10 mm.), soft, and at their bases mouse gray. The under parts are practically the same color as the back and about the muzzle there is a tinge of brownish, perhaps extraneous.

The form of the skull in general is very similar to that of *Furipterus*; braincase slightly higher and narrower but palate broader, especially anteriorly; rostrum slightly longer and broader with lachrymals more expanded. In our specimen the braincase is relatively lower than in the figures published by Peters. Consequently the distinction drawn by Miller in his key to the genera of *Furipteridæ*¹ does not hold, the ratio between the height and length of the braincase being practically the same in the two genera (see measurements). The teeth show numerous slight departures from those of *Furipterus*. The outer upper incisor is separated from the canine by a much greater space, about equalling the basal length of the canine. The upper canine has its posterior cutting edge entire and with only slight concavity toward the tip; its cingulum is scarcely developed, the conspicuous anterior and posterior cusps of *Furipterus* being absent. The posterior upper premolar has only a slight indication of an inner cusp. The upper molars

¹ Families and Genera of Bats, p. 188, 1907.

are larger and wider than in *Furipterus* and the principal cusps are higher, but the cingulum is so slightly developed as to be visible only upon the closest examination. The lower incisors, canine, and premolars are more similar in the two genera than the corresponding upper teeth, but in *Amorphochilus* there is practically no tendency to the development of cusps from the cingulum. A slight space exists between the inner pair of lower incisors. Lower molars with scarcely any cingulum. Entoconids relatively farther from metaconids; commissure from entoconid to hypoconid higher and stronger, especially in the first lower molar, in which the entoconid is but slightly higher than the commissure, which forms a broad blade.

The following measurements have been taken: Male, measured in flesh: Total length 86; tail 28; hind foot 7. Female, in alcohol: Total length 83; head and body 54; tail 29; hind foot 6.5; forearm 36; third digit: metacarpal 34.4, 1st phalanx 5.2, 2nd phalanx 22.2; fourth digit: metacarpal 31, 1st phalanx 6.8, 2nd phalanx 10.5; fifth digit: metacarpal 31.2, 1st phalanx 10.5, 2nd phalanx 6.7; tibia 18; calcaneum 15.3. Skull: Greatest length 12.1; basal length 11.3; interorbital constriction 13.1; zygomatic width 7.3; mastoid width 6.5; maxillary width at base of M^2 4.8; width between tips of canines 2.5; width of braincase 5.8; depth of braincase including audital bullæ 6.7; frontal angle to occiput 7.6; upper toothrow, C to back of M^4 4.7; width of M^3 1.3; lower toothrow including incisors 5.7.

***Myotis nigricans* (Wied).**

Six specimens, Moyobamba.

Although fairly common and widely distributed, vespertilionine bats usually are more difficult to obtain in South America than those of other groups. In almost all cases where we saw them, it was under conditions where shooting was extremely difficult. While staying at "Los Baños," near Moyobamba, we discovered the roosting place of some of these small bats in the side of the wall of a house, the only entrance apparent being a crevice in a door jamb. A light net stretched over this crevice early in the evening soon entangled six bats, evidently all that were roosting in that place, for no further captures were made although the net was kept there for several days. Such differences as appear on comparison of these specimens with others from eastern Brazil are not sufficiently marked to warrant any separation at the present time.

Myotis nigricans mundus (H. Allen).

Vespertilio mundus H. Allen, Proc. Acad. Nat. Sci. Phila., p. 280, 1866 — Type from Maracaibo, Venezuela.

Vespertilio concinnus H. Allen, supra cit., pp. 280-281 — Type from Salvador.

Myotis nigricans concinnus Osgood, Field Mus. Nat. Hist., Pub. 155, Zoöl. Ser., X, p. 65, Jan. 10, 1912.

One specimen, Hacienda Limon, near Balsas, Marañon River.

Although subsequent material may point to a different conclusion, the only one justifiable at present is the reference of this specimen to the form ranging southward from southern Mexico and for which the name *mundus* seems available. In a former paper (supra cit.), I referred a specimen from the vicinity of Maracaibo, Venezuela, to *M. n. concinnus*, overlooking the fact that it is practically a topotype of *Vespertilio mundus* of Harrison Allen. Since *mundus* has page priority over *concinnus*, it will be necessary to use it, although its type unfortunately has been lost.¹ That the description of *mundus* applies to the same species as that of *concinnus* there can be little doubt, the measurements being even smaller than those given for *concinnus*.

Our specimen is slightly smaller than typical *nigricans* and even paler, especially on the under parts, than typical *mundus*. Its skull is somewhat larger than that of the Maracaibo specimen but has the same general form. Both skulls differ from those of *nigricans* in having a narrower rostrum and interorbital space, characters which may prove to be of specific importance, but the disposition of the form as a subspecies of *nigricans* for the present seems more convenient than any other treatment.

Myotis simus Thomas.

A single specimen obtained at Yurimaguas by Mr. Anderson is provisionally referred to this species, with the description of which it is in essential agreement.

Myotis sp.

A relatively large *Myotis* (forearm 41) with well-developed glandular facial rugosities was obtained at Hacienda Limon. In the present imperfect state of knowledge of South American vespertilionine bats, its relationships are scarcely even conjectural.

¹ See Bull. 62, U. S. Nat. Mus., p. 290, 1909.

Molossops milleri * sp. nov.

Type (skin) from Yurimaguas, Peru. No. 19562 Field Museum of Natural History. Female adult. Collected Sept. 30, 1912, by M. P. Anderson. Orig. No. 61.

Characters.— Size small, smaller than any previously described species of *Molossops*; color dark without whitish markings; pelage short but very soft and silky; patches of fur well developed on inner proximal and outer distal sides of forearm and across wing membrane to and covering the middle third of the metacarpal of the fifth digit. General characters about as in *M. planirostris*.

Color.— Upper parts dark glossy blackish brown, the hairs of the middle of the back with pale brownish fawn bases, those of the head and sides nearly or quite self-colored; under parts decidedly paler, Prout's brown to mummy brown, the throat and breast rather paler than the abdomen and sides.

Skull.— Anteorbital or lachrymal breadth decidedly less than half of basal length and evidently less than in related forms; braincase broad and bulging laterally, depressed medially and without suggestion of a sagittal crest; palate moderately domed, slightly concave longitudinally as well as laterally.

Measurements.— Type, measured in the flesh by the collector: Total length 83; head and body 57; tail 26; foot 6.5. Additional measurements from dry skin: Lower leg 10; forearm 29; third digit, metacarpal 29.7, first phalanx 13.2; second phalanx 11. Skull of type: Greatest length 16; basal length 14.7; zygomatic breadth 10.5; anteorbital or lachrymal breadth 6.5; postorbital constriction 4.4; breadth of braincase 8.4; breadth of anterior nares 2.7; front of canine to back of last molar 6.

Remarks.— The dark color of this species renders comparison with *M. planirostris* unnecessary and its small size distinguishes it from all other species. I am indebted to Mr. Oldfield Thomas for making direct comparison of the type of *M. milleri* with that of *M. p. paranus*.

Mormopterus kalinowskii (Thomas). KALINOWSKI'S BAT.

One specimen, Hacienda Limon, near Balsas, Marañon River.

Except in certain larger dimensions, this specimen, an adult female, agrees with the original description of the type. It possesses a well-

*For Mr. Gerrit S. Miller of the U. S. National Museum.

developed subcircular pad at the base of the thumb, and therefore does not differ from *M. minutus* in that respect.¹

Measurements taken from the alcoholic specimen are as follows: Total length 82; head and body 48; tail 34; lower leg 11; hind foot 7.5; forearm 39; third metacarpal 39; fifth metacarpal 24. Measurements of the skull are: Greatest length 15.7; basal length 14.8; zygomatic breadth 9.4; mastoid breadth 8.9; breadth across lachrymal processes 6; interorbital constriction 3.5; occipital depth 5.3; upper toothrow, without incisors, 5.7.

Molossus obscurus Geoffroy. DUSKY MOLOSSUS.

Eleven specimens: Yurimaguas (1), Moyobamba (10).

This bat, like *Hemiderma* and *Glossophaga*, roosts about buildings but usually in less accessible places, and is therefore not so easily obtained. Average measurements of nine specimens: Total length 110 (105-114); tail 39.88 (37-45); hind foot 9.3 (8-11); forearm (dry) 40.3 (38.5-41.8).

Cebus macrocephalus Spix. BROWN CAPUCHIN MONKEY.

Four specimens, Tambo Yaku, near Rioja.

Although monkeys are said to be common throughout the montagna along our route, we encountered them only once. A small troop passed near our camp at Tambo Yaku July 5 and after two had been shot some of the others lingered in the vicinity until the following day, when two more were killed. They were rather shy and easily started into flight; but they seemed to rely only on their speed and agility in getting away, without any attempt at quick or crafty concealment. When started in a given direction they continued even though it took them almost directly over the cause of their alarm. This species and most other monkeys of the region are much sought as food and they are therefore steadily becoming scarcer near regular routes of travel. We sampled their flesh and found it so well flavored that we preferred it to fresh peccary meat, which was available at the same time. Monkeys are reported as far west as Tambo Almirante at an elevation of about 5,000 ft. and not more than 40 miles east of Chachapoyas.

Reference of these specimens to *Cebus macrocephalus* is provisional. They agree fairly well with the colored figure given by Spix and to a considerable degree with the description and measurements published

¹ Cf. Miller, Bull. Amer. Mus. Nat. Hist., XII, p. 176, 1899.

by Elliot. Although considerable variation may be admitted among the species of this genus, it is more than likely that it is overestimated in many cases on account of material having insufficient or erroneous data as to locality. In specimens taken at one locality by reliable collectors, variation has rather narrow limits.

Flesh measurements of an adult male are: Total length 870; tail 395; hind foot 128; forearm 130; circumference of chest 320. Skull: Greatest length 107; basal length 84.3; zygomatic breadth 77.3; breadth of braincase 54.6; palatal length 34.3; postorbital constriction 30.4; upper molar series 23.1.

Lagothrix infumata (Spix). BROWN WOOLLY MONKEY.

One specimen (♂ ad), Puerto Arturo, near Yurimaguas.

The name *infumata*, as applied to this specimen, is intended in a collective sense to indicate relationship to that species rather than to *L. lagoiricha*. The head is dark seal brown as described for *L. thomasi* but the back is without any indication of a blackish dorsal line. In respect to the color of its head, therefore, it appears to resemble *thomasi*, while in the color of its back it is like *infumatus*. Without material for comparison, it is difficult or impossible to determine what should be its exact designation. Flesh measurements are: Total length 1,071; head and body 445; tail 626; hind foot 138.

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NEW MAMMALS FROM BRAZIL
AND PERU

BY

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CHICAGO, U. S. A.

October 22, 1915.

NEW MAMMALS FROM BRAZIL AND PERU

BY WILFRED H. OSGOOD

Among mammals obtained by the Field Museum before its field work in South America was temporarily discontinued, are a few belonging to species or subspecies not as yet described and named. Eight of these, of which the status seems reasonably certain, are described below. Two new subgenera of rodents, the existence and relationships of which were discovered as a result of the recent growth of American collections of neotropical mammals, are also included. For the use of material for comparison I am indebted to Dr. J. A. Allen of the American Museum of Natural History, New York, Dr. Witmer Stone, Academy of Natural Sciences, Philadelphia, and Mr. Gerrit S. Miller Jr., U. S. National Museum, Washington.

***Marmosa impavida neglecta* subsp. nov.**

Type from Yurimaguas, Peru. Altitude 600 ft. No. 19636, Field Museum of Natural History. Adult female. Collected September 28, 1912, by Malcolm P. Anderson. Original No. 55.

Characters:— Similar to *Marmosa impavida* of central Peru but color of under parts buff instead of soiled whitish; upper parts somewhat paler, especially sides of face and interorbital region; front of hind legs dark brown instead of grayish.

Color:— Upper parts in slightly worn pelage russet brown to cinnamon rufous; forehead and interorbital region pale cinnamon; black facial stripe and eye ring well marked, extending nearly to rhinarium; under parts entirely buff, the hairs of the sides of the belly normally with slaty bases, the others self-colored; short-haired part of lower leg dark brown on front and sides; tail uniformly dusky except for slight irregular light markings on under side.

Skull:— Very slightly larger than in typical *impavida* and having somewhat smaller mastoid bullae; otherwise similar.

Measurements:— Type and two adult paratypes, respectively, measured by the collector: Total length 320, 295, 295; head and body 134, 119, 129; tail vertebrae 186, 176, 166; hind foot with claws 17, 18,

19. Skull of type: Greatest length 37.9; basal length 36.9; zygomatic breadth 19; least interorbital breadth 6.2; nasals 7.9×3.9 ; palate length from gnathion 21.4; upper tooththrow c to m⁴ 15.7; combined length ms¹⁻³ 6.6.

Remarks.— The type locality of *Marmosa impavida* as given by Tschudi is the forest region of eastern Peru between 10° and 12° latitude south. A specimen lately received from this very region indicates that typical *impavida* is appreciably different from the animal of northern Peru. This specimen was collected by M. P. Anderson at San Ramon on the Rio Chanchamayo in the Perené region at about 10° 60' S. lat. and is therefore to be regarded as absolutely typical of *impavida*. It is characterized by rather dark color with a strong admixture of sooty on the upper parts, by pale creamy or soiled whitish under parts except a buffy chin, and by grayish hind legs. The buff-bellied form from Yurimaguas, previously referred to *impavida*, is distinguished from the typical form at a glance.

Holochilus amazonicus sp. nov.

Type from Itacoatiara, Amazon River, Brazil. No. 20136, Field Museum of Natural History. Adult male. Collected May 11, 1913, by Robert H. Becker. Original No. 50.

Characters.— A medium-sized species allied to *Holochilus sciureus* of eastern Brazil, but larger with a heavier skull and relatively weak dentition. Similar to *H. guianae* but slightly larger with a longer tail and a heavier more ridged skull.

Color.— Upper parts dull ochraceous buff rather heavily mixed with dusky producing a general effect of cinnamon brown; sides brighter than back and becoming ochraceous buff as they merge with the under parts; forehead slightly duller-colored than back; chest and abdomen heavily washed with clear ochraceous buff, the hairs light neutral gray at the base and broadly tipped with ochraceous buff; throat, inguinal region, and inner sides of legs light buff, the hairs usually self-colored but sometimes with grayish bases; ears well-haired, ochraceous buff inside, somewhat darker outside; tail uniformly dusky except a very slight subbasal paleness.

Skull.— Decidedly larger and heavier than that of *H. sciureus*;* rostrum much longer; cheek teeth relatively small and light, about equal in actual size to those of *sciureus*; supraorbital ridges elevated and

* Figured by Winge under the name *Sigmodon vulpinus* (E. Museo Lundii, pt. III, pl. II, fig. 5, 1888); see Thomas, Ann. & Mag. Nat. Hist., (6), XIX, p. 495, footnote, 1897.

continuous across parietals to outer edges of interparietal; frontals somewhat expanded behind; anterior border of interparietal somewhat concave; palatine foramina large; mesopterygoid fossa extended forward at least to plane of last molars.

Measurements:— Three adults, measured by the collector: Total length, 389, 375, 374; head and body, 201, 193, 194; tail 188, 182, 180; hind foot with claw 45, 45, 42. Skull of type: Greatest length 41.2; basilar length 32.5; mastoid breadth 15.2; nasals 16.3×4.8 ; interorbital breadth 4.8; length of fronto-parietal suture (between ridges) 8.1; interparietal 10.8×3 ; palatine foramina 8.7×3 ; diastema 12.5; upper toothrow 7.4.

Remarks:— The water rats of the genus *Holochilus* heretofore have been known only from extreme eastern South America, but the taking of an immature specimen in Eastern Peru * and the discovery of the above described form in the middle Amazon region indicates that their range is much more extensive. Of the described forms, only *H. guianae*, *H. sciureus*, and *H. nanus* are geographically near the one here named. *H. nanus* of the lower Amazon region is so much smaller that it need not be considered. *H. sciureus* (type locality, San Francisco River, Brazil) evidently is closely related but its skull, as figured by Winge, is so much smaller, that there is no doubt of its distinctness. *H. guianae*, from the Kanuku Mts., is described as having the interorbital region flat without elevated ridges, a character not shown by our species. The remaining species of the genus inhabit southeastern Brazil and Argentine and on account of their heavier dentition are well distinguished from the northern forms. Doubtless all the species are very similar in color.

***Phyllotis definitus* sp. nov.**

Type from Macate, 50 miles northeast of Chimbote, Peru. Altitude 9,000 ft. No. 21125 Field Museum of Natural History. Adult male. Collected Feb. 14, 1914 by M. P. Anderson.

Characters:— A large full-pelaged species of relatively deep rich color and with the tail about equalling the head and body in length. Upper parts cinnamon brown mixed liberally with dusky, the rump slightly lighter than the back and the shoulders and nape inclining to grayish; nose, forehead, and sides of face decidedly grayish in definite contrast to the body; inside of ears nearly clear ochraceous, outside with some mixture of dusky; under parts buffy ochraceous, paler and more whitish

* See Field Mus. Nat. Hist., Pub. 176, Zool., X, p. 167, Apr. 20, 1914.

on the throat and inguinal region, deeper and generally forming a definite ochraceous band across the pectoral region; all the hairs dark slaty at bases; feet buffy white, the forefeet with faint traces of dusky, the hind feet with the proximal fourth more or less ochraceous; tail dusky above, buffy white below.

Skull rather large and stoutly built, with broad nasals, heavy zygomata, and broad teeth; as compared with that of *P. darwini*,* it is slightly larger, with broader nasals and ascending branches of pre-maxillæ; anterior part of zygomata (infraorbital region) decidedly heavier; mesopterygoid fossa narrower; teeth broader and heavier; incisors especially broad and strong.

Measurements:— Type: Total length 263; head and body 131; tail 132; hind foot (c. u.) 28; ear from notch (dry) 22. Skull of type: Greatest length 31.6; basilar length 25.8; zygomatic breadth 17; nasals 12.4×4.7 ; diastema 8; palatine foramina 7.6×2.2 ; upper tooththrow 5.6.

Remarks:— Four specimens of this species were taken by Mr. Anderson in the mountains above the Rio Santa. They show but little variation and seem to represent a species quite distinct from any previously described. Their ochraceous ears and grayish heads suggest possible relationship with the *Auliscomys* group, but taken as a whole their characters are those of typical *Phyllotis*. However, it would perhaps not be unfair to look upon the species as a somewhat connecting form between *Phyllotis* and *Auliscomys*. Comparison of cranial characters has been made with *P. darwini* mainly because the skull in that species is of approximately the same size; it is obviously not closely related. A species which may have real relationship is *P. micropus*, which also has dark under parts and a relatively short tail; but this too is well distinguished.

***Auliscomys* subg. nov.**

Type, *Reithrodon pictus* Thomas.

Characters:— Somewhat intermediate between *Euneomys* and *Phyllotis*; upper incisors with slight but distinct grooves near the outer edges of their anterior surfaces; molariform teeth slightly more hypsodont than in *Phyllotis* and with the division of the anterior lobe of the second upper and lower molars persisting throughout a longer period of wear so that these teeth in specimens of average age present three outer angles instead of two; pattern of tooth crowns with angles much less oblique than in *Euneomys*; maxillary suture in front of infraorbital foramen

* Specimens from Oroya and Junin, probably representing *P. d. posticalis*.

nearly vertical as in *Phyllotis*, not decidedly flexed forward in its lower half as in *Euneomys*; palatal pits and foramina practically as in *Phyllotis*; tail shorter than head and body as in *Euneomys*.

Remarks:— Some of the species of this group have been referred to *Phyllotis* and others to *Euneomys* and it is clear that although they have affinities to both, they should have some collective recognition. On the whole, they have more of the characters of *Phyllotis* than of *Euneomys* and it seems best therefore to regard the group as a subgenus of *Phyllotis*. The species referable to it with certainty are: *Phyllotis sublimis* Thomas, *P. pictus* Thomas, *P. boliviensis* Waterhouse, *P. b. flavidiior* Thomas, and *P. decoloratus* sp. nov.

***Phyllotis (Auliscomys) decoloratus* sp. nov.**

Type from Tirapata, Dept. Puno, Peru. No. 16500 American Museum of Natural History. Adult female. Collected October 21, 1900, by H. H. Keays.

Characters:— Similar to *Phyllotis pictus* but smaller and paler; somewhat similar to *P. boliviensis* but decidedly smaller, especially the ears and feet, and with the color of the ears and the rump more contrasted with that of the body. General distribution of color practically as in *P. pictus* but paler throughout, the rump inclining to buffy rather than tawny, the head and shoulders a paler grayish and the feet entirely white without traces of ochraceous; inside of ears pale ochraceous buff well-contrasted with the surrounding grayish, but much paler than the rich tawny of *P. pictus*.

Skull decidedly smaller and relatively narrower than that of *P. pictus*; upper incisors distinctly grooved and rather pale in color.

Measurements:— Type and adult male topotype, respectively: Total length 178, 216; head and body 95, 114; tail 83, 102; hind foot 23, 25; ear from notch (dry) 17, 18. Skull of type: Greatest length 26.6; basilar length 20.9; zygomatic breadth 15.4; least interorbital breadth 4.2; nasals 10.4×4; breadth of braincase 12.6; diastema 7; palatine foramina 6.4×2; upper toothrow 5.1.

Remarks:— I am indebted to Dr. J. A. Allen for the privilege of examining the type and several additional specimens of this species from the collection of the American Museum of Natural History. These were at first supposed to represent *P. boliviensis*, but examination of the original description of that species in connection with a topotype kindly loaned by Mr. G. S. Miller, Jr., of the United States National Museum indicates that this is far from the case. *P. boliviensis*, as

stated by Waterhouse, has very large ears and a more uniform coloration than *P. pictus* and *P. decoloratus*. The ear in the single topotype available measures approximately 25 mm. in length whereas in the largest of eight specimens of the species here described it measures only 18 mm., a difference of nearly forty per cent. Specimens from San Antonio and Crucero, Peru, are somewhat brighter in color than those from Tirapata, but are otherwise similar.

Akodon aërosus baliolus subsp. nov.

Type from Inca Mines, Inambari River, Peru. Adult male. No. 20108 Field Museum of Natural History. Collected Aug. 11, 1900, by H. H. Keays.

Characters:— Similar to *Akodon aërosus* as represented by specimens from northeastern Peru (Moyobamba), but darker, more blackish, in color. General color above blackish bistre or mummy brown, the rump rather more blackish than the anterior parts; lower parts correspondingly dark and showing less contrast than in *aërosus*. Skull averaging rather shorter with broader braincase and shorter nasals; otherwise similar to that of *aërosus*.

Measurements:— *Type*: Total length 190; tail 83; hind foot (dry) 25. Skull of *type*: Greatest length 28; basilar length 22.7; zygomatic breadth 14.7; breadth of braincase 13.4; nasals 9.8×3.3 ; interorbital constriction 5.7; palatine foramina 5.9×2.2 ; upper toothrow 4.8.

Remarks:— The slight characters distinguishing this form are constant in the small series examined and the great distance between its range and that of typical *aërosus* lends probability to the inference that larger series would be equally constant. In the thousand miles or more between southern Ecuador, the *type* locality of *aërosus*, and southern Peru, where the present form is found, there is much country not yet visited by naturalists and records of this species are few, but there can be little doubt that it has nearly or quite continuous range along the east base of the Andes from Ecuador to Bolivia.

Dasyprocta nigriclunis sp. nov.

Type from Saõ Marcello, upper Rio Preto, Bahia, Brazil. No. 20746 Field Museum of Natural History. Adolescent female. Collected March 23, 1914, by Robert H. Becker. Original No. 559.

Characters:— A very distinct species with jet black nape and rump and hairy ferruginous ears; hairs of nape elongated to form a slight nuchal crest; size medium; general relationship probably with *Dasy-*

procta prymnolopha, but coloration differing in many respects, notably in the banded instead of clear yellowish or rufescent hairs of the sides of the rump.

Color.—Elongated hairs of nape and rump glossy black, the basal half of the hairs dark quaker drab, in some cases with one or two bands of pale buffy; hairs of top of head, face, sides of body, and proximal part of legs sharply banded black and buffy or ochraceous, the light bands paler and narrower anteriorly, especially on the sides of the shoulders, lighter, more ochraceous, and broader posteriorly on the sides of the rump; fore and hind legs mostly banded also, but narrowly; inner side of hind legs with a narrow line nearly clear buff; maxillary region and chin creamy buff; middle of throat with hairs broadly buff-tipped and with dark drab bases; hairs of chest ochraceous without dark bases, the same color extending along the abdomen on each side of a narrow central line of white; sides of abdomen banded ochraceous and drab; fore and hind feet black, finely sprinkled with ochraceous; front and inner sides of ears thickly clothed with rich ferruginous hairs; a thick tuft of bristly black hairs over each eye.

Skull.—Somewhat smaller and narrower than that of *Dasyprocta aguti*; palate narrow; palatine foramina narrow and slitlike; jugal relatively broad posteriorly but narrow anteriorly and without any pronounced tendency to the development of an angle or postorbital process; infraorbital opening of lacrymal canal at base of incisor narrow and constricted in the middle, much smaller than in other species; supraoccipital rather narrow; teeth about as in *D. aguti*.

Measurements.—Type, measured in the flesh by the collector: Total length 511; hind foot 113. Skull of type: Greatest length 96.2; basilar length 72.7; zygomatic breadth 43.9; least interorbital breadth 26.5; mastoid breadth 33.2; nasals 32.3×15.5 ; length of palate 35.8; width of palate at middle of second molar 6.6; diastema 22.7; depth of jugal in middle 4.5; upper toothrow * (alveoli) 18.2.

Remarks.—Of the described species of *Dasyprocta*, the only one approaching this very distinct new form is *Dasyprocta prymnolopha*, supposed to have come originally from Guiana. Although no specimens of *D. prymnolopha* are at hand, descriptions of that species, of which the best seems to be that given by Waterhouse,† indicate that there are many characters distinguishing it from the above described form. In typical *prymnolopha*, as described, the black rump is bordered on each side by clear golden or chestnut, the long rump hairs are yellow-

* Milk premolar still present but permanent tooth in place and visible beneath it.

† Mamm. II, p. 380, 1848.

ish at the base, the ears are thinly haired and dusky, and in the skull the jugal has a well-developed postorbital process. In all of these respects *D. nigriclunis* is markedly different, the sides of the rump being mixed tawny and black, the long rump hairs are dark drab at the base, the ears are hairy and light ferruginous in color, and in the skull the jugal shows scarcely an indication of a postorbital process. The type of *D. nigriclunis* is slightly immature, for although the last molar is up in place and somewhat worn, the milk tooth is still in the last stages of functional condition. It is possible that an older individual might show some development of a postorbital process of the jugal, but this is rendered improbable by the fact that in various of the yellow-rumped species it is well marked in specimens younger than the type of *nigriclunis*.

Caviella subg. nov.

Type, Cavia australis Geoffroy & D'Orbigny.

Characters:— Intermediate, in a broad sense, between *Cavia* and *Galea*, having certain general cranial characters of *Cavia* and dental characters of *Galea*; palatine foramina large and roughly triangular, their length at least half the diastema; orbital branch of maxillary continuous as in *Cavia*, not broadly interrupted by lacrymal as in *Galea*; palate with a central ridge and deep lateral channels; rostral and interorbital region nearly flat, not laterally sloping; lateral boundary of rostrum formed almost entirely by the premaxillae, the shelflike development of the maxillaries found in *Cavia* and *Galea* being so reduced that the lower border of the infraorbital foramen is clearly visible when the skull is viewed from directly above; incisors projected well beyond the nasals, unpigmented as in *Cavia*; cheekteeth closely similar to those of *Galea*, the enamel loops of the middle teeth nearly equal in size and the posterior loop with no angle on its outer side.

Remarks:— Examination of a considerable series of skins, skulls, and skeletons of various species usually referred to *Cavia* and *Kerodon* indicates that a natural arrangement of generic and subgeneric groups requires some changes in the application of names. The name *Kerodon* should be restricted to one species, *Kerodon rupestris*, which not only differs from the others in habits, in external characters, and in cranial characters, but in important skeletal characters. Chief of these are the narrow and rounded instead of flattened sternum, the thick, heavy, and depressed spinous processes of the lumbar vertebræ, the large neural spine of the axis fully overlapping the first cervical, and the transverse processes of the atlas which are singly instead of doubly perforated on

their inferior surfaces.* Numerous less obvious peculiarities of the skeleton of *Kerodon rupestris* appear on close comparison.

The remaining species may be divided into three groups of subgeneric rank, *Cavia*, *Galea*, and *Caviella*. *Cavia* has long been in use, *Galea* (type *G. musteloides*) has been regarded as a synonym of *Kerodon*, and *Caviella* has not heretofore received a name. Although *Cavia* has frequently been regarded as generically distinct from the species now included in *Galea*, the fact that several of the characters of *Cavia* and *Galea* are combined in *Caviella* strengthens the conclusion that the conditions may best be expressed by one generic and three subgeneric names. A synopsis of the entire group based on the most convenient and obvious characters is as follows:—

Sternum narrow and rounded.

Genus KERODON

Species: *Kerodon rupestris* Maximilian

Sternum broad and flat.

Genus CAVIA

Orbital branch of maxillary continuous; incisors unpigmented.

Posterior enamel loop of middle cheekteeth decidedly larger than anterior and deeply indented on its outer border.

Subgenus CAVIA

Species: *Cavia porcellus* Linnæus, † *C. aperea* Erxleben, *C. aperea azaræ* Wagner, *C. rufescens* Lund, *C. rufescens guianæ* Thomas, *C. rufescens pamparum* Thomas, *C. rufescens venezuelæ* Allen, *C. cutleri* Bennett, *C. atahualpæ* Osgood.

Enamel loops of middle cheekteeth approximately equal in size and shape.

Subgenus CAVIELLA

Species: *C. australis* Geoff. & D'Orbigny, *C. mænas* Thomas, *C. niata* Thomas, *C. niata pallidior* Thomas.

Orbital branch of maxillary broadly interrupted by lacrymals; incisors pigmented.

Subgenus GALEA

Species: *C. musteloides* Meyen, *C. boliviensis* Waterhouse, *C. boliviensis leucoblephara* Burmeister, *C. boliviensis littoralis* Thomas, *C. auceps* Thomas, *C. spixi* Wagler, *C. palustris* Thomas, *C. wellsi* sp. nov.

* This character is shared with *Cavia*, but sharply distinguishes from *Galea*; no skeleton of *Caviella* has been available.

† Domestic guinea pig; syn. *C. cobaya*.

Cavia (Galea), wellsi* sp. nov.

Type from Saõ Marcello, junction of Rio Preto and Rio Sapaõ, Bahia, Brazil. No. 20783 Field Museum of Natural History. Adult female. Collected March 19, 1914, by Robert H. Becker. Original number 533.

Characters:— Similar to *Cavia spixi* from the *catanga* of eastern Brazil, but very slightly darker in color and markedly different in cranial characters, the skull being shorter and broader and the audital bullae larger.

Color:— Fresh, unworn pelage: Upper parts wood brown and dusky finely punctulated, the hairs of the anterior part of the body deep mouse gray basally and with two or sometimes three annulations of wood brown and dusky distally; hairs of posterior part of the body paler basally, between mouse gray and light mouse gray of Ridgway; a light eye ring (tulleul buff) with a very slight interruption at the anterior canthus of the eye and a broadening at the posterior canthus which continues with slight admixture of dusky to the base of the ear and thence above the ear to a definite postauricular spot which is whitish on its lower side; inside of ears well clothed with buffy hairs; hairs of maxillary region with broad avellaneous tips, those of the lower throat similar but with narrower tips and with the dark basal color somewhat exposed; chin and fore-throat, chest, belly, and inside of legs creamy white, a few of the hairs along the median line without dark bases; upper side of fore and hind feet pale wood brown or buffy.

Skull:— Similar to that of *C. spixi*, but broader, and more heavily ridged; audital bullae decidedly larger; ascending branches of pre-maxillæ broader and more spatulate; supraorbital border from lacrymal to squamosal more elevated, especially anteriorly; lacrymal and maxillary arm of zygoma broader and heavier; posterior border of lacrymal with a nearly semicircular orbital process; interparietal small and triangular; palatine foramina short and relatively expanded; palatine very slightly pitted and joining maxillary evenly instead of at an angle; mesopterygoid fossa rounded in front; basioccipital narrow; foramen magnum high and narrow; cheekteeth relatively heavy; front of incisors creamy buff, paler than in *C. spixi*.

Measurements:— Type: Total length 234; hind foot 51. Skull of type: Greatest length 57.5 (59.2); † basilar length 45.5 (46.1); zygomatic

* Named for James W. Wells, author of *Three Thousand Miles Through Brazil*, and explorer of the Rio Preto in 1874.

† Measurements in parentheses are those of a specimen of *Cavia spixi* (No. 20289), from Jua, near Iguatu, Ceara, Brazil.

breadth 33 (30); interorbital breadth 12.2 (12.4); nasals 22.5×8.8 (22.5×8.8); width of nasal branch of premaxilla 2.7 (1.3); interparietal 7×4.2 (11×5.2); width of audital bulla at point of greatest inflation 10 (8.6); diastema 14.2 (15.8); length of palate 24.5 (25.3); palatine foramina 5.7×2 (7×1.2); upper toothrow (crowns) 13.2 (12.1).

Remarks.— The external differences between this form and *Cavia spixi* are very slight and perhaps inconstant, but the cranial characters are numerous and marked. Specimens from the state of Ceara, Brazil, have been used to represent *Cavia spixi* for present comparisons although Wagler's original description of that species states that the type was obtained by Spix on the Amazon River. The name *spixi* has been applied invariably by subsequent authors to the species of the arid interior *catanga* districts of northeastern Brazil in the states of Bahia and Ceara. This region was traversed by Spix and Martius and in fact the only mention of a cavy to be found in the account of their travels occurs in a list of the animals of the Campos Geraes de San Felipe which is a dry *catanga* region lying just east of the present settlement of Januaria, Bahia. They spent considerable time in this region and especially mention hunting there and collecting a number of animals.* The cavy is listed under the native name *prehá* and is referred to *Cavia aperca* but it is more than likely that the species of this region is the one which is here regarded as typical *spixi*. In fact, until evidence to the contrary is forthcoming, it seems necessary to disregard Wagler's statement of locality, and to assume that the type came from this part of the state of Bahia. Without examination of the type, this seems to be the only course possible, for no specimens agreeing with the original description are known from the Amazon Region unless those described as *Kerodon palustris*, from the lower Tocantins River, be regarded as such. In separating *palustris* from *spixi*, Thomas mentions no localities for *spixi*, but it seems inferred that the name was applied to the animal from Bahia and Ceara.† *C. palustris*, as described, differs from *spixi* and *wellsi* in lacking a postauricular spot and in having small audital bullae.

***Eptesicus diminutus* sp. nov.**

Type (dry skin and skull) from Saõ Marcello, Rio Preto, Bahia, Brazil. No. 20971 Field Museum of Natural History. Adult male. Collected March 23, 1914, by Robert H. Becker.

Characters.— Similar in general to *Eptesicus hilarii* but smaller with a particularly small light skull and a relatively slender tragus. Color

* Spix and Martius, *Reise in Brasilien*, II, p. 542, 1828.

† See Thomas, *Ann. & Mag. Nat. Hist.*, (8), VIII, p. 608, June, 1911.

paler than in *E. hilarii*; hairs of back, head, and sides of neck broadly tipped with Mars brown effecting uniform coloration of the upper parts and entirely concealing the deep blackish brown basal color; under parts mostly pale wood brown or Isabella color with the dark brown basal color slightly exposed in a prepared skin; hairs of the inguinal region bordering the interfemoral membrane soiled creamy without dark bases.

Ears slightly thinner than in other species of *Eptesicus*; tragus relatively slender, somewhat attenuated, and less blunt at the tip than in *E. hilarii*; terminal tail vertebrae exerted as in *hilarii*.

Skull small and light, decidedly smaller throughout than in *E. hilarii*; braincase much less elevated posteriorly, its depth in front only slightly less than behind; facial portion of skull relatively long; teeth as in *E. hilarii*, but smaller.

Measurements:— Type, measured by collector: Total length 88; tail vertebrae 37; hind foot 10; forearm (from dry specimen) 35.7; pollex, with claw 4.7; third metacarpal 33; fourth metacarpal 33; fifth metacarpal 31.9; tibia 14.3; calcaneum 13.6; tragus, from anterior base 4.5. Skull of type: Greatest length 14.3 (15.5);* basal length 13.9 (15) interorbital constriction 3.3 (3.8); zygomatic breadth 9.4 (10.1); breadth of braincase 6.6 (7.2); palate length, including spine 5.7 (6.5); breadth between tips of canines 3.1 (3.6); depth of braincase (inion to basioccipital) 5.2 (5.8); upper toothrow, including canine 5.1 (5.7); breadth of third upper molar 1.8 (2); lower toothrow, including canine 5.6 (6.).

Remarks:— Bats from various parts of South America usually assigned to *Eptesicus hilarii*, and perhaps representing a number of recognizable subspecies, vary somewhat in size, but so far as known all have decidedly larger, heavier skulls and teeth than the one above described. Although this species has the forearm only slightly shorter than in some specimens referable to *hilarii*, its skull is so markedly different that it does not seem probable that it will prove to be a geographic form of *hilarii* but rather a wholly distinct species which may be found at localities inhabited also by typical *hilarii*. Two specimens from Lagoa Santa, Minas Geraes, Brazil, have been used to represent *E. hilarii*. Another from Itacoatiara near Manaus on the Amazon evidently belongs to the same form. *E. dorianus*, *E. arge*, *E. andinus*, *E. magellanicus*, and *E. montanus* all appear to be forms equalling or exceeding *E. hilarii* in size.

* Measurements in parentheses are those of a specimen (No. 20742) of *E. hilarii* from Lagoa Santa, Brazil.

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MAMMALS OF THE COLLINS-DAY
SOUTH AMERICAN EXPEDITION

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CHICAGO, U. S. A.

October 31, 1916.

MAMMALS OF THE COLLINS-DAY SOUTH AMERICAN EXPEDITION.*

BY WILFRED H. OSGOOD.

In the latter part of 1914, Mr. Alfred M. Collins of Philadelphia and Mr. Lee Garnett Day of New York called upon the writer to discuss plans for a trip to South America. As a result of this meeting and several subsequent ones, it was decided by Mr. Collins and Mr. Day that they would not only finance but personally conduct an expedition to be largely devoted to the collecting of natural history specimens, especially mammals and birds. As finally arranged, the party included Mr. Collins and Mr. Day and their friend Mr. Willard Walker, who also shared in the expense, and representatives of two museums, Mr. George K. Cherrie for the American Museum of Natural History of New York, and Mr. Robert H. Becker for the Field Museum of Natural History. The route chosen led across the continent of South America from west to east through Peru, Bolivia, and Brazil. Sailing from New York December 26, 1914, the party proceeded via Panama to Mollendo, Peru, arriving there on January 15, 1915. Thence they proceeded by rail to Arequipa, from which place a short but successful hunting trip was made to Pampa de Arrieros, Peru, where specimens of guanacos and vicuñas were obtained. Another short stop was made at Puno on Lake Titicaca and from there quick time was made by rail and stage via La Paz, Oruro, Arque, and Parotani to Cochabamba, Bolivia. From Cochabamba it was decided to travel by pack train over a little-used and difficult trail to the port of Todos Santos on the Chaparé River, an affluent of the Mamoré. Owing to heavy rains, this part of the trip was very arduous, but it was successfully accomplished and some collecting was done in spite of untoward conditions. On March 16th a small steamer left Todos Santos with the expedition and arrived at Trinidad on the Mamoré March 20th. Four days later Guajaramerim was reached and thence to Porto Velho on the Madeira the party went by rail, arriving March 29th. From this point to Manaus, no stops were made and, with the exception of Mr. Cherrie who remained on

*An illustrated general account of this expedition written by Mr. Day was published in the American Museum Journal for January, 1916.

the Amazon near Santarem for a time, the whole party returned directly to the United States.

Notwithstanding the difficult climatic conditions and the limited time which was available for actual field work the collections obtained are of considerable size and importance, especially in view of the very small representation of the fauna of the region traversed which was previously possessed by North American museums. According to the generous plan of Mr. Collins and Mr. Day these collections are to be divided equally by the American Museum of Natural History and the Field Museum of Natural History, the types of new birds remaining with the New York institution and those of new mammals with the Field Museum.

The collection of mammals numbers some 325 specimens belonging to 41 species and subspecies, of which four are new. In the brief account of this collection which follows, I am indebted to Mr. Collins for the notes on the hunting of guanacos and vicuñas.

Marmosa elegans venusta Thomas. MOUSE OPOSSUM.

Four specimens, Parotani.

These topotypes are welcome additions to the collection of the Field Museum, as of course they would be to any other. An interesting character shown by two of them which are mature is a rather definite dark spot occupying a considerable space on the side just behind the shoulder. This is colored like the dark dorsal area and forms an interruption in the lower half of the lighter lateral area which in its upper half separates this dark spot from the dorsal area.

Bradypus tridactylus Linnaeus. THREE-TOED SLOTH.

Three specimens, Santarem, Brazil. Collected by G. K. Cherrie.

Hippocamelus antisimensis D'Orbigny. PERUVIAN GUEMAL.

One specimen, Pampa de Arrieros, Peru.

This is an immature male with milk dentition and short, stubby horns. The pelage is somewhat worn but in general the hairs of the body have buffy tips producing a rather pallid effect which is sharply contrasted with a dark blackish brown area on the back and rump just anterior to the base of the tail. The tail itself is entirely white both above and below and the white areas on the inner sides of the legs extend to the hoofs. The dark facial markings, so well developed in the Chilian *H. bisulcus*, are reduced to brownish patches over the eyes.

This species was found up to an altitude of 13,000 feet, in general ranging somewhat lower than the guanaco and vicuña.

Lama glama huanachus Molina. GUANACO.

Six specimens, Pampa de Arrieros, Peru.

Well-preserved skins and skulls of three male and two female guanacos and one complete skeleton are in the collection. The herds from which they were obtained are almost if not quite the northernmost now existing and the specimens will be of great interest in determining the geographic variation in the species. This cannot well be attempted until specimens are secured from central Chile, the type locality of Molina's *huanachus*. It is evident, however, that the Peruvian guanacos of this collection are not closely related to the "small Peruvian guanaco" to which Lönnberg has given the name *Lama glama cacsiloensis* and which shows great similarity, at least in certain cranial characters, to the vicugna. In size our specimens are only slightly smaller than the Patagonian guanaco. A skull of an adult male measures as follows: Total length 290 (307)*; basal length 277 (290); greatest width 148 (146); least postorbital width 61.5 (64); length of three upper molars 59 (63); width across middle of second upper molar 69 (75); greatest length of nasal laterally 63 (78).

Measurements of an adult male, taken in the flesh by the collector, are as follows: Length "from between ears to root of tail" 1300; circumference of upper neck 330; of lower neck in front of shoulder 550; girth behind foreleg 1080; girth at middle of belly 1160; girth at loin 860; base of ear to point of shoulder 650.

Lama vicugna Molina. VICUGNA.

Four specimens, Pampa de Arrieros, Peru.

These consist of skins and skulls of two males and one female and skeleton of one male. So far as recorded, they are the only first class specimens of this species ever brought to a North American museum.† This is perhaps on account of the poverty of North American museums in South American material rather than because of the rarity of the animal; but it is evident that the vicugna is not easy to procure even in those localities where it is still common.

Measurements of an adult male, taken in the flesh by the collector, are as follows: Length "from between ears to root of tail" 1250; base of ear to point of shoulder 670; circumference of upper neck 260; of lower neck in front of shoulder 430; girth behind foreleg 840; girth at middle of belly 960; girth at loin 750.

*Measurements in parentheses are those of a Patagonian guanaco published by Lönnberg. (Archiv. för Zoologi, VIII, No. 19, p. 2, 1913).

†The specimen recorded as *Lama vicugna* by Elliot (Cat. Mamm. Field Mus., p. 37, 1907) proves to belong to another species.

The following account of the hunting of guanacos and vicuñas has been contributed by Mr. Collins:

"Glad we were to reach Mollendo on the west coast of Peru after three weeks sailing from New York. Here we unloaded our sixty pieces of baggage, and owing to the kindness of the Peruvian officials, due to the assistance of the American Minister at Lima, we were passed through the customs without any difficulty, no restriction being placed on the use of our arms, which we felt would be the case while crossing Peru. We were very glad of this as it was our intention to hunt on the highlands for vicuña and guanaco and a small variety of deer.

"We had just enough time to pass our baggage and catch the train which followed the shore for a while and then started to climb to an absolutely barren ground. Suddenly upon reaching an altitude of some 2000 feet we entered the clouds and found a most fertile country, the ground being covered with beautiful flowers. A couple of thousand feet higher we crossed a table-land almost flat, having a sandy soil, the sand being blown by the high winds into numerous dunes, crescentic in shape, which were constantly changing their positions. Again we climbed and twisted through barren mountains, with here and there green, where water was to be found. Finally, we reached Arequipa at an altitude of 7500 feet, and here the train stopped for twenty-four hours in order to give the passengers an opportunity to become accustomed to the altitude.

"The next day we proceeded on our way and at a point 12,500 feet above sea level, called Pampa de Arrieros, we left the train, hearing that at this point the animals we were desirous of getting were to be found. Having finally reached our hunting ground, and with a considerable amount of stored up energy after three weeks idleness on the steamer, it not yet being noon, we at once made arrangements for mules in order to make a hunt that day. After climbing several thousand feet higher, we suddenly came in sight of our game. Dismounting and starting to run after it, we suddenly realized the height at which we had arrived, our hearts beating so rapidly that it became impossible for us to continue. The rest of the day we traveled at a snail's pace after the game, which always kept in a very tantalizing way within sight but out of range. Finding that it would be impossible for us to come up with it, we decided to return to our mules and go back to camp. A sudden downpour drenched us to the skin, and a little later darkness overtaking us, and the chill of night coming on, we suffered intensely from the cold. The great heat of the day, the drenching by rain, and the sudden chilling of the air brought on all of us attacks of *soroche*. It was with great difficulty that we were enabled to get back to our rooms in the

railroad station and all night long the whole party suffered intensely from chills and fever.

"The next day, and for several days following, we hunted these wary animals, and each day becoming more and more accustomed to the altitude, we were able to travel not only greater distances, but at a higher altitude. Upon hearing from the Indians that there was a water hole high up on one of the mountains just below the snow line where game was very plentiful, we planned a hunt with the idea of spending a night at this water hole, believing that just before dark or early in the morning might prove to be the best time to get our game. Hour after hour we traveled, and higher and higher climbed, finding the water hole much farther away than we had supposed and at an altitude which taxed our hearts and lungs to the utmost.

"I will never forget the night spent at this point, 18,000 feet above sea level, in a little shelter of stones which had been erected by the Indians and where they watched for game. What was known as a water hole simply consisted of damp soil where, even by digging, we could not get enough water to satisfy our own thirst let alone that of our mules. All night long I was kept awake by the shaking of my companion who had one chill after another, suffering myself all the time from a most terrific headache and gasping all night for breath. The next morning, as soon as it was light enough for us to see, we hurried down the mountain for several thousand feet, and then as the sun came up, we fell to the ground and were soon fast asleep, exhausted from the night's experience. Not only did the altitude affect us but the air was so dry and the wind on these mountains blew so violently that our faces and hands became badly sunburned. In addition to the entire skin coming off my face four times in ten days, my nose swelled to at least double its normal size, my lips were badly cracked and almost constantly bleeding, and my hands were blistered on the palms as well as the backs.

"It is hard to imagine any animals being able to live where there is such a lack of vegetation, but these sure-footed animals grow fat there. They are seldom hunted by the white man but the Indians are continually after them, making them exceedingly shy and difficult to obtain. While the guanaco and vicugna were found on the same mountains, they were never found together. Those that we obtained were shot at long range. A small deer, the guemal, was found on these same mountains but much lower down, its range not exceeding an altitude of from 12,000 to 13,000 feet, while the vicugna and guanaco were found from 14,000 to 18,000 feet.

"Pampa de Arrieros is a small settlement of a couple of dozen mud houses occupied mostly by the workers on the railroad, a church,

and a railroad station where we succeeded in obtaining rooms. As it was a meal station we were able to get very good food indeed. We hunted mostly from mule back but had considerable difficulty in getting fresh mules as the climbing was exceedingly hard on them, and it seemed to be against the principles of the owners to feed them any more than what they were able to pick up for themselves, the consequence being that after a mule had been ridden for a couple of days it became so exhausted it was worthless to us.

"The gait of the guanaco is a canter or easy lope, and by bounds they attain great speed. Reddish brown on back and lighter under parts. Cool gray tone of head and ears; head held erect. Neigh of horse, neck of camel, feet of deer, and swiftness of the devil. The call is a weird, tremulous sound and half idiotic neigh."

Sciurus aestuans gilvicularis Wagner. SQUIRREL.

Four specimens (skins only), Santarem, Brazil. Collected by G. K. Cherric.

Sciurus* ignitus Gray. SQUIRREL.

One specimen, Roquefalda, Bolivia, collected February 19.

This specimen is provisionally regarded as representing the species described by Gray in 1867 from a squirrel taken in "Bolivia" by Bridges. It agrees with the original description and disagrees with specimens previously referred to this species in at least four respects: (1) in its relatively soft full pelage, (2) in its dark chestnut ears and postauricular spots, (3) in its white or whitish chin and throat, and (4) in its whitish under parts more or less grizzled and washed with buffy. I am not informed as to whether or not Gray's type is still preserved, but without examination of it, the probability that it belongs to this species rather than to the one to which the name *ochrescens* has been applied seems very great.

Sciurus irroratus ochrescens Thomas. SQUIRREL.

One specimen, Chaparé River, below Todos Santos.

This is obviously an example of the form described by Thomas as *Sciurus cuscinus ochrescens* which Allen† has identified with Gray's *Macroxus ignitus*. It does not agree with Gray's description, however, for the under parts are entirely ochraceous and it does not have the

*Without more study than I am at present able to give, I do not feel justified in using the generic terms recently proposed by J. A. Allen in his Review of South American Scuridae. His position seems very radical, and it is doubtful if the same standards could be applied successfully in other groups.

†Bull. Am. Mus. Nat. Hist., XXXIV, pp. 204-206, May, 1915.

"cheeks, chin, and throat white." It is difficult, also, to appreciate "back of the ears bright red bay"; and since both of these features are found in another specimen obviously belonging to a different species, it seems necessary to recognize both *ochrescens* and *ignitus*.

Sciurus langsdorffi Brandt. LANGSDORFF'S SQUIRREL.

Two specimens, Porto Velho, Madeira River, Brazil.

Oryzomys sp.

One specimen (skull only), Parotani.

Beyond the determination of this skull as a representative of the *longicaudatus-stolzmanni* series, no further identification is possible with the material at hand. Doubtless it is not the same as the species recorded by Thomas* from Charuplaya in eastern Bolivia under the name *stolzmanni*, for Parotani is on the high plateau and Charuplaya is almost or quite within the Amazonian forest.

Oryzomys chaparensis sp. nov.

Type from Todos Santos, Chaparé River, Bolivia. Altitude about 1200 feet. No. 21,330 Field Museum of Natural History. Adult male. Collected March 15, 1915 by R. H. Becker.

Characters. A species of medium size with the tail slightly longer than the head and body, the pelage rather short, and the throat and inguinal region with self-colored hairs; mammæ (in one specimen) $1-2=6$.

Color. Upper parts ochraceous buff liberally mixed with dusky lines, producing a general effect approaching wood brown or Isabella color; head, face, and sides practically like back; ears dusky outside, cinnamon inside; a poorly defined line of ochraceous buff between the color of the upper parts and the under parts; feet white; outer side of tarsal joint broadly and distinctly marked with brownish; tail finely scaly and except upon close examination appearing naked, dusky above and for its distal third below, whitish for its proximal two-thirds below; under parts creamy, the hairs of the belly and breast with dark bases, those of the throat and inguinal regions and the median part of the inner sides of the legs self-colored.

Skull. Skull relatively long and slender; interorbital region rather narrow and elevated, the anterior half of the frontals being distinctly higher than the posterior; supraorbital edges sharp and elevated but not beaded; nasals broad and with considerable median depression posteriorly; zygomatic plate broad, convex in front; palatine foramina short

*Ann. & Mag. Nat. Hist., (7), IX, p. 130, 1902.

and forming obtuse angles in front and behind; audital bullæ small; teeth small. As compared with a skull of *O. eliurus* from Sapucay, Paraguay, that of *O. chaparensis* is slightly larger and more angular; the interorbital region is a little wider, higher, and more sharply edged; nasals broader; palatine foramina shorter.

Measurements. Type: Total length 215; head and body 104; tail 111; hind foot 26; ear from notch (dry) 14. Skull of type: Greatest length 26.8; basilar length 21; zygomatic breadth 13.5; breadth of braincase 11.2; interorbital constriction 4; nasals 10.5x3.5; palatine foramina 4.4x1.9; diastema 6.9; length of zygomatic plate 2.7; upper toothrow 3.6.

Remarks. Although the state of knowledge of the genus *Oryzomys* makes it difficult or practically impossible to determine the exact relationship of isolated species, it is apparent that this one does not show many similarities to any of the recently described Peruvian and Bolivian species and it is therefore probable that its allies are among the species described by early authors from eastern South America. Of those available for comparison, *O. eliurus* is nearest in size but its coloration is of the usual type and its skull differs in various ways. The coloration of the under parts in *O. chaparensis* is characteristic, for although the differentiation of self-colored light areas on the pectoral and inguinal regions is not unusual among rodents, it is relatively rare in the genus *Oryzomys*.

Only two specimens have been examined, an adult male and a female. This female was nursing young and has the mammæ functionally enlarged and conspicuous but shows no trace of more than three pairs whereas four pairs are normal in *Oryzomys*. The absence of the anterior pair of pectoral mammæ may be accidental in this specimen or it may be a peculiarity of the species.

***Œcomys mamoræ* Thomas.**

Ten specimens, Todos Santos, Chaparé River.

Since their external and cranial measurements agree closely with those of the published description of this species, there is scarcely any reason to doubt that these specimens are practically typical representatives of it and so far as recorded the only ones extant except the type which is preserved in alcohol and therefore not trustworthy for color characters. The color, especially that of the under parts, as shown by the present series, is somewhat variable. In the majority, particularly those not fully mature, the rich, tawny ochraceous lateral line which borders the color of the upper parts widens and extends with only slight dilution across the middle of the belly and forward as a light wash to the midpectoral region. Across the middle of the belly and breast

there is tendency for the hairs to have dark bases, the throat, axillæ, and inguinal regions being always white to the roots of the hairs. In one old female the entire under parts are pure snowy white sharply separated from the upper parts by a broad (5 mm.) tawny ochraceous lateral line. Both fore and hind feet are more or less brownish, and the ears, while usually tawny, are sometimes dusky antero-internally.

Two adults present the following flesh measurements: Total length 333, 328; head and body 149, 147; tail 184, 181; hind foot 27, 27.

Hesperomys callosus boliviæ Thomas.

One specimen, Trinidad.

On geographic grounds, this specimen might be either *H. callosus* or *H. c. boliviæ*; and with nothing more than descriptions for comparison, its identification cannot be regarded as positive. The tooth-row measures 4.1 mm., which is exactly the length given for that of the type of *H. c. boliviæ*, and other cranial measurements correspond closely. External measurements are as follows: Total length 200; head and body 122; tail 78; hind foot 23.

Phyllotis (Graomys) domorum Thomas.

Three specimens, Parotani.

These are typical examples of this species and from the region of the type locality. Their examination has been of particular interest in connection with the grouping of certain South American Muridæ recently made by Thomas.* A small group including the present species has been given generic rank under the name *Graomys*, but this group is so closely allied to typical *Phyllotis* that it seems better to treat it as a subgenus rather than as a genus. This conclusion is largely influenced by a consideration of *Phyllotis amicus*, a species which is assigned inferentially by Thomas to *Phyllotis* but which shows such affinity to *Graomys* that the exceedingly close relationship between the two groups can scarcely be doubted. In all external features except size the resemblance of *P. amicus* and *P. domorum* amounts to practical identity. The very soft, satiny pelage and the pure white self-colored areas of the under parts are very characteristic. The skull of *P. amicus* has the short, rounded braincase of typical *Phyllotis* but its very broad frontals and its slightly undercut zygomatic plate show very decided approach to the condition in *Graomys*. It lacks the definite supraorbital bead but the supraorbital border is trenchant and even slightly elevated. The second upper molar is more nearly five-parted than in true *Phyllotis*, and in this respect also there is resemblance to

*Ann. & Mag. Nat. Hist., (8), XVII, pp. 139-143, Jan., 1916.

P. domorum. In fact it seems necessary to include the species *amicus* as a peripheral member of the group *Graomys* and to recognize its connectant character by treating that group as a subgenus co-ordinate with typical *Phyllotis*.

Akodon puer Thomas.

One specimen, Parotani.

This specimen agrees closely with the original description of *A. puer*, the principal discrepancy being in the color of the ears which are mixed grayish and dusky in some contrast to the body color. Flesh measurements are: Total length 169; tail 75; hind foot 20.

Akodon varius Thomas.

One specimen, Parotani.

Although comparison with the type from Cochabamba would be desirable, there seems little reason to doubt the identity of this specimen, especially since Thomas in the original description has referred to another from this locality. Flesh measurements are: Total length 203; head and body 108; tail 95; hind foot 26.

Akodon dayi sp. nov.

Type from Todos Santos, Chaparé River, Bolivia. No. 21329 Field Museum of Natural History. Adult male. Collected March 15th, 1915 by Robert H. Becker. Original No. 784.

Characters. A medium-sized species of dark, rich, color. Somewhat allied to *A. cursor* but very much darker with larger hind feet and a heavier and decidedly deeper skull. Similar in color to *A. aerosus bahiulus*, but under parts paler and more heavily washed with fulvous; cranial characters widely different.

Color. Upper parts varying from Vandyke brown to burnt umber; middle of back scarcely or not at all darker than sides; under parts rich rufous; ears blackish without mixture of fulvous; feet brownish black; tail blackish above and below.

Skull. As compared with that of *A. aerosus*, the skull is long and high, both incisor and molar teeth are heavier, and the braincase is narrower; the supraorbital edges are sharp and continuous with a definite ridge which crosses the parietals to the occipito-squamosal suture, where it turns abruptly downward and becoming more decided forms a sharp vertical ridge to the mastoid bulla; the occiput scarcely projects beyond the vertical plane of the back of the interparietal which is often sharp-angled behind, forming with the supraoccipital a definite inion; the zygomatic plate is broad and nearly vertical or slightly con-

cave in front; the nasals end posteriorly in a point which greatly exceeds the endings of the premaxillæ. As compared with the skull of *A. cursor*, that of *A. dayi* shows a slight resemblance in the development of the parietal ridge, but the entire skull is so much deeper and heavier that detailed comparison is unnecessary.

Measurements. Average of ten adults: Total length 198 (186-214); head and body 119 (110-134); tail 79 (75-84); hind foot 26 (25-27). Skull of type: Greatest length 30.8; basilar length 24.8; zygomatic breadth 15.6; interorbital constriction 5.6; median length of frontals 10.5; interparietal 7.5x1.7; nasals 11.7x3.9; palatine foramina 7.4x2.8; diastema 8; median length of zygomatic plate 3.3; upper toothrow 4.9.

Remarks. Although having considerable color resemblance to *Akodon a. baliolus*, this species differs from it so widely in cranial characters that it is probable it has no close affinity and its nearest relatives perhaps are to be sought among the species of eastern Brazil. The only available species of this region which shows even slight similarity is *A. cursor*, but this is smaller and paler and has a relatively low flattened skull.

A series of thirty-nine specimens of this new species was obtained mostly about the half-dozen native huts forming the small village of Todos Santos. All of them give evidence of having been very fat and many have white hairs scattered through the pelage of the rump and back, both features being possible indications that they were leading slightly abnormal existences. Their presence in the village in large numbers was doubtless due to the prevalence of heavy rains and floods in the surrounding dense forest.

Dasyprocta variegata subsp. VARIED AGOUTI.

Two specimens, Porto Velho, Brazil.

These are provisionally referred to this species of which no typical examples are at hand.

Proechimys brevicaudus securus Thomas. SPINY RAT.

Six specimens (2 ad., 4 yg.), Todos Santos, Chaparé River.

These are referred to this form largely on geographic grounds. So far as can be determined from comparison with descriptions, they combine the characters of *P. securus* and *P. bolivianus*, having the short foot of the one and the long narrow skull of the other. Their resemblance to *P. brevicaudus* is striking not only in cranial characters but also in external appearance, especially when the variability of *brevicaudus*, as previously shown,* is considered. In one specimen there is consider-

*See Field Mus. Nat. Hist., Zool. X, p. 168, 1914.

able fulvous on the sides of the belly and likewise on the throat; on the other the under parts are practically pure white. The upper parts are quite as in *P. brevicaudus*. I see no objection to treating this form, if it be a valid one, as a subspecies of *brevicaudus*, for whatever local variations there may be, it is beyond speculation that all are relatively recent derivatives of a common stock. The fact of such slight differentiation in animals from localities so distant from each other is also an indication of general continuity of distribution and probable sub-specific relationship.

Measurements of the two adults are: Head and body 259, 243; hind foot (dry) 50, 47.5; greatest length of skull 57.8, 60.2.

Ctenomys opimus Wagner. TUCO-TUCO.

One specimen, Oruro.

This is somewhat immature and noticeably paler than a single topotype of *C. opimus* with which it has been compared. Thomas* has referred specimens from Oruro to this species and has specially mentioned a wide color variation among individuals from one locality, so our specimen probably has no extraordinary peculiarities. It is to be remembered, however, that rodents of fossorial subterranean habits are usually subject to much local differentiation, and when our knowledge of the tuco-tucos is on a par with that of their North American analogues, the Geomyidæ, we will doubtless recognize a much larger number of forms than at present.

Cavia musteloides boliviensis Waterhouse. BOLIVIAN CAVY.

Twenty-four specimens, Parotani.

A series of this size all taken at one time and place affords a valuable opportunity to observe variation, especially since such series thus far have seldom been preserved. In both color and cranial features considerable variation appears; rather more, generally speaking, than is found among cricetine and murine rodents. The color of the upper parts is relatively uniform throughout the series, the general tone being slightly darker or lighter according as the buffy annulations of the black-tipped hairs are narrower or broader. The broad, basal color of the hairs of the upper parts varies narrowly between shades of mouse gray and smoke gray always being darker mid-dorsally than laterally. The color of the under parts ranges from pale buff or creamy to the roots of the hairs (except on the throat) to creamy whitish with a dark grayish undercolor extending throughout except on the inner sides of the legs where the hairs are pale and self-colored. This latter type is

*Ann. & Mag. Nat. Hist., (7), IX, p. 227, 1902.

the predominant one, and in general the effect on the under parts is grizzled. The variation in the width of the buffy annulations on the hairs of the upper parts is correlated with the general extent of buffiness; and while some specimens have distinct, buffy eye rings and postauricular spots, others have these markings whitish rather than buffy or so reduced as to be scarcely apparent. The series includes several immature examples not more than half-grown, and these are colored practically as in the adults. It thus appears that there are two styles of coloration one in which the under parts are grayish or whitish and the other in which they are buffy. Comparing extremes of the two styles, one might easily entertain the idea of their specific distinctness.

Examination of the skulls, of which about half are unbroken, shows the usual slight variations in the size and shape of nasal and interparietal bones, but the most striking irregularity is found in the size of the auditory bullæ, the horizontal diameter of which ranges from twelve to fourteen millimeters in specimens of the same sex and apparently the same age.

In separating *Cavia boliviensis* from *C. musteloides*,* Thomas has mentioned only characters which appear to be within the limits of the variation in this Parotani series, and it is therefore possible that *C. boliviensis* should be treated as a synonym of *C. musteloides*. However, in the absence of specimens from Sahama, which has been selected as the type locality of *musteloides*, it does not seem quite safe to conclude that no differentiation exists. But it is reasonably certain that *boliviensis* is at most no more than a subspecies of *musteloides*.

A note in Mr. Becker's field catalogue states that the cavies were obtained on rocky hills surrounding the fertile irrigated valley in which Parotani is situated.

Viscaccia punensis Thomas. TITICACA VISCACHA.

One skin without skull, Puno, Peru. Collected by G. K. Cherrie, January 22nd.

The pelage of this individual is in worn, ragged condition consisting principally of the thick "wool hairs." The dorsal line is barely apparent, and there are no white axillary spots. As compared with specimens of *V. inca* and *V. subrosea* it is darker, more brownish, throughout. Flesh measurements are as follows: Total length 320; tail 280; hind foot 90; ear 65.

Canis culpæus andinus Thomas. BOLIVIAN WOLF.

One specimen, Pampa de Arrieros, Peru. Altitude 13,500 feet.

* Ann. & Mag. Nat. Hist., (8), VIII, p. 254, 1911.

Nasua montana Tschudi. MOUNTAIN COATI.

Two specimens, Porto Velho, Brazil.

These dark-colored and short-tailed coatis, one adult and one immature, are referred to *N. montana* with considerable doubt; but, with such material as is at hand for comparison, no better disposition of them is possible.

Felis pardalis chibigouazou Griffith. SOUTHERN OCELOT.

One specimen, Porto Velho, Brazil.

Although not wholly agreeing with descriptions, this specimen may be referred tentatively to this form on geographic grounds.

Felis pardalis ocelot Smith. NORTHEASTERN OCELOT.

An imperfect skin without skull obtained at Santarem by G. K. Cherrie is in the collection. It is closely similar to a specimen from Georgetown, British Guiana, both being richly rufescent dorsally and having numerous small shoulder spots and the body markings large, bold, and distinct. These are characters described and figured by Hamilton Smith for his Ocelot No. 2 to which Mearns* has regarded the name *Felis ocelot* applicable. I have therefore ventured to adopt this name for these specimens and to consider Guiana as the type locality.

Tayra barbara madeirensis Lönnberg. MADEIRA TAYRA.

One specimen, Todos Santos.

This specimen has nearly or quite the coloration described for this subspecies, but the hair is not especially short. The hinder parts of the animal are blackish brown and the tail quite black evidently very different from the pale color of the type of *T. b. brunnea* which is from the relatively nearby region of the Beni River.

Glossophaga soricina Pallas. COMMON GLOSSOPHAGA.

One specimen, Trinidad.

Artibeus anderseni † sp. nov. ANDERSEN'S ARTIBEUS.

Type (in alcohol) from Porto Velho, Brazil. No. 21331 Field Museum of Natural History. Adult male. Collected April 3, 1915 by R. H. Becker. Original No. 886.

Characters. Similar to *Artibeus toltecus rarus*, but smaller and darker, being quite the smallest species of *Artibeus* yet known; forearm 34–36. Color dark brownish above and below, no evident light facial stripes; hairing on limbs and membranes as in *A. cinereus* and *A. toltecus*.

*Proc. U. S. Nat. Mus., XXV, p. 239, 1902.

†For Dr. Knud Andersen of the British Natural History Museum.

Skull with the facial region relatively short and the palate short and wide; teeth slightly smaller than in *A. toltecus rarus*, first upper molar reduced in size, especially as compared with the second which it exceeds only slightly.

Measurements. Type: Head and body 45; hind foot 10; pollex with claw 7; forearm 35; third metacarpal 32.7; fourth metacarpal 32.3; fifth metacarpal 33; inner margin of ear conch 11; tibia 13; calcar 3.8. Skull of type: Greatest length 18.2; basal length 16.3; mastoid width 9.5; zygomatic width 11; width of braincase 8.6; maxillary width across m^1 7.8; width across cingula of canines 5.4; length of palate 7.1; upper tooththrow including canine 5.8.

Remarks. No specimens of any of the smaller *Artibeus* have heretofore been obtained from Brazil or elsewhere in central South America between Surinam, where *A. quadrivittatus* occurs, and Ecuador and Peru, where *A. toltecus rarus* and *A. glaucus* have been found. Although obviously related to all of these and occupying an intermediate region, the present species is probably distinct. It is characterized chiefly by small size, and by its short-faced skull and reduced first upper molar.

Four specimens are in the collection, all in alcohol; hence no accurate description of the color is possible. Actual comparisons have been made only with two specimens of *A. toltecus rarus* from near the type locality.

***Artibeus jamaicensis lituratus* Lichtenstein.**

One specimen, Santarem, Brazil. Collected by G. K. Cherrie.

***Molossus obscurus* Geoffroy. DUSKY MOLOSSUS.**

Eleven specimens, Trinidad (7), Todos Santos (1), Porto Velho (2).

This common and widely distributed species is well represented. The specimens show no obvious distinctions from others from eastern Brazil.*

*A pale form of *M. crassicaudatus*, first noticed in this connection, may be described briefly as follows:—

***Molossus crassicaudatus tecticola* subsp. nov.**

Type from Juá, near Iguatú, Ceara, Brazil. No. 20221 Field Museum of Natural History. Adult male. Collected August 21, 1913 by R. H. Becker.

Characters. Similar to *M. crassicaudatus* and *M. obscurus*, but very much paler, the general color of the upper parts being brownish Isabella color with the bases of the hairs whitish buff; under parts still paler, a sort of vinaceous drab. Skull practically as in *M. crassicaudatus*.

Type: Total length 103; tail 38; foot 11; forearm (dry) 39.

This is a well marked form occupying the arid parts of eastern Brazil and although there is much color variation among specimens from other parts of South America, it seldom approaches the degree of paleness shown by all specimens of this form. Eight skins and thirty-five alcoholics have been examined.

Eumops bonariensis Peters.

Twenty-nine specimens, Trinidad.

These agree very closely with the original description of this species as well as with specimens from east-central Brazil. No comparison with specimens from Argentine or Paraguay has been possible.

Saccopteryx bilineata Temminck. STRIPED BAT.

Seven specimens, Porto Velho, Brazil.

Myotis nigricans Maximilian. BLACKISH BAT.

One hundred and twelve specimens. Junction of San Antonio and Espirito Santo rivers (25), Todos Santos (77), Trinidad (10).

The name *nigricans* is here used in the inclusive "blanket" sense. Should an east Bolivian form of this group prove recognizable the name *hypothrix** will be available and these specimens may perhaps be regarded as typical.

Leontocebus weddelli Deville. WEDDELL'S MARMOSET.

One specimen, Porto Velho, Brazil.

So far as can be judged from descriptions alone, this specimen is typical of this species. The white frontal marking is well developed. The hind feet are not wholly black but have considerable mixture of chestnut.

Callicebus donacophilus D'Orbigny. TITI MONKEY.

Two specimens, Todos Santos.

These are almost wholly russet brown on the upper parts, the hairs being faintly annulated with darker and without any distinct grayish areas. The hands and feet and tail are abruptly grayish in sharp contrast. The median under parts and the inner sides of the legs are bright clear tawny.

Callicebus caligatus Wagner. TITI MONKEY.

One specimen, Porto Velho, Brazil.

Without material for comparison, it is difficult to make positive identification of this specimen. It seems probable that it may be intermediate between *C. caligatus* and *C. brunneus* and may be referred tentatively to the former. The tail is mostly dark brown superficially, but the hairs are light at the base and finely specked or annulated with

*D'Orbigny & Gervais, Voy. Amér. Mérid., IV, Mamm., p. 16, 1847.

brownish. At the tip of the tail the terminal tuft of hairs is wholly light-colored, practically white, but with innumerable, fine peppery annulations. The under parts are mixed with blackish and chestnut, the blackish predominating.

Saimiri sciurea collinsi subsp. nov. COLLINS SQUIRREL MONKEY.

Type from Fazenda Teso, near Soure, Marajo Id., Brazil. No. 19534 Field Museum of Natural History. Adult male. Collected November 15, 1911 by E. Sneathlage.

Characters. Similar to typical *Saimiri sciurea*, but hands and feet darker, more richly colored; white area around ears very narrowly or not continuous with white surrounding eyes; back much paler, less fulvous.

Upper parts in general similar to those of *S. sciurea*, but head, shoulders, and foreback almost wholly grayish, the median suffusion of fulvous reduced to the merest trace; middle and hind back with a strong tinge of fulvous but much paler than in *sciurea*; hands and feet and lower limbs tawny rather than orange ochraceous; white face marking not broadly continuous with white around ears, but separated from it by a grizzled area connecting the color of the top of the head with the gray patch on the lower cheek; under parts and tail practically as in *sciurea*.

Skull and teeth small.

Measurements. Type: Total length 660; head and body 249; tail 411; hind foot 86.

Skull of type: Greatest length 63.6; zygomatic breadth 37.3; breadth of braincase 34.6; palatal length 17.5; upper toothrow (molars and premolars) 12.8; width of first upper molar 3.9.

Remarks. A single specimen of a squirrel monkey purchased in the market at Para is included in the collection brought back by the expedition and has led to comparisons showing rather marked differences between the animal of the lower Amazon region and that of Guiana to which the name *sciurea* restrictively applies. Comparison has not been possible with *S. madeirae* and *S. macrodon* which are doubtless related, although apparently not quite so closely as is typical *sciurea*.

Specimens from the Rio Branco region in northern Brazil agree closely with typical examples of *sciurea* from Georgetown, British Guiana.

Saimiri boliviensis D'Orbigny. BOLIVIAN SQUIRREL MONKEY.

Two specimens, Todos Santos.

Aotus boliviensis Elliot. BOLIVIAN NIGHT MONKEY.

Three specimens, junction of San Antonio and Espirito Santo rivers.

All of these are females and seem to be typical representatives of this form. They were shot by Mr. Collins at about sunrise on the morning of March 5th.

Cebus fatuellus peruanus Thomas. PERUVIAN CAPUCHIN MONKEY.

Four specimens, Todos Santos (1), Porto Velho (3).

An adult male and female and two immature examples furnish some variation in color, and in the present confused state of knowledge of the monkeys of this genus about all that can be said of these particular ones is that they are probably related to *C. fatuellus*.

The adult male has the sides of the body clay color becoming darker toward the mid-dorsal line where a dark brownish line extends from the occiput to the tail; top of head black narrowly surrounded with pale buffy mixed with black; a dark line passing in front of ears and under chin; proximal half of outer side of arms light creamy buff; distal half of arms and legs black mixed with buff and ochraceous; toes with a few grayish hairs mixed with the black; tail black, the hairs of basal third with yellowish tips.



ON THE RANGE OF THE GUANACO AND THE VICUGNA.



VICUGNAS.
Photographs by A. M. Collins.



GUANACO "RING" OR GATHERING PLACE.



REGION INHABITED BY THE GUEMAL.
Photographs by A. M. Collins.

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THE FISHES OF THE FRESH WATERS OF PANAMA

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CHICAGO, U. S. A.
December 28, 1916.

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THE FISHES OF THE FRESH WATERS OF PANAMA.

BY SETH E. MEEK* AND SAMUEL F. HILDEBRAND.

PREFACE.

The present report is based upon the fresh water species of fishes collected during the "Smithsonian Biological Survey of the Panama Canal Zone." The ichthyological reconnaissance, however, was made co-operatively by the Smithsonian Institution, Field Museum of Natural History and the U. S. Bureau of Fisheries.

With the exception of a small number of specimens contributed by Messrs. H. Pittier and E. A. Goldman of the U. S. Department of Agriculture, the collections were made by the authors during two seasons, viz.; from January to May inclusive, 1911, and from January to March inclusive, 1912. The winter and early spring months were chosen because they represent the dry season in Panama. In 1911 the work was, however, well extended into the rainy season, for during the month of May it rained every day and the streams became so high and muddy that our efforts had to be confined to collecting marine species. It became impossible to dry the nets or our clothing, except by artificial heat, therefore, on May 22 the work was abandoned and resumed the following January.

We are greatly indebted to the Panama Rail Road Company for furnishing free transportation to and from New York and for a free pass on the Panama Rail Road. We are also deeply indebted to the Isthmian Canal Commission, and General George W. Goethals in particular, for extending to us every convenience and assistance possible. To the Darien Gold Mining Company we also owe our deepest gratitude for rendering invaluable aid on our expedition to the Darien region. Without the help thus received it would have been impossible to make so large and thorough a collection as the present one.

Our knowledge of the fresh water fishes of the Isthmus of Panama heretofore was fragmentary. It was based on small collections made at various times, usually not by naturalists, but by tourists and others who possessed a popular interest in the subject. The small collections thus secured were reported upon by various authors, viz.; Kner & Steindachner, Steindachner, Günther, Gill, Evermann & Goldsborough

*Deceased July 6, 1914.

and others. The collection at hand, therefore, is the first large and general one made in the fresh waters of the Isthmus.

The present survey was made after much work had been done on the Canal and natural conditions had been considerably disturbed, but yet before the water was turned into the Canal and before the species from the two slopes were allowed to intermingle. The natural conditions had at the time of our visits been most disturbed in the Rio Grande on the Pacific slope of the Canal Zone. This stream had been thoroughly cut to pieces and in view of this fact it seemed important, in order to obtain a comprehensive knowledge of the fishes of the Canal Zone, to extend the survey to other Pacific slope streams. In this connection it is an interesting fact that several species, namely, *Pimelodella chagresi*, *Plecostomus plecostomus*, *Astyanax fasciatus*, *Brycon argenteus*, *Curimatus magdalena*, *Thoracocharax maculatus*, *Priapichthys tridentiger* and *Microleotris panamensis* gen. et sp. nov., taken in streams both east and west of the Rio Grande were not found in it, the presumption being that they once occurred there but that they had disappeared on account of the unfavorable conditions created by the construction of Canal.

Two small preliminary papers containing the descriptions of new species have already been published in the Zoological Series of Field Museum of Natural History (Vol. X, 1912 and 1913, pp. 67 and 68, and pp. 77 to 91). In the present and final report we have endeavored to give concise descriptions of all the species known to occur in the fresh waters of Panama, along with keys which we believe will afford ready means of identification. We have avoided technical terms as far as possible and hope that the work may prove of use in the high schools of the Canal Zone, and in other institutions of learning in Panama, as well as to ichthyologists. A complete report on the marine species is in the course of preparation and will be offered later.

The senior author, on account of ill health, was obliged to withdraw from the work during the course of its preparation. His untimely death occurred on July 6, 1914, thus delaying greatly the completion of the report. In the fall of 1915 Prof. C. H. Eigenmann of Indiana University kindly offered the use of his library, collections from Colombia and other South American countries, and his laboratory at the University for the further study of this collection. Advantage was taken of this opportunity, the specimens were shipped to Bloomington, and the study of them was there completed by the junior author, who is much indebted to Prof. Eigenmann for many valuable suggestions and for aid in classifying difficult forms. Without the Colombian collection for comparison, many forms, the relationship of which is now definitely established, would have remained unknown.

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INTRODUCTION.

GENERAL TOPOGRAPHY AND HYDROGRAPHY OF PANAMA.

In the region of the Canal Zone the Atlantic slope is very much broader than the Pacific slope. Following the line of the Panama Canal, it is about 40 miles from the Atlantic coast to the crest of the divide and only 10 miles from thence to the Pacific coast. This, in the Canal Zone region, where the rainfall is heavy,* gives rise to the comparatively large Rio Chagres on the Atlantic slope opposed by rather small coastal streams on the Pacific slope, namely, the Rio Chorrera, Rio Grande, Rio Marte Arnade, Rio Abaco, Rio Juan Diaz and other small streams.

Going eastward or toward Colombia the Pacific slope becomes broader and the Atlantic slope narrower. The increased width of the Pacific slope then gives rise to the rather large Rio Bayano, the mouth of which is about 30 miles east of Panama City, and to the still larger Rio Tuyra which empties into San Miguel Bay, about 100 miles southeast of Panama City. Opposite these streams, on the narrow Atlantic slope, there are only very small coastal streams.

In western Panama the watershed more nearly follows the median line of the Isthmus and no large streams occur on either slope.

There are then three river basins of considerable size in Panama, viz.; the Rio Chagres on the Atlantic slope and the Rio Bayano and the Rio Tuyra on the Pacific slope. Collections were made in all of these streams. The Rio Chagres with its numerous tributaries was quite thoroughly explored, and it is believed that our collections contain, with perhaps very few exceptions, all the species occurring there. Our explorations in the Rio Bayano and the Rio Tuyra basins were not so thorough, and our collections from these rivers are certainly not exhaustive, but sufficient to indicate the nature of their faunas. Besides these large streams, the small streams opposite the Rio Chagres and as far westward as the Rio Chame on the Pacific slope were visited and collections made in each. On the Atlantic slope only a few of the small coastal streams, two at Porto Bello and two at Toro Point, were visited. This then leaves many small streams of western Panama unexplored.

*The rainfall in the Canal Zone region is heaviest on the Atlantic slope and particularly at Porto Bello where during a single day of 24 hours as much as 11 inches of water are known to have fallen. In 1909, 58.07 inches of rain fell during the month of December and the total rainfall for the year was 237.28 inches.

That the faunas of these small streams are of much interest is indicated by the fact that *Hoplosternum punctatum* sp. nov. belonging to a distinctly South American family, of which heretofore no representative was known north of the Rio Atrato Basin in Colombia, was taken in the Rio Marte Arnade, a small stream, about 6 miles east of Panama City, and was not seen elsewhere in Panama. *Gephyrocharax intermedius* sp. nov. was found only in the Rio Chame; *Bryconamericus cascajalensis* sp. nov. only in the Rio Cascajal at Porto Bello; *Rivulus brunneus* Meek & Hildebrand only in a small coastal stream at Toro Point and *Microoleotris panamensis* gen. et sp. nov. only in the Rio Juan Diaz and the Rio Chorrera. *Ancistrus chagresi*, which is common in the Rio Chagres Basin, was taken on the Pacific slope only in the Rio Chorrera.

THE RIO CHAGRES AND ITS FAUNA.

The Rio Chagres is but slightly affected by tides at its mouth, as there is a difference of less than two feet between mean high and mean low water on the Atlantic coast of Panama. Ascending this stream, it is found to flow through a low swampy region in its lower course, or as far as Gatun. Here it receives its largest tributary, the Rio Trinidad, which is a sluggish stream winding its way for many miles southward through a low, dense jungle where mosquitoes abound in countless numbers. It reaches the mountains opposite the Rio Chorrera. In the upland regions it is free from rapids, but the current is swift.

At Gatun the Rio Chagres receives another tributary of considerable size, namely, the Rio Gatun, which assumes an easterly course, and is a clean, clear stream, usually with sandy or pebbly bottom and without rapids or falls but with a strong current.

Following again the course of the Rio Chagres from Gatun upward it assumes the general direction of the present Canal, i. e., southeastward until Gamboa is reached where it makes a rather sharp turn to the left and then follows an east by northeast course. As far up as Alhajuella or about 50 miles from its mouth, following the winding course of the stream, the current is swift but no rapids occur. From this point upward it becomes swifter and at intervals rapids appear which can be crossed only when the water is at a low stage. At San Juan, the last native village on the river, the stream forks; the left fork is known as the Rio Pequeni which soon again divides forming the Rio Boqueron and the Rio Pequeni. The fork to the right, going up stream, at the village of San Juan is the Upper Chagres. Following its course the mouth of a large tributary is soon reached. This is the Rio Indio which has a waterfall a short distance above its mouth; below it a large num-



NATIVE PULLING A BOAT ACROSS RAPIDS ON THE UPPER CHAGRES.



FISHING PARTY ON THE RIO GATUN.

ber of specimens of *Joturus pichardi* were obtained with a discharge of dynamite.

The regions through which the upper courses of these streams flow are entirely uninhabited. A traveler in this region is obliged to provide himself with provisions, for nothing can be obtained except fish and game. Large fishes belonging to the genus *Brycon* are plentiful, and there is doubtless also an abundance of game, although no effort was made by us to obtain it. The region is densely wooded and no headway can be made into the jungle without cutting a trail. Large crocodiles and caimans abound, and several species of monkeys may from time to time be seen leaping from tree to tree. On several occasions numbers of monkeys made early morning visits to our camps, chattering profusely in the trees overhead, but upon the first movement or sound from the occupants of the camp the chattering ceased and a grand rush was made for the jungle.

We made the trip up these streams in a wooden dug-out, "poled" by two natives. As it is impossible to paddle a canoe against the strong current in most places, the natives use a pole with an iron shoe at the base. One man stands in the stern of the boat to guide and to push and the other occupies the bow, walking forward, securing a hold and then running back as the boat is pushed along. Even during our expedition, when the streams were at a very low stage it was necessary for us to land and walk past several rapids while our boatmen by means of a rope pulled the boat across them. In coming down stream and crossing rapids considerable skill is required. Our boatmen were very careful either to go faster than the current or slower in order to retain control of the boat. It is then obvious that an expedition on the Upper Chagres and its tributaries should not be undertaken without skillful boatmen who are familiar with the streams.

The waters of the lower Chagres are constantly turbid, but those of its upper tributaries were clear and cool at the time of our expedition. The beds of all of the upper tributaries are pebbly or rocky. Large boulders usually occur at the rapids, making traveling all the more difficult.

The stages of the river often change rapidly owing to freshets in the mountains, the highest water usually occurring during November and December, at the close of the rainy season, and the lowest water during February and March. The rapidity with which the stream at times rises may be seen from the following figures obtained from the records kept by the Isthmian Canal Commission at its hydrographic station at Alhajuela: On December 26, 1909, the river had an elevation of 96.6 feet at 7:00 A. M.; at 7:00 P. M. the elevation was 121 feet. On December 26,

1911, it rose from an elevation of 101.4 feet at 9:00 A. M. to 110 feet by 10:00 A. M. It is evident that at such times all boating on the river must cease.

The fish fauna in the upper courses of the Chagres is rather rich in quantity but rather poor in variety. On the lower courses of the Chagres the larger fishes have become comparatively rare, owing in part at least to the illegal use of dynamite, but the number of species is greater than in the uninhabited region.

The following is a list of species obtained by us in the Rio Chagres Basin: Family *Siluridae*; *Pimelodella chagresi*, *Rhamdia wagneri*: Family *Loricariidae*; *Plecostomus plecostomus*, *Chatostomus fischeri*, *Ancistrus chagresi*, *Loricaria uracantha*: Family *Characidae*; *Astyanax ruberrimus*, *Bryconamericus emperador*, *Brycon petrosus*, *Brycon chagrensis*, *Gephyrocharax atricaudata*, *Creagrutus notropoides*, *Hyphessobrycon panamensis*, *Pseudocheiroidon affinis* gen. et sp. nov., *Compsura gorgonæ*, *Ræboides guatemalensis*, *Piabucina panamensis*, *Hoplias microlepis*: Family *Gymnotidae*; *Hypopomus brevirostris*: Family *Pæciliidae*; *Gambusia cascajalensis*, *Gambusia episcopi*, *Gambusia nicaraguensis*, *Mollienisia sphenops*, *Priapichthys tridentiger*, *Rivulus elegans*: Family *Mugilidae*; *Agonostomus macracanthus*, *Agonostomus monticola*, *Joturus pichardi*: Family *Cichlidae*; *Æquidens cæruleopunctatus*, *Cichlasoma maculicauda*, *Neotopolus panamensis*, *Geophagus crassilabris*: Family *Gobiidae*; *Awaous taiasica*, *Dormitator maculatus*, *Leptophilypnus fluviatilis* gen. et sp. nov., *Microeleotris mindii* gen. et sp. nov., *Eleotris isthmensis* sp. nov., *Eleotris pisonis*, *Guavina guavina*, *Phtlypnus dormitor*, and *Sicydium salvini*.

The representatives of the family *Siluridae* occur on both slopes of Panama and southward and seem to be well established species that are not at the present time undergoing any rapid changes in different localities.

Of the family *Loricariidae*, *Loricaria uracantha* was taken only in the Rio Chagres* and does in fact have no very near relatives. Since the Isthmus of Panama is the northernmost limit of the range of this family and its center of distribution occurs somewhere in South America, this species may be regarded as one of the earliest migrants,† which appears to have changed remarkably under the new environment. *Chatostomus fischeri* is really a Pacific slope fish in Panama, but it seems to have reached this region before the last gap between the Rio Chagres and the Pacific slope streams was closed. It has apparently not thrived

**Loricaria uracantha* is recorded from the Pacific slope of Panama, but it was not seen there by us.

†In our discussion on distribution, Panama is regarded as a very remote center of distribution. See Meek, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1914, p. 134.



NATIVES "POLING" A BOAT ACROSS RAPIDS ON THE UPPER CHAGRES.



FISHING PARTY ON A TRAIL THROUGH THE JUNGLE.

well in the Chagres, as it is very rare there, nor has it undergone any changes different from those of the Pacific slope. *Ancistrus chagresi*, by whatever route it may have reached the Rio Chagres, is now abundant there and may also be regarded as one of the early migrants. It was found on the Pacific slope only in the small Rio Chorrera, the upper tributaries of which are opposite those of the Rio Trinidad. It, therefore, seems probable that this species crossed from one stream into the other before the gap between them became closed. The other representative of this family, *Plecostomus plecostomus*, is of wide distribution and occurs on both slopes of Panama and southward.

Among the characins evolution seems to be rather actively at work in a number of species. *Brycon chagrensis*, *Brycon petrosus*, *Creagrutus notropoides* and *Ræboides guatemalensis* all have closely related opposites or relatives on the Pacific slope, but the influence of the different environment during their period of separation has brought forth certain definite and marked changes. *Hyphessobrycon panamensis* alone of all the characins from the Rio Chagres has no near relative elsewhere in Panama. The genus, however, reappears in Colombia. The Panama representative was probably one of the early migrants reaching the Chagres before the last passage between this river and the Pacific streams was closed. If it actually reached the Atlantic slope by that route, then we are obliged to conclude that the species was unable to maintain itself on the Pacific slope and while it became extinct there it thrived on the Atlantic. The rest of the species of the *Characidae* known from the Chagres are common to both slopes of Panama. Of these *Astyanax ruberrimus* at least also occurs throughout Colombia, and *Hoplias microlepis* while replaced by *H. malabaricus* in the Rio Tuyra Basin and in Colombia, oddly enough again reappears on the western slope of Ecuador.

The single representative of the family *Gymnotidae* is of wide distribution, and does not appear to be undergoing any rapid changes.

The representatives of the family *Paciliidae* are common to both slopes, with the single exception of *Gambusia nicaraguensis* which can scarcely be regarded a fresh water form, as it seldom occurs above brackish water.

Of the family *Mugilidae* three species occur in the Rio Chagres. Two of them at least are common to both slopes of Panama and Central America as well as to the West Indies.

Of the family *Cichlidae* there are two species, *Æquidens cæruleopunctatus* and *Geophagus crassilabris*, that are of rather wide distribution and are found everywhere in the streams of Panama. *Cichlasoma maculicauda* is found only on the Atlantic slope of Panama and north-

ward to Guatemala. *Neetroplus panamensis* is known only from the Rio Chagres, although there are representatives of the genus in Costa Rica and other parts of Central America. The last two species may be regarded as migrants from Central America.

The fresh and brackish water representatives of the family *Gobiidae* alone seem to have Panama as a center of distribution. They appear to have yielded to the different environment of the two slopes and only one species, *Sicydium salvini*, an upland form, is now common to both slopes. *Awaous taiasica*, *Dormitator maculatus*, *Microeleotris mindii* sp. nov., *Eleotris pisonis* and *Philypnus dormitor* all have very near relatives on the Pacific slope, differing sufficiently so that usually they can be distinguished quite readily.

THE RIO BAYANO AND ITS FAUNA.

The Rio Bayano is a broad stream at its mouth and owing to the excessively high tides on the Pacific coast of Panama, varying from 20 to 30 feet between high and low water, the current changes twice daily for 30 or more miles up stream. Throughout this entire distance the river is broad and muddy, but the head of steam boat navigation is not far above the mouth of the Rio Mamoni which empties into the main stream about 20 miles from the sea. The lower course of the Bayano has large quiet bays where the crocodile is very abundant. There are places where on a sunny day an observer may stand in one position and count a hundred or more noses of these beasts projecting above the water. Many marine species of fishes run up and down the lower part of this stream with the tides.

The Rio Mamoni has a much greater fall than the main stream and soon rises above tide level. It then becomes, at least during the dry season, a clear stream with a rocky or pebbly bottom. About 10 or 15 miles above its mouth is situated the town of Chepo which is one of the oldest and best known towns of Panama outside of the limits of the Canal Zone. During the dry season this stream is quite small at this village. It was so low during our visit that we were obliged, in order to reach Chepo, to leave our dug-out behind and travel overland the last 5 or 6 miles. In this region of savanas this was not difficult. We did not explore the stream beyond Chepo, although it extends for many miles back into the mountains, and very probably supports forms of fishes not obtained by us.

Following again the course of the main stream for from 10 to 15 miles above the mouth of the Mamoni another tributary of considerable size is reached. This is the Rio Calobre which flows through a densely wooded and uninhabited region. The lower portion of this stream is

also subject to a flow of water in opposite directions for a few miles above its mouth. The water, however, is fresh, as the back water entering it is the fresh water from the main stream which is being held back by the onrush of the tide. This stream too is rocky above the head of tide and its fish fauna is quite rich in species but not in quantity.

Time did not permit us to follow the course of the main stream beyond the mouth of the Calobre. It would at any rate at the time have been impossible for us to explore the upper tributaries of the Bayano, as they lie within the San Blas region controlled by the hostile San Blas Indians, who do not permit a white man to enter their territory. These streams must, therefore, remain unexplored until these Indians learn that the white man is not their enemy.

The fish fauna of the Rio Bayano Basin is essentially that of the Rio Tuyra. The following species were obtained by us in the Rio Bayano Basin: Family *Siluridæ*; *Pimelodella chagresi*, *Rhamdia wagneri*: Family *Loricariidæ*; *Chatostomus fischeri*, *Ancistrus spinosus* sp. nov., *Oxyloricaria citurensis*, *Oxyloricaria panamensis*: Family *Characidæ*; *Astyanax ruberrimus*, *Astyanax fasciatus*, *Bryconamericus emperador*, *Brycon argenteus*, *Brycon striatulus*, *Gephyrocharax atricaudata*, *Curimatus magdalena*, *Hoplias microlepis*, *Luciocharax beani*, *Piabucina panamensis*, *Pseudocheiroidon affinis* gen. et sp. nov., *Compsura gorgona*, *Raboides occidentalis* sp. nov., *Thoracocharax maculatus*: Family *Gymnotidæ*; *Hypopomus brevirostris*: Family *Pæciliidæ*; *Gambusia episcopi*, *Mollienisia sphenops*, *Priapichthys dariensis*, *Priapichthys tridentiger*: Family *Mugilidæ*; *Agonostomus monticola*: Family *Cichlidæ*; *Æquidens cæruleopunctatus*, *Cichlasoma calobrense*, *Cichlasoma tuyrense*, *Geophagus crassilabris*: Family *Gobiidæ*; *Awaous transandeanus*, *Dormitator latifrons*, *Hemieleotris latifasciatus*, *Eleotris pictus*, and *Philypnus maculatus*.

The following species of more northern distribution reach their southernmost limit in the Rio Bayano; *Piabucina panamensis*, *Gambusia episcopi*, *Priapichthys tridentiger*, *Agonostomus monticola*, *Joturus pichardi** and *Hemieleotris latifasciatus*. The following species are not known north of this river basin; *Chatostomus fischeri*, *Ancistrus spinosus* sp. nov., *Loricaria variegatus*,† *Oxyloricaria citurensis*, *Oxyloricaria panamensis*, *Cichlasoma calobrense* and *Cichlasoma tuyrense*. *Plecostomus plecostomus*, although found on both slopes of Panama and northern South America, is not recorded from the Rio Bayano, and was not taken in this river by us, but it doubtless occurs there. According

*This species was not taken by us, but it is recorded from the Rio Bayano by Jordan & Gilbert under the name *Joturus stipes*.

†This species was not taken here by us but the type is from the Rio Mamoni.

to our present knowledge there is not a single species whose habitat is limited to this river basin alone, as all species occurring here are found also in streams either to the eastward or westward of it.

THE RIO TUYRA AND ITS FAUNA.

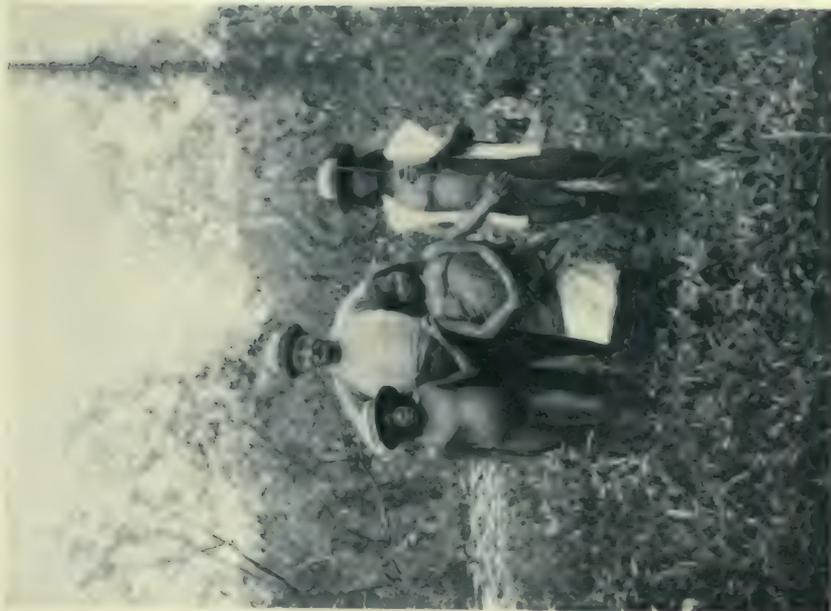
This river like the Bayano is subject to the high tides of the Pacific coast. It empties into San Miguel Bay, and for many miles inland it is a broad expanse of water in which the current changes twice daily. The head of steam boat navigation is at El Real about 75 miles above its mouth. The head of tide is at Pinogana about 15 miles above El Real.

Several miles below El Real is the mouth of the Rio Chucunaque, a tributary nearly as large as the main stream. This stream lies almost wholly within the San Blas region. Its exploration was therefore not undertaken.

The main stream was followed as far as Boca de Cupe, about 30 miles above the head of steamboat navigation. This distance was traveled in the native wooden dug-out. This stream has rather swift current above the head of tide, but there are no strong rapids, such as occur in the Rio Chagres. Before reaching Boca de Cupe the mouths of three tributaries of rather large size are reached, namely the Rio Aruza, Rio Yape, and the Rio Capeti. An overland trip from Boca de Cupe was made to the upper part of the Aruza, and the other two were followed only a short distance above their mouths. Interesting collections were obtained from each. At the native village of Boca de Cupe, located at the mouth of the Rio Cupe, the main stream was fished as well as the smaller tributary.

From Boca de Cupe the Darien Gold Mining Company has constructed a small tramway to its mines in the mountains at Cana, a distance of about 30 miles. This was followed and some of the small streams en route were fished. At Cana the small Rio Cana and the somewhat larger Rio Setiganti were visited and rather extensive collections made in each. An overland trip of about 10 miles was made from Cana to the Rio Grande another one of the upper tributaries of the Rio Tuyra. These small mountain streams are all very rocky and collecting is difficult. Most of the streams were clear and cool at the time of our visit, but the Rio Cana was very turbid with a reddish sediment on its bed. However, a number of very interesting forms not seen elsewhere were secured from the latter.

Some of the upper tributaries of the Rio Tuyra and those of the Rio Atrato of the Atlantic slope of Colombia come very close together and the water shed between the two basins is very low. We were informed by the employees of the Darien Gold Mining Company that the Indians



AN INDIAN FAMILY OF THE RIO TUYRA BASIN. THE LATE DR. S. E. MEEK IN REAR. (NOTE THE FISHING SPEAR HELD BY THE HEAD OF THE FAMILY.)



SCENE ON THE UPPER CHAGRES.

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of this region, during the rainy season when the streams are high, often drag their canoes from the head waters of one basin to those of the other, and inasmuch as the fishes of the two streams are much alike it seems very probable that within comparatively recent times a gap remained somewhere along this water shed.

The following species were obtained in the Rio Tuyra Basin: Family *Siluridæ*; *Ageneiosus caucanus*, *Pimelodella chagresi*, *Pimelodus clarias punctatus*, *Rhamdia wagneri*, *Trachycorystes amblops*: Family *Loricariidæ*; *Leptoancistrus canensis*, *Lasiancistrus planiceps*, *Chatostomus fischeri*, *Ancistrus spinosus* sp. nov., *Plecostomus plecostomus*, *Loricaria fimbriata*, *Loricaria capetensis*, *Loricaria filamentosa latiura*, *Loricaria variegata*, *Oxyloricaria citurensis*, *Oxyloricaria panamensis*: Family *Pygidiidæ*; *Pygidium striatus*: Family *Cyclopidæ*; *Cyclopium pirrense*: Family *Characidæ*; *Apareiodon dariensis*, *Astyanax ruberrimus*, *Astyanax fasciatus*, *Bryconamericus emperador*, *Brycon argenteus*, *Brycon striatulus*, *Gephyrocharax atricaudata*, *Creagrutus simus*, *Curimatus magdalenæ*, *Hemibrycon dariensis* sp. nov., *Hoplias malabaricus*, *Luciocharax beani*, *Piabucina festæ*, *Phanagoniates macrolepis*, *Pseudocheirodon affinis* gen. et sp. nov., *Compsura gorgonæ*, *Ræboides occidentalis* sp. nov., *Thoracocharax maculatus*: Family *Gymnotidæ*; *Eigenmannia virescens*, *Hypopomus brevirostris*, *Sternarchus rostratus*, *Sternopygus dariensis* sp. nov.: Family *Pæciliidæ*; *Mollienisia caucana*, *Priapichthys dariensis*, *Priapichthys tridentiger cana*: Family *Cichlidæ*; *Æquidens cæruleopunctatus*, *Cichlasoma calobrense*, *Cichlasoma tuyrense*, *Cichlasoma umbriferum*, *Geophagus crassilabris*: Family *Gobiidæ*; *Awaous transandeanus*, *Philypnus maculatus*.

Among the family *Siluridæ* there are again the two species, *Pimelodella chagresi* and *Rhamdia wagneri*, occurring everywhere in Panama. *Ageneiosus caucanus* is common to the Rio Tuyra and the Rio Atrato, and the other two species of this family, while not identical, are very closely related to Atrato forms, from which they are slowly changing under the different environment. The genera *Ageneiosus*, *Pimelodus* and *Trachycorystes* all reach the northern limit of their range in the Rio Tuyra.

Under the family *Loricariidæ*, there is again the widely distributed species *Plecostomus plecostomus*, and *Chatostomus fischeri*, the latter occurring on both slopes of Panama and quite surely also in Colombia. *Loricaria fimbriata* and *Loricaria filamentosa latiura* also occur on the Atlantic slope of Colombia and *Oxyloricaria panamensis* occurs on both slopes of Colombia and in Ecuador and reaches its northern limit in the Rio Bayano. *Ancistrus spinosus* sp. nov., *Loricaria variegata* and *Oxyloricaria citurensis* also are found in the Rio Bayano. *Leptoancistrus*

canensis, *Lasiancistrus planiceps* and *Loricaria capetensis*, all originally described in one of our preliminary papers (1913), remain peculiar to this stream. The last two, however, have very near relatives on the Atlantic slope of Colombia.

The families *Pygidiidae* and *Cyclopidae* are each represented by a single species; both are described as new in our preliminary paper (1913). This in both instances represents the northernmost record for these families. The Panama representatives have very near relatives in Colombia.

In the family *Characidae* there are the following species that appear to be peculiar to the Rio Tuyra; *Apareiodon dariensis*, *Creagrutus simus* and *Hemibrycon dariensis* sp. nov. While distinct, all have near relatives in Colombia, and may therefore be regarded as among the latest migrants. *Phanagoniates macrolepis*, *Piabucina festæ* and *Hoplias malabaricus* do not occur in other streams of Panama, but their range extends southward into Colombia or beyond. The rest of the representatives of this family are found in other streams of Panama and five of them occur also in the Rio Chagres, viz.; *Astyanax ruberrimus*, *Bryconamericus emperador*, *Gephyrocharax atricaudata*, *Compsura gorgonæ* and *Pseudocheirodon affinis* gen. et sp. nov. Only the first one of these is known from south of the Rio Tuyra. *Brycon striatulus*, *Brycon argenteus* and *Thoracocharax maculatus* also appear to reach the southern extreme of their range in the Rio Tuyra. They, however, possess very near relatives in Colombia. The genus *Brycon* seems to be yielding to the effects of different conditions, and now consists of several rather closely related species.

In the family *Gymnotidae*, *Sternarchus rostratus* seems to be common to the Rio Tuyra and the Rio Atrato. *Sternopygus dariensis* sp. nov. is limited to the Rio Tuyra Basin. The other two species are of wide distribution. *Eigenmannia virescens*, however, is not known north of the Rio Tuyra.

The *Paciliidae* are comparatively rare in this river basin and the species are few. *Mollienisia caucana* reaches its northern limit of distribution in the Rio Tuyra; the variety *Priapichthys tridentiger cana* seems to be peculiar to this stream; and *Priapichthys dariensis* is known from this river basin and westward on the Pacific slope of Panama.

In the family *Cichlidae* there is a single species, *Cichlasoma umbriferum*, that seems to be peculiar to this stream. *Cichlasoma tuyrense* and *Cichlasoma calobrense* are common to this stream and the Rio Bayano. The other two species of this family are of rather wide distribution and occur on both slopes of Panama and southward.

The two representatives of the family *Gobiidae* taken here by us are widely distributed on the Pacific slope of tropical America.

GENERAL CONCLUSIONS WITH RESPECT TO DISTRIBUTION.

We regard Panama as a very remote center of distribution and believe that the fresh water fishes have mostly migrated to this region within comparatively recent geologic times.

The fish fauna of Panama is essentially that of South America, and most of the forms seem to have entered from that direction. The families *Loricariidae*, *Pygidiidae*, *Cyclopidae*, *Callichthyidae*, as well as several of the representatives of the families *Siluridae*, *Characidae*, *Gymnotidae* and *Cichlidae* known from South America reach their northern limit of distribution in Panama. The extreme likeness of the fauna of the Pacific slope of Panama and that of the Atlantic slope of Colombia, and in particular the close similarity of the fishes of the Rio Tuyra and the Rio Atrato strongly indicate that the last gap between these two streams was closed within comparatively recent times. As previously stated the watershed between the upper tributaries of these streams is still very low and the natives continue to drag their canoes from the head waters of one stream to those of the other.

Several species of the family *Loricariidae*, as well as some of the South American forms of the families *Siluridae*, *Characidae* and *Cichlidae*, have found their way into the Rio Chagres. These seem to us to have reached this river before the last gap between the Rio Chagres and the streams of middle Panama was closed, rather than to have migrated directly from the Colombian streams. If this is the case, the last gap between the Chagres and one of the Pacific slope streams opposing it must have been closed earlier than the last passage between the Rio Tuyra and the Rio Atrato, for the similarity between the fishes of the two slopes in the region of the Canal Zone is not nearly so great as it is farther eastward (Rio Atrato — Rio Tuyra). It then is very probable that only the earliest migrants succeeded in reaching the Rio Chagres Basin.

The representatives of the family *Paciliidae* may have entered Panama from Central America, as the majority of the species resemble Central American forms more than they do South American. The fresh water representatives of the family *Mugilidae* have evidently migrated to this region from the north and reach the southern limit of their range in the Rio Chagres and the Rio Bayano.

The fresh water species of the family *Gobiidae* are more numerous in Panama than elsewhere. Most of them still frequent brackish water and it is probable that they evolved from marine shore forms, which have worked their way up streams and into fresh water.

FOOD FISHES OF PANAMA.

The most important food fishes of the fresh waters of Panama are the characins belonging to the genus *Brycon*. These fishes reach a larger size than any of the other fresh water species. They are of good flavor, but the flesh is penetrated by numerous small bones. This fish is used both in the fresh and smoked state. The species of the genus *Hoplias* reach a rather large size and are of some value as food but are considered of inferior flavor. The catfish, *Rhamdia wagneri*, is everywhere considered a good food fish. In the Darien region the Indians quietly wade around in the creeks to seek out their hiding places and take them with a spear. A few of the *Loricariidæ* are also used as food to a limited extent.

The fresh water species of the family *Mugilidæ* are food fishes of some value. The largest species, *Joturus pichardi*, occurring only at the base of waterfalls, reaches a length of about two feet. It takes the hook quite readily and is considered the best game fish of the streams of Panama. The members of the family *Cichlidæ*, are used to some extent, but are of relatively little importance, their size seldom exceeding a length of 12 inches. A few species of *Gobiidæ*, those of the genera *Philypnus* and *Guavina*, are sometimes eaten, but are of little importance.

There is little fishing carried on on the rivers of Panama, yet in the more thickly populated regions the larger species are comparatively rare, while in the unsettled regions they are rather abundant. Little or nothing has of course been done to protect the fisheries. The natives have learned the use of dynamite in killing fishes, and this destructive method probably, to a large measure, accounts for the diminished supply in the populated regions.

NOTES OF EXPLANATION.

The plan that has been followed is to give the name of each species, the name of the original describer, and a brief synonymy. The synonymy includes all the names that have become synonyms, together with references to literature of local interest, and often a reference to a general work is given. Then follows a diagnostic description; then a brief statement of the size and number of specimens at hand, where taken, and what, if anything, is known of the habits, food, etc., and finally in a very brief statement the range of distribution is given.

The proportions given in the text for the different species are based upon measurements accurately made with calipers and slide rule.

Unless there were not enough specimens at hand, not fewer than ten were measured, and in many instances where the measurements were of special importance a much larger series was used, selecting as a rule as wide a range in size as possible. The counts of fin rays, scales, etc., are based upon similar series.

Such an expression as the following, occurring at the beginning of the description of nearly every species, "Head 2 to 3.5; depth 3 to 3.8," signifies that the length of the head, measured from the end of the snout to the bony margin of the opercle, is contained 2 to 3.5 times and that the greatest depth of the body is contained 3 to 3.8 times in the length of the body from the end of the snout to the base of the caudal fin. In giving the number of fin rays Arabic numerals are used to indicate the number of soft rays and Roman numerals the number of spines. For example, D. IV-I, 16 signifies that in this instance there are two dorsal fins, the first being composed of four spines and the second of one spine and sixteen soft rays. If these spines and soft rays were included in a single fin instead of in two fins, the result would be written thus; D. V, 16.

For the purpose of ready identification artificial keys to the families, genera and species are introduced. In using them, first determine which of the major groups the species is in and then take up the regular order of letters under each group. If the characters of the specimen in hand do not agree with those given under the single letter, look under the same double letters, ignoring all intervening matter.

A SYSTEMATIC CATALOGUE OF THE FRESH WATER FISHES OF PANAMA.

All of the fishes of the fresh waters of Panama belong to the class *Pisces* (fishes) and to the subclass *Teleostomi* (the true fishes), which possess a bony skeleton; a well developed skull; gill-opening a single slit on each side; nostrils at least two, not median; fins well developed, usually paired; alimentary canal more or less convoluted.

KEY TO THE FAMILIES OF FRESH WATER FISHES OF PANAMA.

- a. Scales wanting, body smooth or with bony plates; one to 6 pairs of barbels or whiskers more or less developed about the mouth and nostrils.
- b. Body wholly naked (naked in Panama species) or with a single series of bony plates along side.
- c. Adipose fin present.
- d. Mouth terminal or subterminal; the lips not reverted and not forming a disc. *Silurida*, p. 239.
- dd. Mouth inferior; the lips reverted, forming an oval sucking disc. *Cyclopida*, p. 265.
Pygidiida, p. 266.
- cc. Adipose fin wanting.
- bb. Body mostly or wholly covered with bony plates.
- e. Sides and back and often the ventral surface covered with bony plates; mouth wholly inferior; the lips reverted, forming a sucking disc. *Loricariida*, p. 246.
- ee. Sides with 2 series of bony plates; mouth terminal or subterminal; the lips not reverted nor developed into a sucking disc. *Callichthyida*, p. 263.
- aa. Scales usually present (present in all of the Panama species); no whiskers about the mouth and nostrils.
- f. Fins without spines.
- g. Body compressed or subterete, not eel-shaped; dorsal fin present.
- h. Adipose fin usually present (wanting in *Phanagoniates* and *Hoplias*); head naked, usually more or less compressed; lateral line complete or not (wanting in *Piabucina*). *Characida*, p. 267.
- hh. Adipose fin wanting; head partly scaly, usually depressed, flat above; lateral line wanting. *Pæciliida*, p. 313.
- gg. Body more or less eel-shaped; dorsal fin wanting or represented by a mere filament. *Gymnotida*, p. 306.

- ff. Fins with spines.
- i. Body elongate, not very deep; dorsal fins 2, separate or more or less united; lateral line incomplete or wanting.
- j. Scales large, dorsal fins well separated; caudal fin forked; ventral fins abdominal, far apart. *Mugilidæ*, p. 332.
- jj. Scales if present (present in all of the Panama species) moderate or small; dorsal fins separate or united; caudal fin rounded; ventral fins thoracic, close together or united to form a sucking disc. *Gobiidæ*, p. 349.
- ii. Body deep, compressed; scales moderate; lateral line interrupted under base of dorsal, reappearing lower down on caudal peduncle; dorsal fin single, composed of spines and rays. *Cichlidæ*, p. 338.

Order I. Nematognathi.

THE CATFISHES.

Fishes without scales, the body smooth or provided with bony plates, and with whiskers about the mouth. Parietals and supra-occipitals confluent; the four anterior vertebræ co-ossified; no mesopterygium; suboperculum wanting or modified into the uppermost branchiostegal.

Family I. Siluridæ.

Body naked or with a single series of plates along middle of sides; mouth terminal or subterminal; opercle well developed; gill-openings usually wide; maxillary a mere vestige; caudal vertebræ not compressed; air-bladder well developed, lying free in the abdominal cavity; dorsal fin over abdominal portion of vertebral column; adipose fin present, long or short; anal fin not very long, its origin far behind that of dorsal.

KEY TO THE GENERA.

- a. Eye with a free orbital margin; adipose fin longer than anal.
- b. Occipital process failing to reach dorsal plate; adipose fin much longer than head. *Rhamdia*, p. 239.
- bb. Occipital process reaching dorsal plate; adipose fin shorter or not very much longer than head.
- c. Fontanel not continued beyond eyes; humeral process spine-like. *Pimelodus*, p. 241.
- cc. Fontanel continued beyond eyes; humeral process broad, not spine-like. *Pimelodella*, p. 242.
- aa. Eye without a free orbital margin; adipose fin shorter than anal.
- d. Barbels 6, a pair of maxillary barbels and 2 pairs of mandibular barbels; caudal fin obliquely truncate, emarginate or rather deeply concave. *Trachycorystes*, p. 243.
- dd. Maxillary barbels present, very small, especially in the female; no mandibular barbels; caudal fin forked. *Ageneiosus*, p. 244.

1. Genus *Rhamdia* Bleeker.

Rhamdia Bleeker, Verhand. Natuurk. Vereen. Nederl. Indie, IV, 1858, 197 (sp.); Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 101 (type *Pimelodus quelen* Quoy & Gaimard).

Body elongate; mouth terminal or with lower jaw the shorter; jaws with villiform teeth; no teeth on vomer or palate; nostrils remote from each other; no nasal barbels; barbels 6; occipital process small or wanting, not reaching the dorsal plate; eye with a free orbital margin; dorsal fin with 1 slender spine and 5 to 8 branched rays; adipose fin long, adnate to the back. To this genus belongs a large number of fresh-water catfishes, inhabiting streams from southern Mexico to Peru and the Rio de la Plata. One species only occurs in the Panama Canal Zone region.

1. *Rhamdia wagneri* (Günther).

Pimelodus cinerascens (non Günther) Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München, 1865, 49 (Panama).

Pimelodus wagneri Günther, Trans. Zool. Soc. London, 1868, 474 (Atlantic and Pacific rivers of Panama); Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1879 (Rio Mamoni, Chepo, Panama).

Rhamdia bransfordi Gill, Proc. Ac. Nat. Sci. Phila., 1876, 337 (Panama).

Rhamdia wagneri Eigenmann & Eigenmann, Occ. Pap. Cal. Ac. Sci. I, 1890, 133 (Gorgona, Rio Chagres; Rio Obispo, Panama; Turbo, Atlantic coast, Cent. America); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 151; Regan, Biol. Cent. Amer., Pisces, 1907, 131 (Shirures, Costa Rica; western Ecuador).

Head 3.6 to 4.55; depth 5.1 to 6.55; D. I, 6; A. 11 to 13.

Body elongate, compressed posteriorly; head depressed; profile gently elevated anteriorly, nearly straight; snout broad, its length 2.25 to 2.5 in head; eye 5.45 to 7.5; interorbital 2.4 to 2.94; mouth broad, its width greater than length of snout; the upper jaw a little in advance of the lower; maxillary barbels varying considerably in length, reaching opposite base of ventrals to opposite or past base of anal; teeth in the jaws in villiform bands; none on palatines or vomer; head covered with skin; occipital process narrow, not extending to the small dorsal plate; fontanel long and narrow, extending past anterior margin of eye; dorsal fin with a poorly developed spine; origin of dorsal not quite half as far from tip of snout as from base of caudal; adipose fin notably longer than head, its base 2.65 to 3.3 in body; caudal fin forked, the lower lobe the larger, rounded; anal fin short, its origin somewhat nearer base of caudal than base of pectorals; ventral fins inserted behind vertical from base of last dorsal ray, failing to reach origin of anal; pectoral fins rather short, the spine rather weak, and without barbs except in young, its length 1.8 to 2.45 in head.

Color bluish black above, pale below; sides yellowish green and with a single dark band in young. Dorsal fin with a dark band across middle and a lighter one below it.

Numerous specimens of this species were collected. It is found in all the streams of Panama. The specimens at hand vary in length from 45 to 350 mm. It is considered a food fish of some importance. In the Rio Tuyra Basin the Indians quietly wade around in the streams and seek their hiding places and take them with a spear. In this they are so adept that they seldom miss their aim.

Habitat: Streams of both slopes of Central America, from Costa Rica southward to Ecuador.

2. Genus *Pimelodus* Lacépède.

Pimelodus Lacépède, Hist. Nat. Poiss., V, 1803 (species of several genera); Cuvier, Règne Animal, II, 1817, 203 (species having a single band of teeth in upper jaw); Lütken, Dan. Vidensk-Selsk., Skr., (5) XII, 1875, 163 (type *Pimelodus maculatus* Lacépède = *Silurus clarias* Bloch).

Pseudariodes Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 99 (type *Pseudariodes clarias* Bloch).

Pseudorhamdia Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 101 (type *Pseudorhamdia maculata* Lacépède = *Silurus clarias* Bloch).

Body elongate, head covered with thin skin, granulose; occipital process reaching dorsal plate; humeral process broad; fontanel not continued beyond anterior margin of eyes; eye with a free orbital margin; one pair of maxillary barbels; 2 pairs of mandibular barbels; caudal fin forked.

2. *Pimelodus clarias punctatus* (Meek & Hildebrand).

Megalonema punctatum Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 77 (Rio Tuyra, Marrigante, Panama).

Megalonema robustum Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 78 (Rio Tuyra, Marrigante, Panama).

Head 3.9 to 4.1; depth 4.4 to 5.25; D. I, 6; A. 11 to 13.

Body elongate, compressed; dorsal region elevated; head not much wider than deep, its width 1.34 to 1.6 in its length; snout not very broad, its length 2.04 to 2.25 in head; eye 4.7 to 6; interorbital 2.94 to 4; width of mouth a little less than length of snout; maxillary barbels reaching opposite anal or to base of caudal; occipital process rather wide, not fully united with the dorsal plate, its greatest width greater than eye, except in young of less than 150 mm. in length; teeth in villiform bands, none on palatines or vomer; gill-membranes free from the isthmus; humeral process rather narrow, pointed slightly upward; dorsal spine equal to or a little longer than head, a rudimentary spine at its base;

origin of dorsal slightly nearer adipose than tip of snout; adipose fin shorter than head, 4.8 to 5.5 in length of body; caudal fin deeply forked, the upper lobe the longer; anal fin without distinct spine, its origin behind origin of adipose; ventral fins inserted under posterior rays of dorsal; pectoral spine with hooks on both sides in young, becoming smoother with age, 1 to 1.23 in head.

Color bluish above, pale silvery below. Young with numerous round specks or spots on head and side, which become fewer with age and wholly disappear in specimens of 200 mm. and more in length. Fins unmarked.

We have 8 specimens of this species, ranging in length from 142 to 300 mm. All are from the lower Rio Tuyra, some of them from below the head of tide water.

This fish is probably not distinct from *P. clarias* (Bloch) of which there are at hand numerous specimens from the Rio Atrato and Rio Magdalena. However, we do not find the dark spots, so characteristic in the young from the Rio Tuyra, present in the specimens from the more southern streams. The occipital process apparently is also slightly wider in the Rio Tuyra specimens. Our specimens may, therefore, be considered a variety of *P. clarias* with dark spots present in all except the adults.

Habitat: Rio Tuyra Basin.

3. Genus *Pimelodella* Eigenmann & Eigenmann.

Pseudorhamdia (non Bleeker) Steindachner, Sitzb. K. Ak. Wiss. Wien, LXXIV, 1876, 604 (type *Pimelodus lateristriga* Müller & Troschel).

Pimelodella Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd. Ser., I, 1888, 131 (type *Pimelodus cristatus* Müller & Troschel).

This genus differs from *Pimelodus* in having a narrower and more spine-like humeral process and the fontanel extends farther back, notably past anterior margin of eye. Only a single species is found in the waters of Panama.

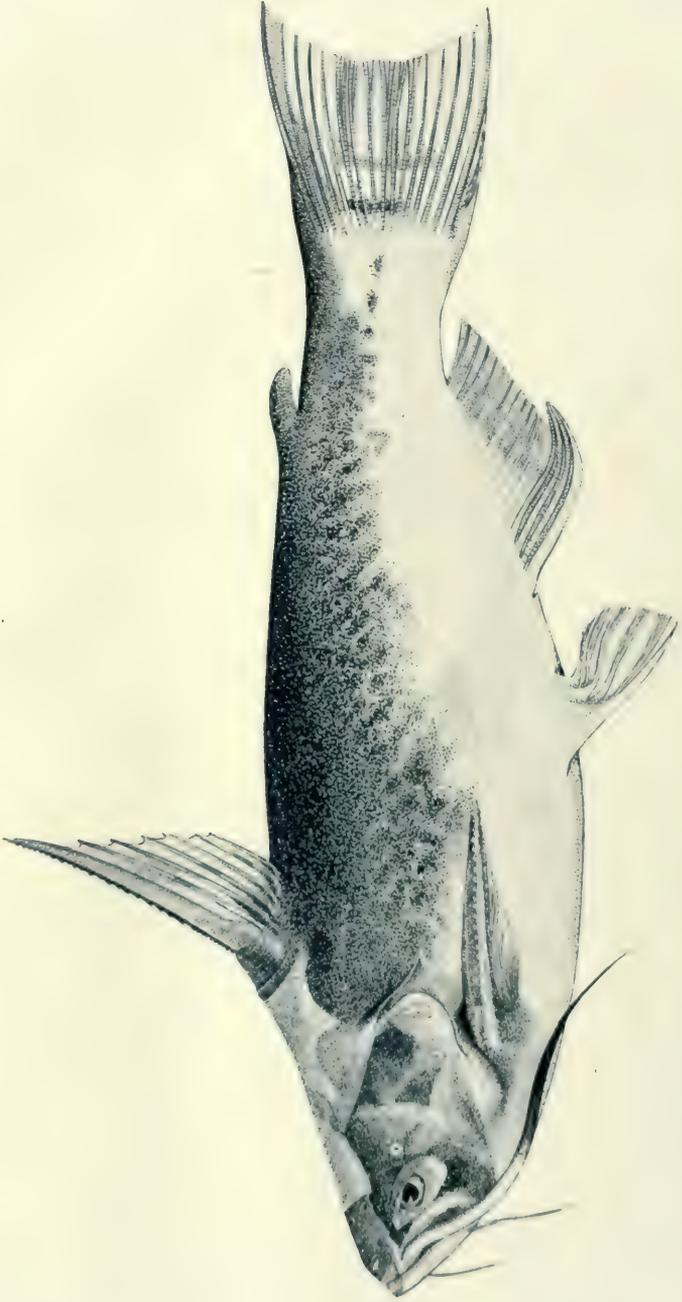
3. *Pimelodella chagresi* (Steindachner).

Pimelodus (*Pseudorhamdia*) *chagresi* Steindachner, Sitzb. K. Ak. Wiss. Wien, LXXIV, 1876, 584 (Rio Chagres and its tributaries).

Pimelodella chagresi Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd. Ser., I, 1888, 134 (Rio Obispo), and Occ. Pap. Cal. Ac. Sci., I, 1890, 160 (Rio Chagres and its tributaries).

Head 3.8 to 4.7; depth 5.2 to 6.2; D. I, 6; A. 11 or 12.

Body elongate, compressed, the dorsal region moderately elevated; head rather narrow; snout tapering, 2.3 to 2.7 in head; eye 3.85 to 4.6;



TRACHYCORYSTES AMBLOPS (Meek & Hildebrand).
From a specimen 138 mm. in length.

interorbital 4.13 to 4.73; mouth narrower than length of snout; upper jaw a little in advance of the lower; maxillary barbels usually reaching to or somewhat past origin of anal; teeth in villiform bands, none on vomer or palatines; occipital process long and narrow, reaching dorsal plate; fontanel long and narrow, reaching backward to or a little beyond posterior margin of pupil; origin of dorsal about midway between tip of snout and origin of adipose; dorsal spine a little longer than eye and snout; adipose fin varying in length, but always longer than head, 3 to 3.95 in length of body; caudal fin deeply forked, the upper lobe much the longer, notably longer than head; anal fin without a spine, its origin a little behind origin of adipose; ventral fins failing to reach origin of anal, inserted just behind vertical from base of last dorsal ray; pectoral fins rather short, the spine without hooks on its distal third or fourth, but with strong hooks on basal portion, its length 1.2 to 1.63 in head.

Color greenish, with a jet black lateral band and another pair of bands on each side of median line of back, extending from nape to upper surface of caudal peduncle. Fins unmarked.

This species is represented by numerous specimens, ranging in length from 40 to 142 mm. Common on both slopes of Panama.

This species can inflict most painful wounds with its fin spines, which bear poison glands at the base.

Habitat: Both slopes of Panama.

4. Genus *Trachycorystes* Bleeker.

Trachycorystes Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 88 (type *Trachycorystes typus* Bleeker = *Auchenipterus trachycorystes* Cuvier & Valenciennes).

Parauchenipterus Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 88 (type *Parauchenipterus galeatus* Linnæus).

Body elongate or robust, covered with naked skin; occipital firmly joined to dorsal plate; lower jaw usually projecting; mandibular barbels in 2 pairs, one pair of maxillary barbels; teeth in villiform bands, none on vomer or palatines; eye small, lateral, covered with skin; dorsal with a spine and from 4 to 6 rays; adipose fin shorter than anal; caudal fin obliquely truncate, emarginate or rather deeply concave, the lobes round or pointed; outer margin of pectoral spine serrate.

4. *Trachycorystes amblops* (Meek & Hildebrand).

Felichthys amblops Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 77 (Rio Tuyra, Marrigante, Panama).

Head 3.7 to 4.35; depth 3.85 to 5.25; D. I, 5; A. 17 to 20.

Body rather robust; profile from snout to dorsal straight and gently elevated in female, concave in adult males; head depressed, its width 1 to 1.8 in its length; posterior part of body rather strongly compressed; snout short, broad, about equal to diameter of eye; eye 4.4 to 6.65 in head; interorbital 1.53 to 1.63; mouth broad; a pair of maxillary barbels, with a bone extending to anterior margin of eye in female, almost or quite to gill-opening in male; chin with 2 pairs of barbels; teeth in the jaws in bands; gill-opening small; dorsal plate rather broad; humeral process narrow, pointed slightly upward; dorsal spine in female somewhat shorter than head, notably longer than head in the male, with barbels on its anterior margin, at least in young and in males; origin of dorsal more than half as far from tip of snout as from tip of adipose; adipose fin over posterior part of anal; caudal fin forked, both lobes pointed, equal to or longer than head; anal fin rather low, with heavy membrane on its base, length of its base shorter than width of head; ventral fins reaching origin of anal; dorsal fin not nearly reaching base of ventrals, the spine usually about equal to length of head.

Color dark above, pale below; sides variously spotted or marked with black. Usually with a dark spot or elongate blotch on middle of side below dorsal; some specimens with roundish black spots on sides of head and caudal peduncle. Fins unmarked. Our largest specimen much darker than the others.

There are 8 specimens in the present collection, ranging in length from 87 to 192 mm. All are from the lower Rio Tuyra. One specimen is from several miles above and the others from several miles below the head of the tide.

This species is very closely related to *T. fisheri* Eigenmann, from which it differs mainly in the shape of the caudal, which has a much more concave margin, and longer and more pointed lobes. It also differs from the latter in the more posterior position of the dorsal and in the shorter anal.

Habitat: Rio Tuyra Basin.

5. Genus *Ageneiosus* Lacépède.

Ageneiosus Lacépède, Hist. Nat. Poiss., V, 1805, 132 (type *Ageneiosus armatus* Lacépède).

Pseudogeneiosus Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 108 (type *Ageneiosus brevifilis* Cuvier & Valenciennes).

Body elongate; snout much longer than eye, with maxillary barbels only; eyes lateral; the orbit without a free margin; occipital process

firmly joined to the dorsal plate; humeral process wanting; gill-membranes joined to the isthmus; dorsal fin with a rather weak spine and 6 or 7 rays, its origin in advance of ventrals; adipose fin very short; anal fin long.

5. *Ageneiosus caucanus* Steindachner.

Ageneiosus caucanus Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1880, 61, Pl. VI, figs. 1 & 2 (Rio Cauca); Eigenmann & Eigenmann, Occ. Pap. Cal. Ac. Sci., I, 1890, 306.

Head 3.5 to 3.8; depth 6.1 to 7.45; D. I, 6; A. 32 to 40.

Body elongate, compressed; profile from snout to dorsal deeply concave in large males, only slightly concave in females; head low; snout very broad, much depressed, its length 1.77 to 2 in head; eye small, lateral, covered by a membrane, 5 to 10 in head; interorbital width 1.88 to 2.46; mouth wide, its width greater than length of snout; a pair of maxillary barbels present, very small in the female; with a stiff bone, extending to or beyond angle of mouth in the male; teeth in villiform bands, the one in upper jaw about as wide as eye, none on vomer or palatines; upper surface of head with a few rather prominent ridges and striations, covered with thin skin; a long narrow frontal fontanel; dorsal spine in the female rather weak and shorter than snout, much longer in the male, and with strongly developed barbs on its anterior side; origin of dorsal not much behind base of pectorals, a little more than half as far from tip of snout as from tip of adipose; adipose fin small, its base not longer than eye, over posterior fifth of anal; caudal fin forked, the lobes of about equal length; anal fin long, its base equal to or longer than head, the spine much more strongly developed in the male than in the female; ventral fins usually not quite reaching origin of anal; pectoral fins failing to reach ventrals, the spine 1.93 to 2.25 in head.

Color yellowish creamy. The back in some specimens uniform bluish black. In others this color is broken up into stripes, or blotches. Sides with dark spots varying notably in size among the individuals. There is usually a series of spots forming a row from just above angle of gill-opening backward. Dorsal fin usually with dark spots. Caudal fin with a dark longitudinal bar on its upper lobe and a single blotch on the lower lobe. In very large examples both lobes bear several dark blotches, but no definite bar. Anal and ventrals unmarked; pectorals with or without a few dark blotches.

There are 45 specimens of this species in the Panama collection. They range from 130 to 460 mm. in length. All are from the lower Rio Tuyra, some of them from below the head of tide water and others from as far up as Boca de Cupe.

We have at hand for comparison a few large male specimens from the Rio San Juan, Colombia. With these our specimens seem to agree in all characters of specific importance.

Habitat: Rio Tuyra Basin, Panama, and south to Ecuador.

Family II. Loricariidæ.

Sides and back and sometimes the lower surface covered with bony plates, these often provided with teeth-like spines; mouth wholly inferior, provided with reflected, disk-like lips; premaxillaries not protractile; maxillary bone thin, bearing a barbel which is partly united with the oval disk; no mental or nasal barbels; teeth if present hooked and in a single series; no teeth on palatines; no frontal or occipital fontanel; nostrils close together; gill-membranes broadly joined to the isthmus; dorsal fin present, situated on the abdominal portion of the spinal column and not connected with the occipital by processes; adipose fin, if present, composed of a spine and a membrane; anal fin usually present, short; alimentary canal very long, coiled.

MEASUREMENTS.

In the present work the length of head in this family is measured to the margin of the temporal plates which usually extend to above base of pectorals; the total length of body is measured to tip of longest ray of caudal, exclusive of filament, if present; the standard length as usual is measured to base of caudal fin; by the mandibular ramii are meant the two bones bearing teeth, forming the posterior border of the mouth and corresponding to the lower jaw in other fishes.

KEY TO THE GENERA.

- a. Body rather short, robust; caudal peduncle short, compressed; adipose fin usually present.
- b. Adipose and anal fins present.
- c. Scutes on back and sides distinctly carinate; opercle firmly attached to the interopercle and not independently movable.
Plecostomus, p. 247
- cc. Scutes on back and sides without prominent ridges or carinations; opercle more or less freely movable.
- d. Margin of snout naked, with or without tentacles.
- e. Snout without tentacles; mandibular ramus about equal to interorbital.
Chatostomus, p. 249.

- ee. Margin of snout bearing tentacles, long and numerous in the male, short and few in female; mandibular ramus much narrower than interorbital. *Ancistrus*, p. 250.
- dd. Margin of snout with granules and bristles; mandibular ramus notably shorter than interorbital. *Lasiancistrus*, p. 253.
- bb. Adipose and anal fins wanting; margin of snout granular, bearing short bristles; mandibular ramus nearly equal to interorbital. *Leptoancistrus* gen. nov., p. 254.
- aa. Body long and slender; caudal peduncle very long, strongly depressed; adipose fin wanting.
- f. Eye with a distinct orbital notch; teeth usually bifid, and in small or moderate numbers. *Loricaria*, p. 255.
- ff. Eye without an orbital notch; teeth setiform, numerous. *Oxyloricaria*, p. 261.

6. Genus *Plecostomus* Gronow.

Plecostomus Gronow, Mus. Ichth., I, 1754, 24 (sp.); Gronow, Zooph. Gronov., 1763, 127; Bleeker, Nederl. Tijdschr. Dierk. I, 1863, 77 (type *Plecostomus brasiliensis* Bleeker = *Loricaria plecostomus* Linnæus).

Hypostomus Lacépède, Hist. Nat. Poiss., V, 1803, 144 (type *Hypostomus guacari* Lacépède).

Body elongate; back and sides completely covered with carinate bony scutes; first scute of lower lateral series separating the second scute entirely from the temporal plate; lower surface of head and abdomen naked or covered with small granular scales; snout granular; opercle with or without marginal bristles, firmly attached to the interopercle and not capable of independent movement; premaxillaries and dentaries of about equal length, each with slender bifid teeth; adipose fin present; caudal fin emarginate. A large genus of which but one species is represented in the rivers of Panama.

6. *Plecostomus plecostomus* (Linnæus).

Loricaria plecostomus Linnæus, Syst. Nat., Ed. 12, I, 1766, 508 (America).

Hypostomus guacari Lacépède, Hist. Nat. Poiss., V, 1803, 145 (America).

Loricaria flava Shaw, Gen. Zool., V, 1805, 38, Pl. 101.

Hypostomus plecostomus Schomburgk, Fishes Brit. Guiana, I, 1841, 139 (Rio Branco).

Hypostomus robinii Gill, Ann. Lyc. Nat. Hist. N. Y., VI, 1858, 46 (Trinidad).

Plecostomus brasiliensis Bleeker, "Silures de Suriname," 1864, 7 (Surinam).

Plecostomus plecostomus Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd Ser., I, 1888, 169.

Plecostomus seminudus Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd Ser., I, 1888, 169 (Brazil).

Plecostomus boulengeri Eigenmann & Kennedy, Proc. Ac. Nat. Sci. Phila., 1903, 502 (Paraguay).

Head 3 to 3.44; depth 4.4 to 5.3; D. I, 7; A. I, 4; lateral scutes 25 to 28.

Body anteriorly depressed, wider than deep; caudal peduncle posteriorly compressed; dorsal profile anteriorly convex; ventral surface straight, flat; head low and wide; snout broad, its margin granulate except a small triangular area at tip, 1.6 to 1.75 in head; eye 5.25 to 10; interorbital 2.2 to 2.9; mouth wholly inferior; the lips broad, expanded, forming a sucking disc; a single short barbel at angle of mouth; teeth placed on the ramii of the jaws, slender, bifid, curved inward near tip; the ramus of lower jaw 2 to 3.35 in interorbital; occipital and temporal plates each with a median ridge, the former bordered posteriorly by only a single scute; scutes on upper surface of body carinate, spinulose; 3 scutes in advance of dorsal; 6 or 7 between dorsal and adipose; 13 to 15 from anal to base of caudal; ventral surface in advance of vent mostly covered with small granular scales; dorsal fin inserted in advance of anal, nearer tip of snout than adipose fin, its base a little shorter than head, its spine usually about length of head, 2.9 to 3.75 in length; adipose fin well developed, situated somewhat nearer base of caudal than base of last ray of dorsal; caudal fin emarginate, the lobes produced, the lower one usually the longer; anal fin small, its origin a little behind base of last ray of dorsal; ventral fins rather large, reaching well past origin of anal; pectoral fins long, reaching far beyond base of ventrals, the spine much enlarged in adults, bearing recurved spinules.

Color above dark green; head and ventral surface with green spots, these varying notably in size among individuals; fins usually bluish green, with large spots of pale green, those on lower fins arranged so as to form more or less distinct bars.

This species is represented by 150 specimens, ranging in length from 40 to 400 mm. It was found fairly common on both slopes of Panama, except in the Rio Bayano Basin where no specimens were obtained.

This fish lives in rocky streams and is difficult to catch with a seine. Most of our specimens were secured by the use of a set net, in which they readily become entangled.

Habitat: Both slopes of Panama, south to Uruguay.

7. Genus *Chaetostomus* Tschudi.

Chaetostomus Tschudi, Fauna Peruana, Pisc., XV, 1840, 489 (type *Chaetostomus lobarhynchus* Tschudi).

Body elongate, anteriorly depressed, wider than deep, ventral surface flat; head low, broad; snout obtuse, with a naked margin and without spines or tentacles; plates on head rather smooth, without ridges or carinations; back and sides covered with spinulate but not carinate scutes; lower surface of head and abdomen naked; mandibular ramus nearly equal to interorbital width. Adipose fin present. This genus is represented by a single species in Panama.

7. *Chaetostomus fischeri* Steindachner.

Chaetostomus fischeri Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1879, 162, Pl. IV (Rio Mamoni, near Chepo); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 16; Regan, Trans. Zool. Soc. London, XVII, Pt. III, 1904, 248.

Head 3 to 3.25; depth 5.15 to 6; D. I, 8; A. I, 5; lateral scutes 24 or 25.

Body anteriorly depressed; caudal peduncle posteriorly compressed; dorsal profile convex; ventral surface straight and flat; head low and wide, its upper surface spinulate, but without ridges or carinations; snout obtuse, its margin without granules, spines or tentacles, 1.5 to 1.65 in head; eye 6.7 to 9.3; interorbital 2.95 to 3.6; mouth wholly inferior, broad; the lips expanded, papillose, forming a sucking disc, the lower lip with small lobes along its posterior margin and a small barbel on its lateral margin near angle of mouth; teeth situated on the ramii of the jaws, small, numerous, slender, bifid and curved inward near the tips, the ramus of lower jaw 1 to 1.3 in interorbital; interopercle with 1 or 2 short spines; back and sides completely covered with spinulate but not carinate scutes, 6 scutes between dorsal and adipose, 10 or 11 from anal to base of caudal; lower surface of head and abdomen completely naked; dorsal fin inserted a little in advance of base of ventrals, somewhat nearer tip of snout than adipose fin, its base equal to distance from the base of its last ray to tip of adipose, its spine 1.15 to 1.45 in head; adipose fin well developed, inserted slightly nearer base of upper ray of caudal than base of last ray of dorsal; caudal fin emarginate, the lower rays the longest; anal fin small, its origin a little behind last ray of dorsal; ventral fins reaching past origin of anal; pectoral fin large, reaching beyond middle of ventrals; the spines of all the fins with spinules.

Color uniform black above; abdomen white. Tips of dorsal and caudal reddish in life.

Of this species 62 specimens, ranging from 30 to 260 mm. in length, were preserved. It is common in the Rio Tuyra Basin, but only a few specimens were obtained in the Rio Bayano and a single specimen in the Rio Chagres. The last was speared at night by torch light by a native at Ahajuela.

This species lives among the rocks, apparently preferring the rapid courses of streams. In clear water it may often be seen huddled close to the rocks to which it is able to attach itself by means of its sucking mouth and flat ventral surface. It feeds on algae and other plants. Its alimentary canal is convoluted and many times the length of the body. It is prepared as food by the natives of Darien, by boiling it in water.

Habitat: Both slopes of Panama.

8. Genus *Ancistrus* Kner.

Ancistrus Kner, Denkschr. K. Ak. Wiss. Wien, VII, 1853, 272 (sp.); Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 77 (type *Hypostomus cirrhosus* Cuvier & Valenciennes).

Thysanocara Regan, Ann. & Mag. Nat. Hist., Ser. 7, XVII, 1906, 95 (type *Hypostomus cirrhosus* Cuvier & Valenciennes).

Body anteriorly broad; caudal peduncle posteriorly compressed; margin of snout naked, bearing tentacles; the naked margin broad in males and with many tentacles, narrow in the females and with few short tentacles; preopercle independently movable, bearing spines; the premaxillaries and dentaries of about equal length, the mandibular ramus much narrower than interorbital; plates on head and scutes on body without prominent ridges or carinations; adipose fin well developed.

KEY TO THE SPECIES.

- a. Fins moderately elevated, the posterior rays of the dorsal failing to reach adipose when deflexed; base of dorsal scarcely equal to the distance from the base of the last ray to the tip of the spine of the adipose; pectoral fins failing to reach the middle of the ventrals, the spine notably shorter than the head; second scute behind occipital without a distinct median suture.

chagresi, p. 251.

- aa. Fins strongly elevated, the posterior rays of dorsal reaching past origin of adipose when deflexed; base of dorsal equal to the distance from the base of the last ray to the base of caudal; pectoral fins reaching to or past the middle of ventrals, the spine longer than head; second scute behind occipital with an evident median suture.

spinus sp. nov., p. 252.

8. *Ancistrus chagresi* Eigenmann & Eigenmann.

Ancistrus cirrhosus (non Cuvier & Valenciennes) Kner & Steindachner, Abhandl. K. Beyer. Ak. Wiss. München, X, 1864, 61 (Rio Chagres).

Chatostomus cirrhosus Günther, Trans. Zool. Soc. London, 1866, 478 (Rio Chagres).

Ancistrus chagresi Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd Ser., II, 1889, 47 (Rio Chagres), and Occ. Pap. Cal. Ac. Sci., I, 1890, 446.

Xenocara chagresi Regan, Trans. Zool. Soc. London, XVII, Pt. 3, 1904, 256 (Rio Chagres).

Head 2.55 to 2.9; depth 4.7 to 5.75; D. I, 7; A. I, 3 or 4; lateral scutes 24 to 26.

Body anteriorly broad, depressed; caudal peduncle posteriorly compressed; dorsal profile anteriorly gently convex; ventral surface straight and flat; head broad, the interorbital width nearly equal to depth of body, 2.05 to 2.3 in head; snout obtuse, the margin naked; naked portion broad in the males and narrow in females, in the former with well developed tentacles on the margin and a V-shaped patch above near tip of snout; tentacles varying much in number and length among individuals; females with only a few short tentacles along or a little below the margin of snout; length of snout 1.6 to 1.75 in head; eye 7 to 11; mouth rather wide; the lips expanded, with straight margin; barbel on lateral margin of lower lip minute; the premaxillaries quite as long as the dentaries; mandibular ramus 2.45 to 3.2 in interorbital width; teeth slender, bifid, curved inward near the tips; interopercle with from 9 to 15 spines of various lengths, which also vary much among individuals, longer in the male than in the female; sculpture of head without ridges or carinations; scutes on back and sides not carinate, but with strong serrations on their margins; occipital bordered by 3 scutes; the second median scute without a distinct median suture; 6 or 7 scutes between dorsal and adipose, 11 or 12 from anal to base of caudal; lower surface of head and abdomen naked; dorsal fin moderately elevated, the posterior rays when deflexed failing to reach adipose by at least one row of scutes, the spine 1.2 to 1.5 in head; base of dorsal scarcely equal to distance from base of last ray to tip of the spine of the adipose; adipose fin well developed; caudal fin with a straight oblique or slightly concave margin, the lower rays the longest; anal fin small, its origin at vertical from base of last ray of dorsal; ventral fins reaching past origin of anal; pectoral fins reaching past base of ventrals, but failing to reach the middle of these fins, the spine notably shorter than head.

Color uniform dark above or occasionally with small greenish spots on head and predorsal region; abdomen usually with pale green spots

which vary in size, shape and number among individuals; fins all brownish green with pale green spots.

The Panama collection contains 56 specimens, ranging from 45 to 255 mm. in length. Fifty-four of these are from the Rio Chagres Basin. The other two were taken in the Rio Chorrera, a small stream on the Pacific slope west of Panama City.

Habitat: Rio Chagres and Rio Chorrera, Panama.

9. *Ancistrus spinosus* sp. nov.

Type No. 8942, F. M. N. H.; length 135 mm.; Rio Calobre, tributary of the Rio Bayano, Panama.

Head 2.65 to 2.77; depth 4.6 to 4.7; D. I, 7; A. I, 4; lateral scutes 24.

Body broad anteriorly; caudal peduncle posteriorly compressed; head broad; interorbital width nearly equal to the depth of body, 1.95 in head; snout obtuse, the naked portion narrow in the female and with only 4 small tentacles, much wider in the male with a fringe of tentacles along the margin and a V-shaped patch on the upper surface at the tip; length of snout 1.63 to 1.7 in head; eye 8.75; mouth wide; the lips expanded; the lower lip with a small barbel, shorter than eye, on its lateral margin; the premaxillaries and dentaries equal in length; mandibular ramus 3.1 to 3.6 in interorbital width; teeth slender, bifid, curved inward near the tips; interopercle with from 8 to 12 spines, curved outward and forward near the apices, longer in the male than in the female; sculpture of head without ridges or carinations; scutes on back and sides not carinate, their margins very strongly serrate, especially in the male; occipital posteriorly bordered by 3 scutes; the second median scute with an evident median suture; 6 scutes between dorsal and adipose; 11 or 12 between anal and base of caudal; lower surface of head and abdomen naked; dorsal fin very high, the posterior rays when deflexed reaching past origin of adipose, the spine 1.15 to 1.2 in head; base of dorsal equal to distance from the base of its last ray to base of caudal; adipose fin well developed; caudal fin with a nearly straight oblique margin, the lower rays the longest; anal fin small, its origin slightly behind vertical from base of last ray of dorsal; ventral fins reaching well beyond base of anal; pectoral fins very long, reaching to or past the middle of ventral, the spine a little longer than the head.

Color uniform dark above. The male plain brownish below; the female with faint pale spots on abdomen; fins in male plain brownish, in female with faint pale spots.

Apparently a rare species. There are at hand only 2 specimens, a male and female, respectively 130 and 135 mm. in length. The male was taken at the mouth of the Rio Yape, tributary of the Rio Tuyra;

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LASIANCISTRUS PLANICEPS (Meek & Hildebrand).
From a specimen 133 mm. in length.

and the female, which we designate as the type, was taken in the Rio Calobre, tributary of the Rio Bayano.

Differing from *A. chagresi* principally in the higher fins. The male specimen has but 6 rays in the dorsal, but this may be due to an injury, as the fin apparently was mutilated sometime during the fish's career.

9. Genus *Lasiancistrus* Regan.

Lasiancistrus Regan, Proc. Zool. Soc. London, XVII, Pt. III, 1904, 224 & 237 (type *Chaetostomus heteracanthus* Günther).

Body broad anteriorly; caudal peduncle posteriorly compressed; head without prominent ridges, the plates not carinate; scutes on back and sides spinulate but not carinate; lower surface of head and abdomen naked; margin of snout with granules and bristles; premaxillaries quite as long as the dentaries; mandibular ramus notably shorter than interorbital width; preopercle more or less freely movable, armed with rather strong spines, the apex of each spine bent outward and forward; D. I, 7; adipose fin well developed.

10. *Lasiancistrus planiceps* (Meek & Hildebrand).

Ancistrus planiceps Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 79 (Rio Tuyra, Boca de Cupe, Panama).

Head 2.6 to 2.9; depth 5.3 to 6.9; D. I, 7; A. I, 5; lateral scutes 24 or 25.

Body broad, low, depressed anteriorly; caudal peduncle posteriorly compressed; dorsal profile nearly straight from eyes to dorsal; ventral surface anteriorly broad and flat; head low and very wide; snout moderately acute, its margin with granules and bristles, 1.6 to 1.85 in head; eye 7 to 10; interorbital 2.25 to 2.45; mouth of moderate width, the lips expanded, forming a sucking disc; the margin of lower lip nearly smooth, with a very small barbel, shorter than eye, on its lateral margin behind angle of mouth; teeth small, bifid and curved inward near the tips; premaxillaries a little longer than the dentaries; the mandibular ramus 3 to 4 in interorbital width; interopercle with about 20 spines which vary greatly in length among individuals; sculpture of head without carinations and without ridges, except for a broad, low ridge on median line of snout; scutes on back and sides spinulate, the first median scute behind occipital anteriorly convex, broadest at median line of back; 7 scutes between dorsal and adipose, 11 or 12 between anal and base of dorsal; lower surface of head and abdomen completely naked; dorsal fin high, the posterior rays when deflexed failing to reach adipose by 1 or 2 rows of scutes, its spine longer than snout and eye, 1.3 to 1.5

in head; origin of dorsal slightly nearer adipose than tip of snout; adipose well developed, inserted a little nearer base of caudal than base of last dorsal ray; caudal fin with an oblique or slightly concave margin, the lower rays the longest; anal fin small, its origin behind last ray of dorsal; ventral fins reaching well past origin of anal; pectoral fins very long, reaching beyond the middle of ventrals, longer than head.

Color uniform dark above; ventral surface of head and abdomen brownish, with or without bluish spots. Fins with dark spots on the rays and pale ones on the interradial membranes, sometimes forming wavy bars on the fins. The spots most distinct in our largest specimens.

There are 31 specimens in the Panama collection, ranging from 35 to 235 mm. in length. All are from the Rio Tuyra Basin.

We have for comparison 4 specimens (paratypes) from Cartago, Atlantic slope of Colombia, of the rather closely related species, *L. caucanus* Eigenmann (Indiana University Studies, No. 16, 1912, 11). The latter differs from *L. planiceps* in the slightly deeper body, lower dorsal and pectoral fins, in the shape of the first median scute behind occipital, and in color.

10. Genus *Leptoancistrus* gen. nov.

Type *Acanthicus canensis* Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 80.

Body anteriorly low and broad; snout granular to its margin, bearing short bristles; head and body without prominent ridges or carinations; interopercle freely movable, bearing spines which cannot be retracted under the opercle; premaxillaries and dentaries of about equal length; the mandibular ramus nearly equal to interorbital width; the first scute of lower lateral series separating the second scute from the temporal plate; adipose and anal fins wanting.

11. *Leptoancistrus canensis* (Meek & Hildebrand).

Acanthicus canensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 80 (Rio Cana, Cana, Panama).

Head 2.53 to 2.83; depth 5.5 to 6.45; D. I, 8; lateral scutes 22 or 23.

Body very broad anteriorly, more than twice as wide as deep; caudal peduncle posteriorly compressed; head low and very broad; snout broadly semicircular, granular to the margin, the latter bearing short bristles, its length 1.45 to 1.7 in head; eye very small, 7.5 to 10; interorbital 3 to 3.63; mouth wide; the lips expanded, the margin of the upper following margin of snout; the margin of lower lip fringed, with a minute barbel opposite angle of mouth; teeth slender, bifid, curved



LEPTOANCISTRUS CANENSIS (Meek & Hildebrand).
From a specimen 65 mm. in length.

inward near the tips; premaxillaries and the dentaries of about equal width; mandibular ramus about equal in length to interorbital width, 3.25 to 4 in length of head; interopercle freely movable, bearing about 8 enlarged spines and several short ones, the longest spine usually reaching lower third and occasionally to the middle of pectoral; head and snout without prominent ridges or carinations; scutes on body spinulose, but not carinate; ventral surface of head and abdomen naked, also nearly the entire ventral surface of caudal peduncle, the median line posteriorly crossed by a single scute; occipital bordered by 2 scutes; 3 median scutes in advance of dorsal; dorsal fin moderately elevated, the spine 1.65 to 2.15 in head, its origin a little in advance of ventrals, nearer tip of snout than base of caudal; base of dorsal about equal to length of snout; adipose fin wanting; caudal peduncle above with a low keel; caudal fin obliquely truncate, the lower rays the longest; anal fin wanting; ventral fins moderately developed, equal to or slightly longer than snout; pectoral fins large, reaching base of anal in young, and to or past middle of ventrals in adult.

Color dark gray above; pale below. Fins with dark spots on rays, most numerous on dorsal and caudal on which they form more or less distinct bars.

There are at hand 52 specimens of this species. They vary in length from 25 to 75 mm. All are from small mountain streams near Cana in the upper Rio Tuyra Basin.

11. Genus *Loricaria* Linnæus.

Loricaria Linnæus, Syst. Nat., Ed. X, 1758, 307; Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 80 (type *Loricaria dura* Linnæus = *Loricaria cataphracta* Linnæus).

Body elongate, usually depressed throughout; snout pointed or rounded; ventral surface flat, the abdomen wholly or in part covered with bony or granular plates, or sometimes with small granules or entirely naked; orbit with posterior notch; teeth bifid, not setiform, in small or moderate numbers; caudal fin emarginate, one or both of the outer rays often produced.

KEY TO THE SPECIES.

- a. Ventral surface of abdomen completely armed with bony plates.
- b. Lateral keels 2, becoming united on the 15th or 16th scute; pre-dorsal scutes feebly carinate; abdomen with several series of small plates between the enlarged lateral ones; no naked area behind pectoral; maxillary barbel shorter than eye. *uracantha*, p. 256.

- bb. Lateral keels 3, the upper one present on 8th or 9th scute, the other two approximated on the 16th to 18th scute; predorsal scutes strongly carinate; abdomen with 2 series of plates between the enlarged lateral series; a naked area behind pectoral; maxillary barbel longer than eye. *filamentosa latiura*, p. 257.
- aa. Ventral surface of abdomen partly naked.
- c. Lateral keels 2; margin of lower lip with long fringes; maxillary barbel reaching to or past gill-opening; 3 or 4 teeth on each side in upper jaw. *variegata*, p. 258.
- cc. Lateral keels 3; lower lip with short fringes; maxillary barbel never reaching gill-opening; 8 to 10 teeth on each side in upper jaw.
- d. Anterior rays of dorsal reaching past posterior rays when deflexed, the longest ray notably longer than head; anterior rays of anal reaching past posterior rays when deflexed, the longest ray longer than width of head. *capetensis*, p. 259.
- dd. Rays of dorsal reaching equidistant when deflexed, the longest ray not quite as long as head; rays of anal reaching equidistant when deflexed, the longest equal to width of head.

fimbriata, p. 260.

12. *Loricaria uracantha* Kner & Steindachner.

Loricaria uracantha Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München, X, 1866, 56, Pl. VI, figs. 3, 3a, 3b (New Granada; Rio Chagres); Günther, Trans. Zool. Soc. London, 1866, 393 and 478 (Atlantic and Pacific rivers of Panama); Eigenmann & Eigenmann, Occ. Pap. Cal. Ac. Sci., I, 1890, 370 (Atlantic and Pacific slopes of Panama); Regan, Trans. Zool. Soc. London, XVII, Pt. III, 1904, 278 (Panama).

Loricaria bransfordi Gill, Proc. Ac. Nat. Sci. Phila., 1876, 338 (Panama).

Head 4.3 to 4.9; depth 9.5 to 14; D. I, 7; A. I, 6; lateral scutes 28 or 29.

Body low, depressed throughout; caudal peduncle much broader than deep; head very low; snout obtuse, its margin granulate, or with very numerous short bristles in large males, the length 2 to 2.15 in head; a distinct orbital notch; eye 7 to 9.5 in head; interorbital with a ridge over each eye, 3.7 to 4.6 in head; mouth rather narrow; premaxillaries with about an equal number of bifid teeth, from 6 to 10 on each side; the lips large, papillose, the margin of the lower lip fringed; the barbel shorter than eye; lower surface of head naked, the rest of the head and body completely covered with bony scutes or plates; 2 lateral keels anteriorly, becoming completely united on the 15th or 16th scute; occipital and predorsal scutes carinate; scutes on chest and abdomen

mostly small, those between the ventral fins enlarged, a single large plate in advance of vent, bordered anteriorly by 3 enlarged scutes; 5 to 7 rows of small plates across the belly; 16 or 17 scutes from anal to base of caudal; origin of dorsal over or slightly behind base of ventrals; dorsal spine usually about equal to width of head; margin of caudal fin concave, the upper rays the longest; the upper spine enlarged, bearing a filament which is usually lost in preserved specimens; anal fin small, its origin a little in advance of the tips of the deflexed dorsal rays; ventral fins reaching nearly or quite to origin of anal; pectoral fins of about the same length as the ventrals, not quite reaching the base of the latter, 1.3 to 1.77 in head, with short bristles in adult male.

Color brownish above, pale below; the back with 5 or 6 dark cross-bars, the first one at nape very indistinct or wanting, the second under base of dorsal. Fins yellowish green, with dark spots on the rays.

There are numerous specimens in the present collection, ranging from 50 to 185 mm. in length. Although this species has been recorded from both slopes of Panama, our extensive collecting produced none from the Pacific side. We are therefore inclined to doubt the validity of the Pacific slope records. Our specimens are all from the Rio Chagres and its tributaries.

A common species, inhabiting shallow water with swift current, on either sandy or pebbly bottom.

In the National Museum we have examined presumably the type of *L. bransfordi* Gill, which evidently is an adult male of this species. The adult male has a broad head and many short bristles on margin of snout and pectoral fins.

Habitat: Panama.

13. *Loricaria filamentosa latiura* Eigenmann & Vance.

Loricaria filamentosa latiura Eigenmann & Vance, in Eigenmann, Indiana Univ. Studies, No. 16, 1912, 13 (Boca de Certegai, Colombia).

Loricaria turyrensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 81 (Rio Capeti, Panama).

Head 4.1 to 4.6; depth 8.7 to 11.5; D. I, 7; A. I, 5; lateral scutes 30 or 31.

Body broad, strongly depressed throughout; caudal peduncle broad, its width at last anal ray 3.6 to 4 in its length; head low and broad, its width at gill-opening equal to or slightly less than head from that point to tip of snout; snout rather acute, granular to its margin, its length 1.75 to 1.83 in head; orbital notch distinct; eye 7.2 to 9 in head; mouth small; teeth bifid; each jaw with from 8 to 10 teeth on each side; lips papillose, fringed, barbel longer than eye, but failing quite notably

to reach gill-opening; temporal and occipital plates and predorsal scutes carinate; sides anteriorly with 3 keels, the upper one present on 8th or 9th scute, the second and third coming very close together, but not completely united, on the 16th to the 18th scute; ventral surface of head naked; abdomen completely armed, with a series of broad plates on each side and two narrower median rows; a naked area behind base of pectorals; vent anteriorly bordered by a single plate, which in turn is anteriorly again bordered by 3 or 4 smaller plates; 16 to 18 scutes from anal to base of caudal; origin of dorsal over base of ventrals; the anterior rays of dorsal reaching equidistant or slightly past the posterior rays when deflexed, the spine a little longer than the head; caudal fin with rather deeply concave margin, the upper spine produced in a filament; anal fin small, its margin convex, the anterior rays the longest, longer than width of head; ventral fins reaching well past origin of anal; pectoral fins of about the same length as the ventrals, reaching well past the base of the latter, 1.25 to 1.4 in head.

Color dark grayish brown above, slightly lighter below. The fins usually with dark spots on all of the rays.

This species is represented by 19 specimens, ranging from 265 to 355 mm. in length.

We have at hand the paratypes of this species with which we find our specimens to be identical.

Habitat: Rio Tuyra and Rio Atrato basins.

14. *Loricaria variegata* Steindachner.

Loricaria variegata Steindachner, Denkschr. K. Ak. Wiss. Wein, XLI, 1879, 163, Pl. III (Rio Mamoni, near Chepo, Panama); Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd Ser., II, 1889, 36; Eigenmann & Eigenmann, Occ. Pap. Cal. Ac. Sci., 1890, 382.

Head 4.45 to 4.95; depth 12 to 14; D. I, 7; A. I, 5; lateral scutes 32 or 33.

Body much depressed throughout; head low and broad; snout rather acute, granulate to the margin, its length 1.75 to 2 in head; orbital notch distinct; eye 8.65 to 10.7 in head; interorbital 5.2 to 6; mouth narrow; upper jaw with only 3 or 4 teeth on each side, lower jaw with about 6 on each side; the lips papillose, with long fringes, the outer fringe or barbel of lower lip reaching to or past gill-opening; temporal and occipital plates, and predorsal scutes carinate; sides anteriorly with 2 keels, becoming united on the 14th or 15th scute; ventral surface of head naked; abdomen with a lateral series of scutes, bordered by a naked area, and then with a median row of quadrate, granular plates anteriorly, increased to 2 or 3 rows in advance of vent, which is bordered

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LORICARIA CAPETENSIS Meek & Hildebrand.
From a specimen 163 mm. in length.

anteriorly by 2 slightly enlarged plates; a cross row of small plates varying from a few to several in number between pectorals; 18 or 19 scutes from anal to base of caudal; origin of dorsal over or slightly in advance of ventrals, the anterior rays of dorsal reaching past tips of the posterior rays when deflexed, not much shorter than head; caudal fin truncate, the upper rays the longest; the upper spine with a filament; anal fin small, the spine a little shorter than greatest width of head; ventral fin reaching a little past origin of anal, the spine somewhat produced, fleshy at tip; pectoral fins of about the same length as the ventrals, reaching nearly or quite to the base of the latter, 1.25 to 1.7 in head.

Color grayish above, pale below; upper surface sprinkled with small brownish dots and lines; 2 or 3 series of dusky spots sometimes present on the ventral surface of caudal peduncle; fin rays with dark spots, these most numerous on pectorals where they are not only present on the rays but on the interradiial membranes also.

There are 6 specimens, ranging from 235 to 265 mm. in length, in the present collection. All are from the lower Rio Tuyra Basin. Although the type of this species was taken in the Rio Mamoni, no specimens were secured there by us.

15. *Loricaria capetensis* Meek & Hildebrand.

Loricaria capetensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 80 (Rio Capeti, tributary Rio Tuyra, Panama).

Head 4.8 to 4.9; depth 12 to 12.5; D. I, 7; A. I, 5; lateral scutes 30 or 31.

Body depressed throughout; head of moderate width; snout rather acute, its margin granulate, 1.8 to 1.9 in head; interorbital 5.6; mouth narrow; teeth bifid, the inner cusp much longer than the outer, each jaw with about 8 teeth on each side; the lips papillose, each with rather short fringes or tentacles, the longest not nearly reaching gill-opening; temporal and occipital plates and predorsal scutes striate and carinate; sides anteriorly with 3 keels, the third or upper one present on 11 or 12 scutes, the other 2 coming very close together, but not completely united on the 19th to 22nd scute; ventral surface of head naked; abdomen with a lateral row of plates, bordered on each side by a naked area, the median line with 2 or 3 rows of small granular plates, enlarged between the ventrals; a single enlarged plate in advance of vent; 17 or 18 scutes from anal to base of caudal; origin of dorsal slightly behind base of ventrals; the anterior rays reaching past the posterior when the fin is deflexed, the longest ray notably longer than head; caudal fin truncate, the upper spine produced into a filament, about equal to length of body

without head; anal fin small, the anterior rays reaching past the tips of the posterior when deflexed, the longest ray notably longer than width of head; ventral fins reaching origin of anal; pectoral fins a little longer than the ventrals, reaching notably past the origin of the latter, 1.2 to 1.25 in head.

Color grayish above, pale below; back with 4 or 5 indistinct cross-bars, the first one under base of dorsal. Fins with dark spots on the rays.

There are only 2 specimens in the present collection, the type and paratype, respectively 164 and 162 mm. in length. These were taken at the mouth of the Rio Capeti, tributary of the Rio Tuyra.

Evidently very closely related to *L. filamentosa seminuda* Eigenmann & Vance. We have unfortunately no specimens of *seminuda* at hand, but through the kindness of Dr. Eigenmann we were enabled to examine some photographs of this variety. These indicate that *L. capetensis* has the abdominal plates much more weakly developed, leaving more of the abdomen naked. The head appears to be narrower. Its width at gill-opening is equal to its length from that point to tip of snout in *L. capetensis*; in *L. filamentosa seminuda* the width of head at this point is greater than its length from there to tip of snout. Our specimens are somewhat smaller than the one from which the photographs at hand were made, and it may be that the differences indicated are due to age. In that case *L. capetensis* would become a synonym of the latter.

16. *Loricaria fimbriata* Eigenmann & Vance.

Loricaria fimbriata Eigenmann & Vance, in Eigenmann, Indiana Univ. Studies, No. 16, 1912, 12 (Boca de Certegai & Bernal Creek, Colombia).

Head 3.6 to 4.5; depth 12.3 to 13.5; D. I, 7; A. I, 5; lateral scutes 30 or 31.

Body depressed throughout; head of moderate width; snout acute, its margin granulate, 2.1 to 2.4 in head; orbital notch small; eye 5 to 6.65 in head; interorbital 5.5 to 6; mouth small, teeth bifid, the inner cusp much the longer, each jaw with about 8 teeth on each side; the lips papillose, the margins serrate; barbel short; temporal and occipital plates and predorsal scutes striate and carinate; sides anteriorly with 3 keels, the upper one present on about 11 scutes, the other 2 coming very close together, but not completely united, on the 20th or 21st scute; ventral surface of head naked; abdomen laterally with a series of inconspicuous granular plates and a few very small ones on median line of belly; 17 or 18 scutes from anal to base of caudal; origin of dorsal

over base of ventrals; the rays of dorsal reaching equidistant when fin is deflexed, the longest rays slightly shorter than head; caudal fin with concave margin, the upper lobe the longer, upper spine produced in a filament; anal fin small, the anterior rays not reaching beyond the posterior when deflexed, the longest ray equal to width of head; ventral fins reaching origin of anal; pectoral fins slightly longer than the ventrals, reaching a little past the base of the latter, 1.3 to 1.9 in head.

Color grayish; pale below; back with 5 or 6 dark cross-bars. Fins with dark spots on the rays.

Of this species there are 4 specimens, ranging in length from 50 to 80 mm. All are from the mouth of the Rio Capeti, tributary of the Rio Tuyra.

We have for comparison a paratype of this species, with which our specimens agree perfectly.

This species differs from *L. capetensis* in the smaller and more delicate scutes on abdomen, and in the shorter and differently shaped dorsal and anal fins.

12. Genus *Oxyloricaria* Bleeker.

Oxyloricaria Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 81 (type *Loricaria barbata* Kner).

This genus differs from *Loricaria* in the more numerous and setiform teeth and in the absence of the orbital notch.

KEY TO THE SPECIES.

- a. Snout somewhat produced, pointed, its upper profile concave; lateral scutes 33 to 35; caudal fin with a dark longitudinal bar on each lobe. *panamensis*, p. 261.
- aa. Snout broadly obtuse, its upper profile convex; lateral scutes 30 or 31; no dark bars on caudal fin. *citirensis*, p. 262.

17. *Oxyloricaria panamensis* (Eigenmann & Eigenmann).

Loricaria rostrata (non Spix) Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1879, 165 (Rio Mamoni, Panama).

Loricaria panamensis Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd. Ser., II, 1889, 34, and Occ. Pap. Cal. Ac. Sci., I, 1890, 365 (Panama).

Loricaria aurea Steindachner, Anz. K. Ak. Wiss. Wien., 1900, 206, and Denkschr. K. Ak. Wiss. Wien, LXXII, 1902, 138, Pl. V, fig. 1 (Rio Magdalena).

Loricaria frenata Boulenger, Ann. & Mag. Nat. Hist., Ser. 7, IX, 1902, 69 (N. W. Ecuador).

Oxyloricaria panamensis Regan, Trans. Zool. Soc. London, XVII, Pt. III, 1904, 301 (Rio Magdalena; Panama).

Oxyloricaria frenata Regan, Trans. Zool. Soc. London, XVII, Pt. III, 1904, 302, Pl. XVIII, fig. 2 (N. W. Ecuador).

Oxyloricaria dariensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 81 (Rio Tuyra and Rio Bayano basins, Panama).

Head 4.06 to 5.3; depth 8.5 to 13; D. I, 7; A. I, 5; lateral scutes 33 to 35.

Body long, slender, depressed throughout; head without ridges; snout produced, pointed, its margin granular or with short bristles at sides in male, its upper profile concave, 1.57 to 1.7 in head; eye 7.5 to 9.55; interorbital 3.1 to 4.2; lips reverted, papillose; maxillary barbel shorter than eye; predorsal plates 3, without carinations; lateral keels anteriorly obscure, coming close together in young and uniting in the adult on the 17th to the 20th scute; 19 or 20 scutes from anal to base of caudal; dorsal fin anteriorly much elevated, notably longer than head, its origin over base of ventrals; caudal fin forked, both lobes produced, the outer ray bearing a filament; anal fin high, the undivided ray or spine longer than head; ventral fins reaching opposite or past base of anal; pectoral fins reaching opposite lower third or lower half of ventrals, the spine usually equal to length of head.

Color plain olive above; pale below. Anterior rays of dorsal black, the black sometimes more or less broken up into spots; caudal fin with a dark longitudinal bar on each lobe; other fins all with more or less dusky on interradiation membranes.

Of this species we have 86 specimens, ranging in length from 50 to 260 mm. One small specimen is from the Rio Calobre, tributary of the Rio Bayano and all the others are from the Rio Tuyra Basin, where it is quite common.

A study of specimens from Colombia and Ecuador along with our specimens shows that there are quite a number of synonyms under this species. The fact that the lateral keels in the young are not completely united while in the adult they are, in part at least accounts for the numerous names that have been proposed.

Habitat: Pacific slope of Panama, both slopes of Colombia, south to Ecuador.

18. *Oxyloricaria citurensis* Meek & Hildebrand.

Oxyloricaria citurensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 82 (Rio Cupe, Cituro, Panama).

Head 4.55 to 5.1; depth 8.5 to 10; D. I, 7; A. 6; lateral scutes 30 or 31.



OXYLOCARIA CITURENSIS Meek & Hildebrand.
From a specimen 188 mm. in length without caudal filament

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HOPLOSTERNUM PUNCTATUM sp. nov.
From a specimen 95 mm. in length.

Body depressed; anterior profile straight or gently convex; head without ridges; snout not produced, broadly obtuse, its margin granular, with short bristles on sides in male, its length 1.7 to 1.8 in head; eye without orbital notch, 6.5 to 8.7; interorbital 3.1 to 3.6; lips reverted, papillose; maxillary barbel shorter than eye; predorsal plates 3, without carinations; lateral keels anteriorly obscure or wanting, coalesced on 15th or 16th scute; 17 or 18 scutes from anal to base of caudal; 5 to 8 rows of small plates on belly between lateral series; dorsal fin anteriorly not greatly elevated, not much longer than head, its origin over base of ventrals; caudal fin forked, the outer ray of both lobes produced, the upper one bearing a filament; anal fin anteriorly moderately elevated, the spine somewhat shorter than head; ventral fins reaching to or a little past origin of anal; pectoral fins reaching a little beyond base of ventrals, 1.05 to 1.23 in head.

Color dark grayish brown, with obscure darker blotches above; pale below. Fins usually with indistinct dark markings.

This species is represented by many specimens, ranging from 40 to 250 mm. in length. This fish was found only in the Rio Bayano and Rio Tuyra basins. It is rare in the former but abundant in the latter.

This species is rather closely related to *O. tamanae* Regan, from which it differs in having from 5 to 8 longitudinal rows of plates on belly between the lateral series, instead of only 3. The snout in the present species is more obtuse and the fins are lower.

Family III. Callichthyidæ.

Sides with 2 series of lateral scutes; mouth terminal, lower lip not reverted; air bladder vestigiary, one on each side of the coalesced vertebræ and entirely surrounded by a bony capsule, the cavity communicating with the exterior by means of a long narrow slit in the temporal plate. Caudal vertebræ normal, the neural and hæmal spines spine-like, separated from each other.

13. Genus *Hoplosternum* Gill.

Hoplosternum Gill, Ann. Lyc. Nat. Hist. N. Y., VI, 1858, 395 (type

Callichthys lævigatus Valenciennes = *Callichthys littoralis* Hancock).

Body with 2 lateral series of scutes, overlapping along median line, forming a depression; gill-membranes confluent with the skin of the isthmus; two pairs of nuchal plates between humeral and coracoid process; coracoids exposed; 2 pairs of maxillary barbels; no mandibular

barbels; a naked area along ventral surface; adipose fin with a spine; ventral fins inserted below or anterior to the dorsal fin; dorsal spine low; pectoral spine serrate on its inner margin, its surface covered with bristles.

19. *Hoplosternum punctatum* sp. nov.

?*Callichthys* (*Hoplosternum*) *thoracatus* (non Cuvier & Valenciennes)
Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1880, 66 (Cauca, near Caceres).

Type No. 8943, F. M. N. H.; length 110 mm.; Rio Marte Arnade, six miles east of Panama City.

Head 2.96 to 3.26; depth 3.1 to 3.54; D. I, 7 or 8; A. I, 6; lateral scutes, 25 above lateral line and 23 or 24 below it.

Body rather robust; dorsal region moderately elevated; anterior profile straight or gently convex; head broader than deep; snout obtuse, its length 2.2 to 2.36 in head; eye lateral, 7.45 to 8; interorbital 1.6 to 1.67; mouth subterminal, rather small, its width less than length of snout; barbels varying in length, the longest reaching from lower third to opposite distal third of pectoral spine; the lower lip with 2 fleshy lobes; fontanel elongate in young, oval to nearly circular in adult; occipital failing to reach fontanel; the scutes without carinations; 5 or 6 azygous plates in front of adipose spine; coracoids close together anteriorly, or overlapping in the male, separated posteriorly by a V-shaped naked area; distance between pectorals equal to or slightly shorter than length of coracoid plates; dorsal fin inserted notably nearer tip of snout than adipose; dorsal spine about equal to length of snout; adipose with a rather strong spine, the membrane adnate to the back; caudal fin with concave margin, but not as deep as in *H. magdalenæ*; anal fin small, its origin by 2 scutes in advance of adipose; ventral fins about as long as snout and eye, a naked area between them, extending back to vent; pectoral fins failing to reach base of ventrals except in young, the spine with serrations on the back side, its length 1.56 to 1.73 in head.

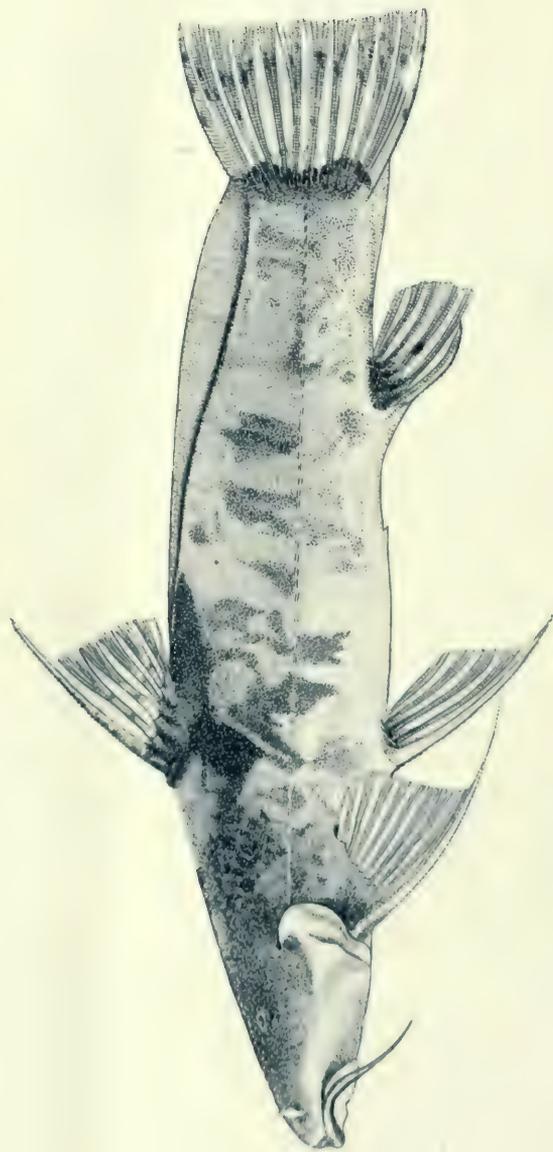
Color brownish black above, somewhat paler below. Entire body, except upper surface of head and dorsal region, with small, roundish black spots. These spots are also present on the rays of the dorsal and caudal fins. Base of caudal with a black bar, followed by a yellowish bar.

Of this species we have 4 specimens, ranging in length from 85 to 110 mm. The largest we designate as the type. These were taken in the Rio Marte Arnade, a small coastal stream about 6 miles east of Panama. This is the only place where this fish was seen. Our specimens were taken during April, 1911. During March the following year this stream



HOPLOSTERNUM PUNCTATUM sp. nov.
From a specimen 95 mm. in length.

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CYCLOPIUM PIRRENSE Meek & Hildebrand.
From a specimen 138 mm. in length.

was again visited and thoroughly fished, but no more specimens were secured.

This fish differs from *H. magdalena* Eigenmann in the more anterior position of the dorsal, the less deeply concave margin of the caudal fin, the fewer azygous plates in front of adipose spine, the shorter coracoids, and in coloration.

Callichthys (Hoplosternum) thoracatus Steindachner (non C. & V.) from the Cauca appears to be very closely related to this species, if not identical with it.

The present species is the most northern representative of the genus.

Family IV. Cyclopidæ.

Naked fishes with robust or elongate bodies; dorsal fin on anterior portion of body; usually an adipose fin with or without a spine, or represented by a movable spine attached by a membrane to the caudal peduncle; teeth in jaws in more than one series.

These fishes inhabit mountain streams of the Andes of Peru to Venezuela and Panama.

14. Genus *Cyclopium* Swainson.

Cyclopium Swainson, Nat. Hist. Fishes, II, 1839, 305 (type *Pimelodus cyclopium* Humboldt).

Body elongate, naked, compressed anteriorly; teeth small; eye small, superior; adipose fin a movable spine attached to caudal peduncle by a membrane, or a long fin with or without a small embedded spine; ribs moderately developed; caudal fin truncate or slightly emarginate, the outer rays slightly produced.

Small, naked fishes inhabiting mountain streams of the Andes of Ecuador, Peru, Colombia, Venezuela, and eastern Panama.

20. *Cyclopium pirrense* Meek & Hildebrand.

Cyclopium pirrense Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 83 (Rio Cana, Cana, Panama).

Head 3.3 to 3.6; depth 5 to 6; D. I, 5; A. I, 5.

Body robust, compressed posteriorly; head depressed, broad, its width equalling its length; anterior teeth of upper jaw pointed, those of the lower bicuspid; snout 1.8 to 2 in head; interorbital 3.4 to 4.1; origin of dorsal over ventrals, its distance from tip of snout 2.2 to 2.4 in body; maxillary barbel reaching slightly past eye; nostrils with a triangular

flap; first dorsal ray with its tip produced, its length 1.1 to 1.4 in head, the tips of first dorsal rays reaching slightly past those of the last rays when the fin is deflexed; pectoral spines produced, their tips reaching to or past middle of ventrals, their length .7 to .9 in head; ventrals 1 to 1.2; adipose fin long, without trace of spine; caudal peduncle deep, 1.7 to 1.9 in head; last anal ray to caudal 1.5 to 1.7 in head; caudal emarginate, the outer rays produced.

Color brownish mottled with darker; base of anal and dorsal black; a faint black bar at base of caudal rays; base of first rays of anal usually with a black spot.

This species was quite abundant in the Rio Cana at Cana. Longest specimen 130 mm. This species ranges farther north than any of the other species of the family.

Family V. Pygidiidæ.

Small fishes with naked bodies, usually villiform teeth, remote nares, skull covered with skin and muscles, no adipose fin, and a rudimentary air bladder enclosed in the lateral processes of the coalescent vertebræ. The family is represented by a number of genera, but only one species is known to inhabit Panama.

15. Genus *Pygidium* Meyen.

Pygidium Meyen, Reise in Peru, I, 1835, 475 (type *Pygidium fuscum* Meyen).

Body elongate, subterete; mouth terminal or subterminal; teeth in bands in both jaws; maxillary with 2 pairs of barbels; a single pair of nasal barbels; eyes superior; dorsal over or behind ventrals; its origin over or in advance of origin of anal; without spine; no adipose fin; opercle and preopercle with small spines; body naked; gill-membranes nearly free from the isthmus or forming a free fold across it.

Small fishes inhabiting mountain streams from Central Chili to Panama and southeastern Brazil and central Argentina.

21. *Pygidium striatum* Meek & Hildebrand.

Pygidium striatum Meek & Hildebrand, Field. Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 78 (Rio Cana, Cana, Panama).

Head 4.9 to 5.75; depth 6.35 to 7.35; D. 8; A. 6.

Body elongate; head depressed; body posteriorly compressed; snout broad, its length 2.08 to 2.9 in head; eye very small, wholly superior,

without free orbital margin, about 11 to 14 in head; interorbital 3.5 to 4.2; mouth rather wide, its width nearly as great as length of snout; upper jaw projecting; the longest maxillary barbel reaching to or a little past gill-opening; teeth in the jaws in villiform bands; dorsal fin with convex margin, its origin about midway between gill-opening and tip of caudal; caudal fin with a straight or slightly convex margin; anal fin small, its origin under or behind base of last ray of anal; ventral fins inserted considerably in advance of origin of dorsal, reaching vent; pectoral fins inserted under margin of opercle, without a definite spine, 1 to 1.33 in head.

Color light olive; a dark band from upper angle of gill-opening to base of caudal. In some individuals there is anteriorly a dark band above this one and one below it. These bands in most specimens are broken up into small round spots which are not much larger than eye. The back with small black spots; in large examples these are also sometimes present on lower part of sides.

Of this species 32 specimens were obtained, ranging in length from 40 to 90 mm. These are all from a small creek at Cana in the upper Rio Tuyra Basin. This creek was very rocky, and the bottom was covered with a reddish sediment.

The species of this genus are difficult to determine and the entire genus stands in need of revision. Our fish is closely related to *P. bogatense* Eigenmann and also to *P. chapmani* Eigenmann. From both it differs in color and in the slightly more anterior position of the dorsal fin.

Order II. Plectospondyli.

THE CARP-LIKE FISHES.

Body scaly; dorsal fin single; fins without true spines. Parietals broad, distinct; the four anterior vertebræ joined together; opercular bones all present.

Family VI. Characidæ.

Body variously shaped, covered with scales which usually are cycloid; head naked; upper jaw mesially formed by the premaxillaries, laterally by the maxillaries; teeth various; dorsal fin small, without spines; adipose fin usually present. Adipose fin wanting in the genera, *Hoplias* and *Phanagornes*, which come within the scope of the present work.

KEY TO THE GENERA.

- a. Caudal fin forked; adipose fin present (except in *Phanagoniatus*).
- b. Scales cycloid.
- c. Teeth wanting. (*Curimatinae*) *Curimatus*, p. 269.
- cc. Teeth in lower jaw wanting. (*Parodontinae*) *Apareiodon*, p. 270.
- ccc. Teeth present in both jaws.
- d. Teeth in a single series in each jaw; lateral line incomplete. (*Cheirodontinae*)
- e. Adipose fin wanting; anal fin long, with more than 40 rays. *Phanagoniatus*, p. 272.
- ee. Adipose fin present; anal fin short, with fewer than 30 rays.
- f. Lower half of base of caudal in the male with a peculiar lobe of enlarged scales. *Compsura*, p. 273.
- ff. No enlarged scales on base of caudal. *Pseudocheirodon* gen. nov., p. 275.
- dd. Teeth in upper jaw in 2 series, those in lower jaw in a single series. (*Tetragonopterinae*)
- g. The thoracic region not greatly dilated or compressed.
- h. Lateral line complete
- i. Dorsal fin inserted far back, its origin nearer caudal than eye, notably behind origin of anal. *Gephyrocharax*, p. 277.
- ii. Dorsal fin inserted over or in advance of anal.
- j. Maxillary with few or no teeth; caudal spot if present not extended on middle caudal rays.
- k. Second suborbital narrow, leaving a naked triangular area below suture between the first and second suborbitals; first series of premaxillary teeth regularly placed. *Astyanax*, p. 279.
- kk. Second suborbital expanded, covering nearly the entire cheek, not leaving a naked triangle below suture between the first and second suborbitals; first series of premaxillary teeth more or less irregularly placed. *Bryconamericus*, p. 282.
- jj. Maxillary in adult with from 5 to 25 teeth; the inner caudal rays black. *Hemibrycon*, p. 285.
- hh. Lateral line incomplete; no caudal spot. *Hyphessobrycon*, p. 286.
- gg. The thoracic region greatly compressed, dilated, forming a semicircular disc. (*Gasteropelecinae*) *Thoracocharax*, p. 287.
- ddd. Premaxillary teeth in 3 series; teeth in mandible in 1 or 2 series, if with 2 series, the outer one composed of only 2 teeth on edge of jaw and directed forward.
- l. Anal fin short, with not more than 17 rays; body long, little compressed. (*Tetragonoptrinae*) *Creagrutus*, p. 289.

- ll. Anal fin long, with more than 40 rays; body strongly compressed anterior profile in adult deeply concave. (*Characinae*)
Raboides, p. 291.
- dddd. Premaxillary teeth anteriorly in 3 or 4 series, laterally in 2 or 3 series; mandible with 2 series, the inner series composed of only 2 conical teeth, placed a little behind the anterior teeth of outer series. (*Bryconinae*)
Brycon, p. 293.
- dddd. Premaxillary teeth in a single series; mandibular teeth in 2 series; lateral line wanting. (*Piabucininae*) *Piabucina*, p. 299.
- bb. Scales strongly pectinate; form slender; jaws much produced, beak-like; palatines with a few teeth. (*Hydrocyninae*)
Luciocharax, p. 302.
- aa. Caudal fin rounded; adipose fin wanting; palatines with teeth. (*Erythrininae*)
Hoplias, p. 303.

16. Genus *Curimatus* Oken.

Curimatus Oken, Isis, 1817, 1183 (type *Salmo edentulus* Bloch).

Body elongate, robust, moderately compressed, abdomen behind ventrals trenchant or not; mouth small, without lips; tongue short, thick, adnate; teeth wanting; lateral line complete; adipose fin present; ventrals inserted below dorsal.

22. *Curimatus magdalenaë* Steindachner. Savaleta.

Curimatus magdalenaë Steindachner, Denkschr. K. Ak. Wiss. Wien, XXIX, 1878, 50 (Rio Magdalena); Steindachner, l. c., XLI, 1879, 167 (Rio Mamoni, Panama); Steindachner, l. c., XLI, 1880, 67 (Rio Cauca); Eigenmann & Eigenmann, Ann. N. Y. Acad. Sci., IV, 1889, 16 (name only); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., XIV, 1891, 47; Eigenmann, Science, N. S., XXII, July 7, 1905, 19; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1906, 332; Boulenger, Boll. Mus. Univ. Torino, No. 346, 1899, 2 (Laguna della Pita, Darien); Regan, Biol. Cent. Amer., Pisces, 1908, 174; Eigenmann, Repts. Princeton Univ. Exp. Patagonia, III, Pt. IV, 1910, 421.

Head 3 to 3.9; depth 2.6 to 3.2; D. 10 or 11; A. 9 or 10; scales in lateral line 37 to 40; 5½ or 6 rows between lateral line and base of anterior dorsal rays.

Body elongate, moderately compressed; dorsal region somewhat elevated; preventral area convex; postventral area usually very slightly keeled; caudal peduncle compressed, its depth 1.85 to 2.2 in head; head rather low, its upper surface with a low median ridge, ending at a short

groove at nape; snout broad, 3.5 to 4.3 in head; eye 3.4 to 4; mouth wide; jaws weak; gill-rakers very short; lateral line straight, slightly above the middle of side; scales large, regularly placed, with a serrate membranous border, 11 or 12 on median line in advance of dorsal; dorsal fin inserted midway between tip of snout and tip of adipose or slightly nearer the latter; caudal forked, the lobes with small scales at base; anal fin with concave margin, the anterior rays reaching far beyond tips of posterior rays when deflexed; ventral fins inserted under the base of dorsal; pectoral fins a little shorter than the ventrals, 1.4 to 1.8 in head.

Color plain brassy, darker above than below; no distinct markings on body or fins.

The Panama collection contains 263 specimens, ranging in length from 75 to 200 mm. These were taken at the following localities: a. Rio Chorrera Basin, at Chorrera and a small creek near Chorrera. b. Rio Marte Arnade. c. Rio Abaco. d. Rio Juan Diaz. e. Rio Bayano Basin, at El Capitan, Chepo, and Rio Calobre. f. Rio Tuyra Basin, at mouth of Rio Yape, Rio Capete, Rio Cupe at Boca de Cupe, Rio Aruza at Aruza, Rio Cituro at Cituro, Rio Setiganti at Cana, Rio Grande near Cana. The above includes all of the river basins visited on the Pacific slope of Panama, except the Rio Chame and the Rio Grande. The latter lies almost wholly within the Canal Zone and had at the time of our visit already been much disturbed by the construction of the Canal. There is little doubt but that this fish occurred there before the digging of the Canal, as it is abundant in streams on both sides of it.

This fish was not found by us where there was much current, but it occurred most commonly in quiet pools and often in stagnant ponds. It is common in streams at the head of tide water. The highest elevation at which it was taken was at Cana in the upper Rio Tuyra Basin.

We have specimens for comparison from the Atlantic slope of Colombia. No differences are apparent, except that the Panama specimens appear to be somewhat darker in color.

Habitat: Pacific slope of Panama, Atrato and Magdalena basins and Lake Maracaibo.

17. Genus *Apareiodon* Eigenmann.

Apareiodon Eigenmann, Ann. Carnegie Mus., X, 1915 (1916), 71 (type *Parodon piraciaba* Eigenmann).

Small fishes with elongate, little compressed body; ventral surface flattish; head small; snout pointed; mouth inferior, a transverse slit; lower jaw scoop-shaped, the lip with a straight transverse margin



APAREIODON DARIENSIS (Meek & Hildebrand).
From a specimen 115 mm. in length.

opposed to the premaxillary teeth; the latter narrow at bases, broad at tips, the cusps of about equal length, forming a straight transverse cutting edge; no teeth on sides of lower jaw; gill-membranes broadly united, free from the isthmus; gill-opening short; gill-rakers very short; lateral line complete; scales moderate, 35 to 45 in lateral series, a few large scales on caudal lobes; dorsal fin inserted in advance of middle of body, partly in front of ventrals; anal very short; pectorals and ventrals similar, short and broad; adipose fin minute, over posterior rays of anal.

23. *Apareiodon dariensis* (Meek & Hildebrand).

Parodon dariensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 83 (Rio Cupe, Cituro, Darien, Panama).

Apareiodon dariensis Eigenmann, Ann. Carnegie Mus., X, 1915 (1916), 71.

Head 4.6 to 4.7; depth 4 to 4.2; D. 11; A. 9; scales 35 to 37.

Body elongate, not much compressed; dorsal profile anteriorly evenly convex; lower outline anteriorly straight, parallel with longitudinal axis of body; head not deeper than wide; snout pointed, much in advance of mouth, 2.8 to 3 in head; eye 4.2 to 4.4; mouth very small, inferior; the lower lip with a straight transverse margin in the largest specimen, the type, in the next largest it is somewhat rounded, in the smallest it is distinctly triangular and feebly 5 lobed; lower jaw entirely without teeth in the 3 specimens at hand; teeth in upper jaw in the largest specimen very narrow at base expanded at tip, with a transverse, pectinate margin; teeth of middle size specimen narrow at base, then expanded and again narrower at tip, one of the cusps much enlarged, pointed; those of the smallest specimen narrow at base, much expanded at tip with an oblique, smooth margin; lateral line complete, straight, very feebly developed, especially in our smallest specimen; scales moderate, striate, regularly placed, 10 or 11 in median series in advance of dorsal; $2\frac{1}{2}$ rows between lateral line and base of anal; 5 or 6 across caudal peduncle from one lateral line to the other; dorsal fin inserted in advance of ventrals, its origin midway between tip of snout and tip of adipose or a little nearer the latter; adipose fin small, over posterior rays of anal; caudal fin forked, with a few large scales on base of fin; anal fin very small, shorter than dorsal, its origin nearer base of caudal than base of ventrals; ventral fins very broad, with 9 rays, reaching past vent which is situated midway between base of ventrals and origin of anal; pectoral fins broad, with 14 rays, inserted under margin of opercle, reaching about $\frac{3}{4}$ of the distance from their base to origin of ventrals.

Color very dark brownish green above, pale below; sides with 2 lateral bands, partly broken into confluent black spots; dorsal, anal and both lobes of caudal each with 2 oblique, black bars; pectorals and ventrals each with more or less black mesially.

Of this species only 3 specimens, respectively 105, 120 and 135 mm. in length, were taken. All are from the Rio Cupe at Cituro, where this stream is very rocky and seining is difficult.

The variation in dentition in the specimens at hand has been noted above. From this it is evident that only the largest specimen, the type, is a typical *Apareiodon*. However, as no other differences are evident, we have identified them all as one species and we tentatively place them under the above named genus.

18. Genus *Phanagoniates* Eigenmann & Wilson.

Phanagoniates Eigenmann & Wilson, Indiana Univ. Studies, No. 19, 1914, 2 (type *Phanagoniates wilsoni* Eigenmann = *Ræboides macrolepis* Meek & Hildebrand).

Body elongate, strongly compressed; chest not trenchant; teeth in a single series in each jaw, tricuspid except in posterior part of maxillary where they are conical; anal fin very long, its origin far in advance of dorsal; origin of dorsal a little behind middle of body; pectoral fins long, over-lapping the minute ventrals; no adipose fin; lateral line incomplete.

24. *Phanagoniates macrolepis* (Meek & Hildebrand).

Ræboides macrolepis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 84 (Rio Cupe, Boca de Cupe, Rio Tuyra Basin).

Phanagoniates wilsoni Eigenmann, Indiana Univ. Studies, No. 19, 1914, (Manigru, Rio Atrato Basin).

Phanagoniates wilsoni Eigenmann, Memoir. Carnegie Mus., VII, 1916, 43, Pl. 5, fig. 1.

Head 4.6 to 5.1; depth 3.3 to 3.9; D. 8 or 9; A. 49 to 53; scales in lateral series 40 to 44.

Body elongate, much compressed, the dorsal profile gently convex, highest at origin of dorsal; head small; snout conical, 3.65 to 4.35 in head; eye 2.6 to 3; interorbital 2.9 to 3.8; mouth small; the lower jaw a little in advance of the upper; maxillary reaching anterior margin of eye; premaxillary teeth tricuspid, 12 in number; maxillary with about 8 teeth, the 3 anterior ones similar to premaxillary, the others conical; lower jaw with about 18 tricuspid teeth, a little stronger than premaxillary teeth; gill-rakers short, far apart, about 6 on lower limb of

first arch; lateral line incomplete, present on 10 to 16 scales; scales thin, striate; dorsal fin small, its origin somewhat nearer base of caudal than tip of snout; caudal fin naked, its lower lobe the longer; anal fin very long, its base greater than half the length of body; ventral fins minute, scarcely longer than eye, reaching origin of anal; pectoral fins rather long, overlapping ventrals, but not quite reaching the tips of the latter.

Color translucent, silvery; sides with a dusky band, most distinct posteriorly. Scales with chromatophores, which are also present on the fins; chin and maxillary black; no caudal spot.

The present collection contains 12 specimens of this species, ranging in length from 35 to 57 mm. These were taken at various points in the Rio Tuyra Basin. A comparatively rare species.

We have for comparison a paratype of *P. wilsoni* Eigenmann, which we find to be identical with the present species. It is noted that in the original description of *P. wilsoni* the scales in the lateral series are given as 34 or 35. However, we are able to count 42 in the paratype that is at hand.

Habitat: Rio Tuyra and Rio Atrato basins.

19. Genus *Compsura* Eigenmann.

Compsura Eigenmann, Memoir. Carnegie Mus., VII, 1916, 60 (type *Compsura heterura* Eigenmann).

Minute fishes, with few teeth; multicuspid incisors, in a single series in each jaw, 2 or 3 teeth on maxillary; second suborbital in contact with the preopercle below and partly behind; lateral line incomplete;

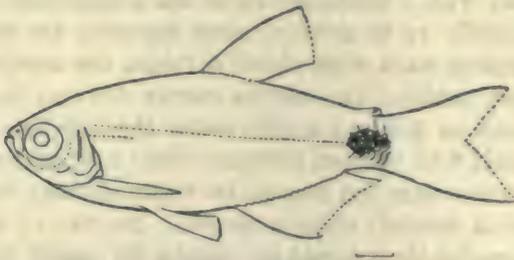


FIG. 1. DIAGRAM SHOWING THE PECULIAR SCALING AT BASE OF CAUDAL FIN OF THE MALE OF *Compsura gorgona* (Evermann & Goldsborough).

scales thin, with a few radiating striæ; the male with a peculiar lobe of enlarged scales on lower half of base of caudal; origin of dorsal about equidistant from snout and base of caudal; adipose fin well developed; interhæmal spines of caudal peduncle not projecting; a conspicuous caudal spot present.

This genus differs from *Cheirodon* in the peculiar scaling on the lower half of the base of the caudal fin of the male, and also in the non-projecting interhæmal spines of the caudal peduncle.

25. *Compsura gorgonæ* (Evermann & Goldsborough).

Cheirodon gorgonæ Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXII, 1909, 99, figs. 1 and 3 (Gorgona, Atlantic slope, Panama Canal Zone).

Cheirodon insignis Eigenmann, Memoir. Carnegie Mus., VII, 1916, 69 (in part).

Head 3.7 to 4.25; depth 2.55 to 3.3; D. 10 or 11; A. 16 to 20; scales 31 to 33.

Body rather short, compressed; profile gently convex from snout to dorsal; head small; snout short, 4.1 to 5.4 in head; eye 2.6 to 3.25; interorbital 3.1 to 3.6; mouth small; jaws subequal; maxillary reaching anterior margin of eye; premaxillary teeth usually 10 in number, each tooth with about 6 cusps, the median cusps considerably enlarged;



FIG. 2. FRONT TEETH OF *Compsura gorgonæ* (Evermann & Goldsborough).
(After Evermann & Goldsborough.)

maxillary usually with 2 teeth, similar to the premaxillary teeth; teeth in lower jaw usually 12 in number, close together, the expanded tips slightly overlapping, each with about 6 cusps, the median ones only slightly enlarged, making the margin evenly convex; lateral line incomplete, present on 5 to 13 scales; scales thin, striate, 10 to 12 in advance of dorsal; 8 to 10 rows between dorsal and adipose; dorsal fin pointed, the anterior rays the longest, its origin midway between tip of snout and base of caudal; adipose fin over last ray of anal, notably nearer base of caudal than dorsal fin; caudal fin naked, the lower lobe the longer; origin of anal under last rays of dorsal, its base considerably shorter than depth of body; ventral fins inserted a little in advance of dorsal, reaching nearly or quite to origin of anal; pectoral fins somewhat longer than ventrals, usually not quite reaching the base of the latter.

Color silvery, with a narrow plumbeous band; a very conspicuous black oval caudal spot, not extended on caudal rays. Head and body



PSEUDOCHEIRODON AFFINIS gen. et sp. nov.
From a male specimen 40 mm. in length.

with comparatively few dusky points, those above base of anal more or less regularly arranged in the form of several V's with the apex pointed backward. Fins with dusky points, those on the anal fin mostly arranged in a single series and on the anterior margin of the rays, few or none on the interradial membranes.

Of this species there are over 200 specimens in the present collection, ranging in length from 25 to 40 mm. It is found along with *Pseudocheirodon affinis*, but is apparently less numerous.

Habitat: Both slopes of Panama.

20. *Pseudocheirodon* gen. nov.

Type *Pseudocheirodon affinis* sp. nov.

Minute fishes ranging in length from 25 to 60 mm. Body elongate, compressed; the back elevated; head small; second suborbital covering nearly the entire cheek; teeth in each jaw in a single series, expanded at tips, their cutting margins transverse or slightly rounded; 2 or 3 teeth on maxillary; lateral line incomplete, present on from 5 to 20 scales; scales thin, with radiating striæ; origin of dorsal about equidistant from tip of snout and base of caudal; adipose fin well developed; base of caudal with normal scales; origin of anal under posterior rays of dorsal, anteriorly with a single row of scales at base; interhæmal spines of the caudal peduncle not projecting; air bladder large, its walls thin; a conspicuous caudal spot usually present.

This genus is closely allied to *Cheirodon* on the one hand and to *Odontostilbe* on the other hand. From the former it differs in the absence of the protruding interhæmal spines on caudal peduncle and from the latter in the incomplete lateral line. From *Compsura* it differs in having the scaling on the base of the caudal in the male normal.

26. *Pseudocheirodon affinis* sp. nov.

Cheirodon insignis (non Steindachner) Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXII, 1909, 98, fig. 2 (Tabernilla, Atlantic slope, Panama Canal Zone).

Cheirodon insignis Eigenmann, Memoir. Carnegie Mus., VII, 1916, 69 (in part).

Type No. 8941, F. M. N. H.; length 38 mm.; Rio Gatun, Monte Liria, Canal Zone.

Head 3.8 to 4.5; depth 2.2 to 2.9; D. 10 or 11; A. 21 to 24 (rarely with only 20 rays); scales 31 to 33.

Body rather short, compressed; profile straight over eyes, elevated at nape; head small; snout blunt, 4 to 4.5 in head; eye 2.6 to 3; interorbital

2.3 to 2.9; mouth small; jaws subequal; maxillary reaching anterior margin of eye; premaxillary teeth usually 10 in number, each with about 6 cusps, the middle ones slightly larger than the outer ones, making the margins round; maxillary with 2 or 3 teeth similar to those of premaxillary; teeth in lower jaw usually 12 in number, close together, the expanded tips slightly overlapping, each with about 6 cusps of nearly equal size, their margins straight, transverse; lateral line incomplete, present on from 8 to 12 scales (present on 20 scales in one specimen); scales thin, striate, 10 to 12 in advance of dorsal, 9 or 10 rows between dorsal and adipose; dorsal

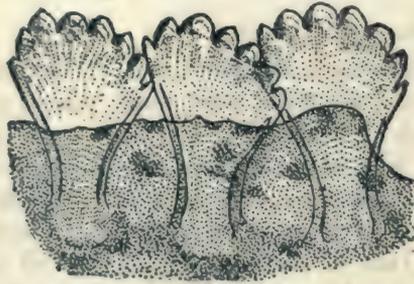


FIG. 3. FRONT TEETH OF *Pseudocheirodon affinis* gen. et sp. nov. (After *Cheirodon insignis* (non Steindachner) Evermann & Goldsborough.)

fin pointed, the anterior rays the longest, its origin midway between tip of snout and base of caudal; adipose fin over last rays of anal, notably nearer base of caudal than dorsal; caudal fin forked, the lower lobe the longer; origin of anal under last rays of dorsal, its base not quite equal to depth of body; ventral fins inserted slightly in advance of dorsal, reaching nearly or quite to origin of anal; pectoral fins somewhat longer than ventrals, usually not quite reaching base of the latter.

Color plain silvery, with a faint plumbeous lateral band; a very conspicuous, black, oval caudal spot, not extended on rays of caudal fin. Head and body, except chest and abdomen, with dusky punctulations. These largest above base of anal. Fins with dusky points, most numerous on the anal fin, occupying principally the interradi al membranes.

Numerous specimens were preserved. They range in length from 35 to 55 mm. Common but not abundant on both slopes of Panama. We have designated as the type a male specimen, 38 mm. in length, taken in the Rio Gatun, Monte Liria, Canal Zone.

Habitat: Both slopes of Panama.

21. Genus *Gephyrocharax* Eigenmann.

Gephyrocharax Eigenmann, Indiana Univ. Studies, No. 16, 1912, 23
(type *Gephyrocharax chocansis* Eigenmann).

Body elongate, compressed; premaxillary teeth in 2 series, the inner with 8 to 10 teeth; second suborbital covering the entire cheek; lateral line complete; dorsal fin inserted posteriorly, its origin nearer caudal than eye, notably behind origin of anal; adipose fin present; the lower fulcra of caudal free, forming a peculiar spur in the male; pectorals long, overlapping the ventrals.

KEY TO THE SPECIES.

- a. The outer rays of caudal fin black; no distinct shoulder spot.
atricaudata, p. 277.
- aa. The outer rays of caudal without black; a distinct shoulder spot present.
intermedius sp. nov., p. 278.

27. *Gephyrocharax atricaudata* (Meek & Hildebrand).

Deuterodon atricaudata Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., 1912, 68 (Rio Frijoles, Panama Canal Zone).

Gephyrocharax atricaudata Eigenmann, Indiana Univ. Studies, No. 20, 1914, 41 (Panama Canal Zone).

Head 3.7 to 4.5; depth 2.8 to 3.8; D. 9 or 10; A. 26 to 33; scales 37 to 43.

Body elongate, rather strongly compressed; dorsal profile anteriorly straight or slightly concave; ventral outline strongly convex; abdomen round in advance of ventrals, keeled from ventrals to vent; head compressed; snout blunt, 3.4 to 4.75 in head; eye 2.6 to 3.44; interorbital 2.4 to 3.1; mouth small, very oblique; the lower jaw a little in advance of the upper; maxillary reaching slightly past anterior margin of eye; second suborbital broad, its lower posterior angle rounded; premaxillary teeth in 2 series, the outer series consisting of 8 teeth, each with 3 to 5 cusps; the inner series with 8 broad teeth, each with 5 cusps, the middle cusp much enlarged; maxillary with 2 small teeth; lower jaw with 8 large teeth and abruptly smaller ones at sides; gill-rakers short, about 8 on lower limb of first arch; lateral line complete, curved downward anteriorly; scales striate, 20 to 23 in median series in advance of dorsal; 6 complete rows between lateral line and base of dorsal; the rows below lateral line abruptly bent downward and backward toward anal; 5 scales in vertical series between lateral line and base of anterior rays of anal; the last scales on lower lobe of caudal much enlarged in males, with a hollow space or pocket underneath, its upper edge attached to

the seventh ray of the caudal; dorsal fin with convex margin, inserted posteriorly, its origin a little nearer the base of caudal than posterior margin of opercle; adipose fin about midway between base of last ray of dorsal and base of upper ray of caudal; caudal fin forked, the lower lobe the longer, the lower fulcra free, forming a short flat spur at margin of the enlarged scale of each side; anal fin rather long, its origin in advance of dorsal, midway between anterior margin of eye and base of caudal, or somewhat nearer the latter; ventral fins reaching to or past origin of anal; pectoral fins long, inserted notably nearer tip of snout than original of anal.

Color pale green above, with a dark vertebral band; sides silvery. A faint lateral band present in young, scarcely visible in adult; an indistinct shoulder spot present. Fins reddish yellow; a black spot or bar at base of caudal, extended to tips of outer rays of both caudal lobes.

Numerous specimens of this species, ranging in length from 30 to 60 mm., were preserved. It is abundant in all streams visited on both slopes of Panama, except in the Rio Chame where it is replaced by the closely related species, *G. intermedius*.

Habitat: Both slopes of Panama.

28. *Gephyrocharax intermedius* sp. nov.

Type No. 8945, F. M. N. H.; length 58 mm.; Rio Chame, Panama.

Head 4 to 4.5; depth 3.1 to 3.55; D. 9 or 10; A. 26 to 31; scales 39 to 43.

Body elongate, rather strongly compressed; dorsal profile anteriorly straight or slightly concave; ventral outline strongly convex; abdomen round in advance of ventrals, keeled from ventrals to vent; head compressed; snout blunt, 3.7 to 5 in head; eye 2.6 to 3.4; interorbital 2.5 to 3; mouth small, strongly oblique; the lower jaw a little in advance of the upper; maxillary reaching slightly past anterior margin of eye; second suborbital broad, with its lower posterior angle rather sharp, often forming almost a right angle; teeth as in preceding species; lateral line complete, curved downward anteriorly; scales striate, 18 to 20 in median series in advance of dorsal; 5 or 6 complete rows between lateral line and base of dorsal; the rows below lateral line abruptly bent downward and backward toward the base of anal, 5 scales in vertical series between lateral line and base of anterior rays of anal; the last scale on lower lobe of caudal much enlarged in males, with a hollow space or pocket underneath, its upper edge attached to the seventh ray of caudal; dorsal fin inserted posteriorly, its origin somewhat nearer base of caudal than margin of opercle; adipose fin about midway between base of last ray

of dorsal and base of upper ray of caudal; caudal fin forked, the lower lobe the longer, its lower fulcra free, forming a flat spur at margin of the enlarged scale of each side; anal fin long, its origin in advance of dorsal, about midway between anterior margin of eye and base of caudal; ventral fins reaching nearly or quite to origin of anal; pectoral fins long, overlapping the ventrals, inserted notably nearer tip of snout than origin of anal.

Color pale green above, with a dark vertebral band; sides silvery. A faint silvery lateral band usually present; a distinct shoulder spot or bar. Fins reddish yellow; a large oval caudal spot, which does not extend either on the middle or the outer rays of the caudal.

Of this species 64 specimens, ranging from 30 to 60 mm. in length, were preserved. All are from the Rio Chame, the only place where it was seen. The type is a male, 58 mm. in length.

This species is closely related to *G. atricaudata* and *G. chocansis* Eigenmann, assuming an intermediate relationship, agreeing more nearly in color with the latter and in structure with the former. From *G. atricaudata* it is easily distinguished by the oval caudal spot which does not extend on the outer rays of the caudal, and the more prominent shoulder spot. No structural differences are evident, and it is possible that the two intergrade, but in the present large collection this is not the case. From *G. chocansis* it differs in the more numerous scales between the lateral line and base of anal (4 in *G. chocansis*, 6 in the present species), and the rows in the present species are more strongly decurrent above base of anal. The spur on lower lobe of caudal is notably shorter and broader in *G. intermedius* and the ray above the spur is flattened and expanded, while in the former it is normal.

22. Genus *Astyanax* Baird & Girard.

SARDINAS.

Astyanax Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854 26, and U. S. Mex. Bound. Survey, 1859, 74 (type *Astyanax argentatus* Baird & Girard).

Pacilurichthys Gill, Ann. Lyc. Nat. Hist. N. Y., VI, 1858, 54 (type *Pacilurichthys brevoortii* Gill).

Body more or less elongate, compressed, depth usually more than 2 in length; second suborbital narrow, leaving a naked triangular area below suture between first and second suborbitals; premaxillaries with 2 series of teeth, the first series with several teeth on each side, the second series equal or graduated, usually 10, sometimes 8 in number; lower jaw with strong teeth anteriorly, usually abruptly smaller, conical ones

on side; maxillary with a few or no teeth; gill-rakers setiform; lateral line complete; no predorsal spine; caudal naked.

KEY TO THE SPECIES.

- a. Sides with a dark, plumbeous, lateral band, darkest and most distinct posteriorly, sometimes indistinctly visible on caudal fin; no caudal spot. Reaching a length of 150 mm. *fasciatus*, p. 280.
 aa. Sides with a plumbeous, lateral band, ending in a large, well defined, oval caudal spot. Reaching a length of 110 mm.
ruberrimus, p. 281.

29. *Astyanax fasciatus* (Cuvier).

Chalceus fasciatus Cuvier, Mem. Mus. Paris, V, 1819, 352 (Brazil).

Tetragonopterus fasciatus Cuvier & Valenciennes, Hist. Nat. Poiss., XX, 1848, 149 (Rio San Francisco); Günther, Cat. Fish. Brit. Mus., V, 1864, 322 (Brazil; ? West Ecuador; ? Rio Chisay; ? Mexico; Guatemala); Vaillant, Bull. Mus. d'Hist. Nat. Paris, 1897, 221 (? Chagres).

Tetragonopterus fischeri Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1879, 166, Pl. I, figs. 1 & 2 (Rio Mamoni, Panama).

Tetragonopterus panamensis (non Günther) Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1879, 166, Pl. I, figs. 1 & 2 (Rio Mamoni, Panama).

Astyanax fasciatus Fowler, Proc. Ac. Nat. Sci. Phila., 1906, 346 (Para).

Astyanax rutilus Eigenmann & Ogle, Proc. U. S. Nat. Mus., XXXIII, 1907, 19 (Truando; West Coast of Central America).

Astyanax grandis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1912, 67 (Rio Juan Diaz, Panama).

Head 3.55 to 4.35; depth 2.35 to 2.6; D. 10 or 11; A. 25 to 27; scales 36 to 39.

Body deep, compressed; the back elevated; head small; snout conical, 3.7 to 4.4 in head; eye 2.6 to 3.6; interorbital 2.4 to 3; mouth small; jaws subequal; maxillary to or slightly past anterior margin of eye, slightly longer than snout; premaxillary teeth in 2 regular series, each with 8 teeth; maxillary with 2 small teeth near its juncture with the premaxillary; lower jaw with 8 strong teeth anteriorly and abruptly smaller ones at sides; gill-rakers short, about 12 on lower limb of first arch; lateral line complete, very slightly decurved; scales rather large, striate, 11 or 12 in advance of dorsal, 9 to 11 between dorsal and adipose, 7 or 8 longitudinal rows between anterior rays of dorsal and lateral line; dorsal fin inserted a little nearer tip of snout than base of caudal, the anterior rays longest, reaching past tips of posterior rays; adipose fin about one-third as far from base of upper caudal ray as from base of last dorsal ray; caudal fin forked, the lobes of about equal length; anal

fin rather long, its origin a little behind base of last dorsal ray, about midway between base of pectorals and base of caudal, its base much longer than head; ventral fins reaching to or slightly past vent, inserted midway between tip of snout and base of last anal ray; pectoral fins reaching nearly or quite to base of ventrals, inserted about midway between tip of lower jaw and base of ventrals.

Color silvery; back dark green, with bluish and silvery reflections; pale silvery below; no caudal spot. Sides with a plumbeous band, most distinct on caudal peduncle; a black shoulder spot present and sometimes a second indistinct spot an eye's diameter behind the first. Fins plain translucent in spirits. Dorsal and pectorals dark green in life; other fins bright red.

This species is represented in the Panama collection by 522 specimens, ranging in length from 60 to 150 mm. It occurs only in the Pacific slope streams in Panama. Apparently one of the later migrants from the Atlantic streams of Colombia.

Habitat: Western slope of Central America, Panama, Colombia, and Ecuador, and the eastern slope from Para to Napo.

30. *Astyanax ruberrimus* Eigenmann.

Tetragonopterus panamensis (non Günther) Gill, Proc. Ac. Nat. Sci. Phila., 1876, 336 (Rio Frijoles, Atlantic slope, Panama).

Astyanax fischeri (non Steindachner) Eigenmann & Ogle, Proc. U. S. Nat. Mus., 1907, 26 (Pacific slope of Panama; Rio Frijoles; Empire; Panama); Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXIII, 1910, 4 (Empire, Canal Zone).

Astyanax ruberrimus Eigenmann, Indiana Univ. Studies, No. 18, 1913, 25 (Isthina, Atlantic slope, Colombia).

Head 3.4 to 4.18; depth 2.2 to 3.15; D. 10 or 11; A. 22 to 27; scales 34 to 38.

Body short, compressed, the back elevated; head small; snout conical, 3.5 to 4.75 in head; eye 2.5 to 4.5; interorbital 2.45 to 3.15; mouth small; jaws subequal; maxillary reaching slightly past anterior margin of eye, scarcely as long as snout; premaxillary teeth in 2 regular series, each series with 8 teeth; maxillary with 2 small teeth near its juncture with the premaxillary; lower jaw with 8 large teeth anteriorly, and abruptly smaller ones at sides; gill-rakers short, about 12 on lower limb of first arch; lateral line complete, slightly decurved; scales rather large, striate, 11 or 12 in advance of dorsal, 9 to 11 between dorsal and adipose fin, 6 or 7 longitudinal rows between anterior rays of dorsal and lateral line; dorsal fin inserted midway between tip of snout and base of caudal, the anterior rays the longest, reaching past tips of posterior

rays; adipose fin about half as far from base of upper caudal ray as from base of last dorsal ray; caudal fin forked, the lower lobe the longer; anal fin rather long, its origin a little behind base of last dorsal ray, slightly nearer base of caudal than base of pectorals, its base notably longer than head; ventral fins reaching vent, inserted midway between tip of snout and base of last anal ray; pectoral fins usually reaching nearly or quite to base of ventrals, inserted midway between tip of lower jaw and base of ventrals.

Color silvery, sides with an ill-defined plumbeous band. A spot or short bar at shoulder, occasionally a second faint one an eye's diameter behind the first. Base of caudal with a well defined black oval spot, a little longer than deep, only slightly extended on base of caudal rays. Fins mostly bright red in life.

The most abundant species of all the fishes of Panama, occurring in large numbers from the lowland waters up to the highest mountain streams, on both slopes of Panama. Our collection contains numerous specimens, ranging in length from 35 to 110 mm.

The Pacific slope representatives average somewhat larger in size and their average depth is proportionately greater. The average depth in length for 38 specimens from various localities on the Pacific slope and of various sizes is 2.48. In a similar series from the Atlantic slope the average depth is 2.67.

Steindachner's name, *fischeri*, has long been used for this species, but his figures strongly indicate that he did not have this species, but *A. fasciatus*, as no caudal spot is indicated. The caudal spot is so conspicuous in the present species that it could scarcely have been overlooked. There is also nothing in Steindachner's description that indicates that it was not the latter species which he had. The only name that is then available is *A. ruberrimus* Eigenmann, of which we have that author's specimens from Colombia for comparison and find them to be identical with the Panama material.

Habitat: Both slopes of Panama and both slopes of Colombia.

23. Genus *Bryconamericus* Eigenmann.

Bryconamericus Eigenmann, Ann. Carnegie Mus., IV, 1907, 139 (type *Bryconamericus exodon* Eigenmann).

Very similar to *Astyanax*. Lateral line complete; caudal naked; second suborbital expanded, in contact with the lower limb of preopercle, and not leaving a naked triangle below suture between the first and second suborbitals. First series of premaxillary teeth more or less irregularly placed.

KEY TO THE SPECIES.

a. Scales regularly placed, in 35 to 41 oblique series from upper angle of gill-opening to base of caudal; 11 to 13 scales in advance of dorsal; 10 or 11 between dorsal and adipose; 7 complete, longitudinal rows between lateral line and base of dorsal. Color silvery, with a plumbeous lateral band. Breeding males without tubercles on head and margin of scales; fins nearly smooth.

emperor, p. 283.

aa. Scales more or less irregularly placed, in 40 to 48 oblique series from upper angle of gill-opening to base of caudal; 12 to 15 scales in advance of dorsal; 12 to 14 between dorsal and adipose; 8 complete longitudinal rows between lateral line and base of dorsal. Color dark silvery, lateral band very dark posteriorly. Breeding males with small tubercles on head and margin of scales; the fins with barbs, very rough to the touch.

cascajalensis sp. nov., p. 284.

31. *Bryconamericus emperor* (Eigenmann & Ogle).

Astyanax emperor Eigenmann & Ogle, Proc. U. S. Nat. Mus., XXXIII, 1907, 26 (Empire, Panama Canal Zone).

Bryconamericus emperor Eigenmann, Indiana Univ. Studies, No. 18, Pt. II, 1913, 11.

Head 3.05 to 4; depth 2.5 to 3; D. 10 or 11; A. 24 to 29; scales 35 to 41.

Body rather deep, compressed, the back elevated; head small; snout conical, 3.8 to 4.8 in head; eye 2.5 to 2.85; interorbital 2.75 to 3; mouth small; jaws subequal; maxillary reaching anterior margin of pupil, slightly longer than snout; premaxillary teeth in 2 series, the outer series irregular, with 10 teeth, the inner series regular with 8 to 10 teeth; maxillary with 2 small teeth near its juncture with the premaxillary; lower jaw with 8 large teeth anteriorly and abruptly smaller ones at sides; gill-rakers short, about 12 on lower limb of first arch; lateral line complete, moderately decurved; scales moderate, striate, 11 to 13 in advance of dorsal, 10 or 11 between dorsal and adipose, 7 or 8 longitudinal rows between anterior dorsal rays and lateral line; dorsal fin inserted midway between tip of snout and base of caudal; adipose fin about one-third as far from base of upper caudal ray as from base of last dorsal ray; caudal fin forked, the lower lobe the longer; anal fin rather long, its origin a little behind base of last dorsal ray, about midway between base of pectorals and base of caudal; ventral fins reaching to or slightly past vent, inserted midway between tip of snout and base of last anal ray; pectoral fins usually reaching to base of ventrals, inserted midway between tip of lower jaw and base of ventrals.

Color silvery; sides with a plumbeous lateral band, ending in a large, black, caudal spot, which is slightly longer than deep and extended only slightly on base of caudal. An ill-defined shoulder spot present.

This species is represented in the Panama collection by numerous specimens, ranging in length from 45 to 90 mm. It occurs on both slopes of Panama, and is always found in company with *Astyanax ruberrimus*, but much less abundant, except in the Rio Tuyra Basin where it outnumbers the latter.

Habitat: Both slopes of Panama.

32. *Bryconamericus cascajalensis* sp. nov.

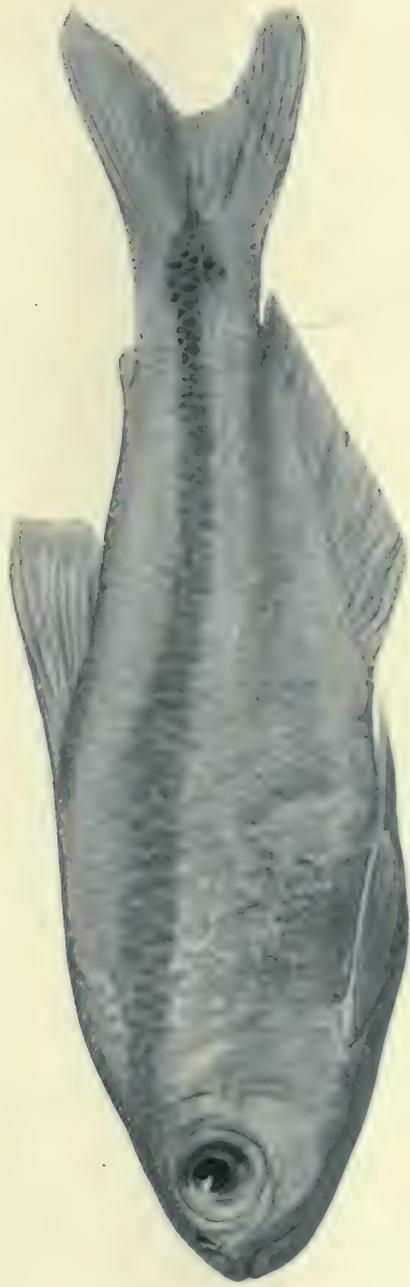
Type No. 8946, F. M. N. H.; length 92 mm.; Rio Cascajal, Porto Bello, Panama.

Head 3.8 to 4; depth 2.6 to 2.95; D. 10 or 11; A. 26 to 29; scales 40 to 48.

Body moderately elongate, compressed; the back elevated; head small; snout conical, 3.4 to 4.25 in head; eye 2.6 to 3; interorbital 2.6 to 3; mouth small; jaws subequal; maxillary reaching to or slightly past anterior margin of pupil, a little longer than snout; premaxillary teeth in 2 series, the outer series irregular, with 10 teeth, the inner series regular, with 8 teeth; maxillary with 2 small teeth near its juncture with the premaxillary; lower jaw with 8 strong teeth anteriorly and abruptly smaller ones at sides; gill-rakers short, about 12 on lower limb of first arch; lateral line complete, slightly decurved; scales rather small, feebly striate, 12 to 15 in advance of dorsal, 12 to 14 between dorsal and adipose, 8 longitudinal rows between lateral line and anterior dorsal rays; dorsal fin inserted about midway between tip of snout and base of caudal; adipose fin only a little more than half as far from base of upper caudal ray as base of last dorsal ray; caudal fin forked, the lower lobe the larger; anal fin rather long, its origin slightly behind base of last dorsal ray, a little nearer origin of pectorals than base of caudal; ventral fins reaching to or slightly past vent, inserted a little nearer tip of snout than base of last anal ray; pectoral fins reaching nearly or quite to base of ventrals, inserted a little nearer base of ventrals than tip of snout.

Color silvery; the back dark green; sides with a plumbeous band, which becomes almost black posteriorly, especially in the males. An elongate caudal spot present, somewhat extended on base of caudal rays. Breeding males with small bluish tubercles on head and margin of scales. An obscure humeral spot present. Fins in breeding males with barbs, making them rough to the touch.

Of this species the present collection contains 38 specimens, ranging in length from 60 to 95 mm. All were taken a little above tide water in



BRYCONAMERICUS CASCAJALENSIS sp. nov.
From a specimen 93 mm. in length.

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HEMIBRYCON DARIENSIS sp. nov.
From a specimen 60 mm. in length.

the Rio Cascajal, a small coastal stream, at Porto Bello, on April 24; nearly all are gravid fish.

This species differs from the preceding in the smaller scales, in the somewhat darker coloration, principally in the darker lateral band and in that the breeding male has numerous small tubercles on head and margin of scales and very rough fins.

24. Genus *Hemibrycon* Günther.

Hemibrycon Günther, Cat. Fish. Brit. Mus., V, 1864, 318 (type *Hemibrycon polyodon* Günther).

Body elongate, compressed; head short; maxillary extending nearly or quite to middle of eye; cheeks nearly entirely covered by the first and second suborbitals, leaving only a narrow naked margin behind; premaxillary teeth in 2 series, the inner series with 4+4 or 5+5 teeth; maxillary in the adult with from 5 to 25 teeth, these in part at least tricuspid, teeth along half or more of its free margin; lower jaw with from 4+4 to 6+6 strong teeth anteriorly and with gradually or abruptly smaller teeth at sides; lateral line complete; scales cycloid; caudal naked; middle caudal rays black.

Closely related to *Bryconamericus*, but with more teeth on the maxillary, at least in the adult, and with the inner caudal rays black.

33. *Hemibrycon dariensis* sp. nov.

Type No. 8947, F. M. N. H.; length 65 mm.; Rio Yape, Rio Tuyra Basin, Panama.

Head 3.45 to 4.5; depth 2.4 to 3.55; D. 9 or 10; A. 27 to 29, rarely 30; scales 8-38 to 41-6.

Body elongate, compressed; profile straight or gently convex over eyes, elevated at nape; head short; snout blunt, 4 to 5 in head; eye 2.6 to 3.25; interorbital 2.8 to 3.15; mouth moderate; jaws subequal; maxillary reaching nearly to opposite middle of eye; premaxillary teeth in 2 series, the outer series irregular, the last tooth on each side and the 2 anterior teeth placed further outward, the second series with 8 larger teeth, each tooth with 4 to 5 cusps, one of them considerably enlarged; maxillary with from 6 to 10 teeth, similar to second premaxillary series, but larger, abruptly smaller ones at sides, these about 10 in number; gill-rakers short, 10 on lower limb of first arch; lateral line complete, decurrent, the pores on anterior 3 to 6 scales usually poorly developed; scales thin, striate, 14 to 16 rows in advance of dorsal, 9 to 11 rows between dorsal and adipose, the longitudinal rows above and in advance

of anal decurrent, with several interpolated rows; origin of dorsal fin about midway between tip of snout and base of caudal; adipose fin well developed, over posterior fifth of anal, a little nearer base of caudal than base of last dorsal ray; caudal fin forked, the lobes of about equal length; anal fin rather long, its base 2.8 to 3.25 in length of body, its origin under posterior rays of dorsal, midway between posterior margin of eye and base of caudal; ventral fins scarcely reaching origin of anal, inserted an eye's diameter nearer tip of snout than base of last anal ray; pectoral fins reaching to or slightly past base of ventrals, only slightly shorter than head.

Color silvery; sides with a plumbeous lateral band, darkest posteriorly; faint humeral and opercular spots present; a black band extending from base of caudal to tips of middle caudal rays.

Of this species there are 66 specimens, ranging from 40 to 80 mm. in length, in the present collection. All were taken in the Rio Tuyra Basin. We have designated as the type a specimen, 65 mm. in length, from the mouth of the Rio Yape.

Considerable variation in the depth of the body and the number of teeth on the maxillary is apparent among our specimens, but these appear to be only individual variations.

This species differs from *H. decurrens* (Eigenmann), of which we have examined a paratype, in the fewer scales in the lateral line, in the slightly shorter and more posteriorly placed anal. In *H. decurrens* there are 44 scales in the lateral line, 31 to 33 anal rays and the origin of the anal is in front of the middle of base of dorsal. This species is also closely related to *H. guppii* (Regan) from which it apparently differs in having one more row of scales between the lateral line and base of dorsal, also one more row between base of anal and lateral line; the rows of scales in *H. guppii* above and in advance of anal are less strongly decurrent and the interpolated rows are fewer.

Habitat: Rio Tuyra Basin, Panama.

25. Genus *Hyphessobrycon* Durbin.

Hyphessobrycon Durbin, in Eigenmann, Bull. Mus. Comp. Zool., LII, 1908, 100 (type *Hemigrammus compressus* Meek).

Dermatocheir Durbin, Ann. Carnegie Mus., 1909, 55 (type *Dermatocheir catablepta* Durbin).

Body short, compressed, the back elevated; head short; premaxillary teeth in 2 series; maxillary teeth, if present, crowded on the upper anterior angle; lateral line incomplete; caudal fin naked; the lobes equal or subequal.

34. *Hyphessobrycon panamensis* Durbin.

Hyphessobrycon panamensis Durbin, in Eigenmann, Bull. Mus. Comp. Zool., LII, 1908, 101 (Rio Boqueron, Atlantic slope, Panama).

Hemigrammus minutus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1912, 67 (Agua Clara, Panama).

Head 3.43 to 3.8; depth 2.4 to 2.85; D. 11; A. 22 to 25; scales 7-32 to 36-6.

Body short, compressed; profile straight over eyes, elevated from nape to dorsal; head short; snout blunt, 3.15 to 4.8 in head; eye 2 to 2.65; interorbital 3 to 4.4; mouth rather small; jaws subequal; maxillary reaching anterior margin of pupil; premaxillary teeth in 2 series, the first series with 6 tricuspid teeth; the inner series with 10 teeth, each with 3 or 4 cusps, one of the cusps considerably enlarged; maxillary with 3 small teeth on the upper anterior angle; teeth in lower jaw in a single series, 8 large ones anteriorly, similar to the second series of premaxillary teeth but larger, and abruptly smaller ones at sides; gill-rakers short, about 10 on lower limb of first arch; lateral line present on 8 to 13 scales; scales thin, striate, 10 to 12 in advance of dorsal, 7 to 9 between dorsal and adipose, 12 longitudinal rows between base of dorsal and base of ventral; origin of dorsal midway between tip of snout and base of caudal; adipose fin well developed, over last rays of anal; caudal fin naked, the lobes of about equal length; anal fin slightly emarginate, its origin under last ray of dorsal; ventral fins reaching past origin of anal, inserted midway between tip of snout and base of last anal ray; pectoral fins reaching past base of ventrals, a little shorter than head.

Color silvery; sides with a dark line at least posteriorly; no caudal spot; one and sometimes two faint shoulder spots present. Scales and fins with dusky points; tip of anal and anterior dorsal ray sometimes black.

This species is represented by 140 specimens in the present collection, ranging in length from 30 to 50 mm. These were taken only in the lower part of the Rio Chagres Basin. Although the type is listed from the Rio Boqueron, one of the upper tributaries of the Rio Chagres, we did not get it there during several days fishing.

Habitat: Rio Chagres Basin, Panama.

26. Genus *Thoracocharax* Fowler.

Thoracocharax Fowler, Proc. Ac. Nat. Sci. Phila., 1906, 452 (type *Gasteropelecus stellatus* Kner).

Body strongly compressed, the thoracic region dilated into a semicircular disc; abdomen compressed into a sharp keel; dorsal profile anteriorly slightly convex; teeth tricuspid or conical, in 2 series on premaxillary;

maxillary with a few small teeth on its edge; mandible with a single series; lateral line incomplete, directed downward and backward; dorsal inserted far back; pectorals large; ventrals very small; adipose present.

35. *Thoracocharax maculatus* (Steindachner). Paribiba.

Gasteropelecus maculatus Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1879, 168 (Rio Mamoni, Chepo, Panama); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 338; Regan, Biol. Cent. Amer., Pisces, 1908, 173.

Head 3.35 to 4; depth 1.7 to 1.9; D. 10 or 11; A. 33 to 36; scales 30 to 35.

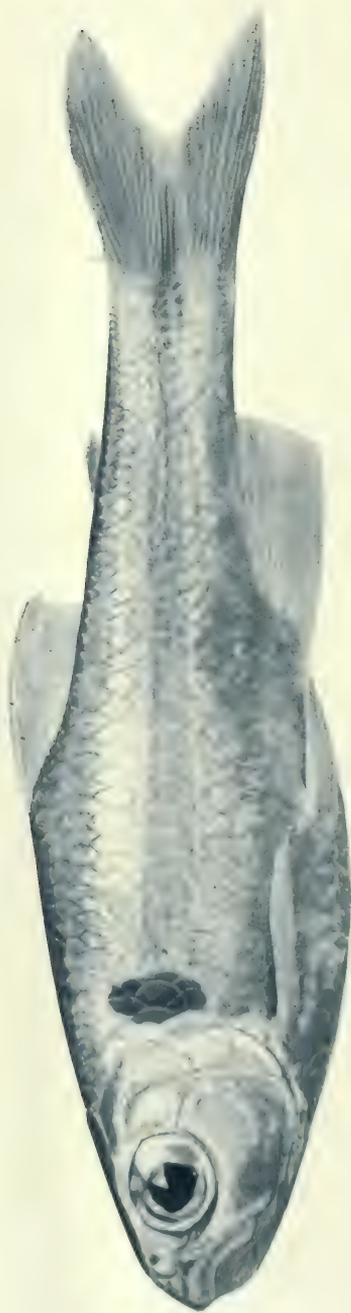
Body deep, strongly compressed; the dorsal profile straight over eyes, but slightly convex from nape to dorsal; the thoracic region much dilated, the abdomen with a sharp keel; head small, flat above; snout blunt, 3.4 to 4 in head; eye 3.1 to 4; interorbital 2.1 to 2.45; mouth small, nearly vertical; lower jaw projecting; maxillary reaching anterior margin of eye; premaxillary teeth in 2 series, the outer series consisting of only 2 conical teeth, near tip of jaw, the second series with 10 tricuspid teeth; maxillary with 4 or 5 pointed teeth on its edge; lower jaw with a single series, anteriorly with 8 tricuspid teeth and abruptly smaller ones at sides; gill-rakers poorly developed; lateral line incomplete, directed downward and backward toward about the third ray of anal, failing to reach base of anal by from 3 to 6 scales; scales large along side, reduced on abdomen and above base of anal, the rows directed downward and backward on lower part of side; dorsal fin small, its origin notably behind origin of anal, about midway between margin of preopercle and tip of caudal; adipose fin small, just behind vertical from base of last anal ray; caudal fin forked, the lobes subequal; anal fin rather long, its base equal to depth of body at origin of dorsal; ventral fins not much longer than pupil, inserted just in front of vent; pectoral fins large, reaching beyond origin of anal, 2 to 2.25 in length of body.

Color silvery, darker above; sides sometimes with a faint plumbeous band; no caudal spot. Chromatophores on scales so arranged as to form dotted vertical lines on sides; abdominal keel dusky. Fins unmarked.

Of this species there are at hand nearly 300 specimens, ranging in length from 42 to 92 mm. These were taken near Chorrera, Panama, and in the Rio Bayano and Rio Tuyra basins.

We have for comparison specimens of *T. brevis* Eigenmann, from Raspadura, Atrato Basin, Colombia. This is certainly a very closely related species, if in fact distinct. The two seem to intergrade, but *T. brevis* averages fewer scales in the lateral series and the average depth is slightly greater.

Habitat: Pacific slope of Panama.



CREAGRUTUS NOTROPOIDES Meek & Hildebrand.
From a specimen 60 mm. in length.

27. Genus *Creagrutus* Günther.

Creagrutus Günther, Cat. Fish. Brit. Mus., V, 1864, 339 (type *Leporinus mülleri* Günther).

Body elongate, not strongly compressed; abdomen rounded; head rather low; second suborbital large, covering nearly the entire cheek; premaxillary teeth in 3 series; maxillary with from 1 to 4 teeth; mandible with a single series of teeth, the anterior ones enlarged; gill-membranes free from the isthmus; lateral line complete; anal fin short, of not more than 17 rays. Species small.

KEY TO THE SPECIES.

- a. Depth of body 3.6 to 4.3; upper jaw little projecting; none of the premaxillary teeth exposed when mouth is closed; 11 or 12 gill-rakers on lower limb of first arch. *notropoides*, p. 289.
- aa. Depth of body 3.1 to 3.7; upper jaw strongly projecting; most of the first series of premaxillary teeth exposed when mouth is closed; 7 to 9 gill-rakers on lower limb of first arch. *simus*, p. 290.

36. *Creagrutus notropoides* Meek & Hildebrand.

Astyanax mexicanus (non Filippi) Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXIII, 1910, 4 (Canal Zone, Panama).

Creagrutus notropoides Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1912, 68 (Rio Indio, upper tributary of Rio Chagres).

Creagrutus affinis (in part) Eigenmann, Indiana Univ. Studies, No. 18, 1913, 7 (Rio Chagres; Puerto Negria; Istmina; Boca de Raspadura).

Head 3.6 to 3.95; depth 3.6 to 4.3; D. 10; A. 14 to 16; scales 5-34 to 38-4.

Body elongate, not strongly compressed anteriorly; caudal peduncle rather strongly compressed, its depth 2.1 to 2.5 in head; dorsal region little elevated; head low, rather wide; snout blunt 3.65 to 4.6 in head; eye 2.6 to 3; interorbital 2.8 to 3.25; mouth small; upper jaw but little in advance of the lower; maxillary-premaxillary border rather strongly curved; maxillary reaching anterior margin of pupil; premaxillary teeth all covered by the lower lip when mouth is closed, the series irregular; maxillary with 3 or 4 small teeth; lower jaw with 8 large teeth anteriorly and about 4 smaller ones at each side; teeth in the young pointed or tricuspid, very blunt or even paved in adult; gill-rakers moderate, 11 or 12 on lower limb of first arch; scales striate, 8 or 9 before dorsal, 9 or 10 between dorsal and adipose; 9 or 10 longitudinal rows between base of dorsal and base of anal; origin of dorsal over base of ventrals, midway between tip of snout and tip of adipose, or slightly nearer the latter; adipose fin well developed, just behind vertical from

base of last ray of anal; caudal fin naked, the lobes subequal; anal fin rather small, its origin a little behind last ray of dorsal, about midway between preopercular margin and base of caudal; ventral fins reaching to or slightly past origin of anal; pectoral fins reaching base of ventrals, about as long as head without snout.

Color silvery; sides with a plumbeous lateral band; a distinct shoulder spot present; caudal spot wanting; fins unmarked.

There are 148 specimens, ranging in length from 35 to 80 mm., in the present collection. All are from the Rio Chagres and its tributaries. Inhabiting upland streams where the current is swift.

We have compared our specimens with specimens of *C. affinis* Steindachner, identified by Dr. Eigenmann, from Colombia and Ecuador. We have also examined a number of the paratypes of *C. magdalenæ* Eigenmann, and find that our specimens differ from both in having 1 or 2 more rows of scales between the base of dorsal and base of anal. Our specimens are also more slender and the upper jaw projects less strongly.

Habitat: Rio Chagres Basin, Panama.

37. *Creagrutus simus* Meek & Hildebrand.

Creagrutus simus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 85 (Rio Cupe, tributary of Rio Tuyra, Cituro, Panama).

Head 3.5 to 4; depth 3.1 to 3.7; D. 10; A. 14 to 16; scales 5-34 to 36-4.

Body elongate, moderately compressed; caudal peduncle strongly compressed, its depth 2 to 2.4 in head; dorsal region little elevated; snout blunt, 3.5 to 4 in head; eye 2.45 to 3.13; interorbital 2.9 to 3; upper jaw notably projecting; maxillary-premaxillary border strongly curved; maxillary reaching slightly past anterior margin of pupil; outer series of premaxillary teeth anteriorly in advance of the lower lip, exposed when the mouth is closed; maxillary with 2 or 3 small teeth; lower jaw with 8 large teeth anteriorly and 3 to 5 smaller ones at sides; teeth in the young tricuspid or pointed, blunt in the adult; gill-rakers short, 7 to 9 on lower limb of first arch; scales striate, 9 or 10 before dorsal, 7 to 9 between dorsal and adipose, 9 or 10 longitudinal series between base of dorsal and base of anal; origin of dorsal over base of ventrals, a little nearer tip of adipose than tip of snout, adipose fin well developed, over base of last anal ray; caudal fin naked, the lobes subequal; anal fin rather small, its origin just behind last ray of dorsal, about midway between margin of opercle and base of caudal; ventral fins usually reaching origin of anal; pectoral fins usually not quite reaching base of ventrals, slightly longer than head without snout.

Color silvery; sides with a plumbeous lateral band; a distinct shoulder spot present; no caudal spot; fins unmarked.

The present collection contains over 400 specimens of this species, ranging in length from 30 to 70 mm. All are from the Rio Tuyra Basin. Inhabiting upland streams where the current is swift.

This species is evidently very closely related to *C. affinis* Steindachner, from which it, however, differs in having 1 or 2 more longitudinal rows of scales between the base of dorsal and base of anal.

Habitat: Rio Tuyra Basin, Panama.

28. Genus *Rœboides* Günther.

ANCHOVATA OR ANCHOBETA.

Rœboides Günther, Cat. Fish. Brit. Mus., V, 1864, 347 (type *Anacyrtus microlepis* Reinhardt).

Body elongate, ventral region rounded; teeth mostly pointed, in 2 or more series, present on maxillary, premaxillaries and mandible; gill-openings wide, the membranes separate, free from the isthmus; gill-rakers slender; shoulder girdle with a large spine; lateral line straight, complete; anal fin very long; adipose fin well developed.

KEY TO THE SPECIES.

- a. Scales in lateral line 82 to 89, rarely with 80 or 81; gill-rakers short, 8 or 9 on lower limb of first arch; origin of dorsal notably nearer tip of snout than base of caudal; origin of anal nearer tip of snout than base of last ray of anal; no black blotch behind the obscure spot at upper angle of gill-opening; a black longitudinal bar in lateral band under base of dorsal usually present.

guatemalensis, p. 291.

- aa. Scales in lateral line 72 to 80; gill-rakers longer, 10 to 11 on lower limb of first arch; origin of dorsal about midway between tip of snout and base of caudal; origin of anal midway between tip of snout and base of last anal ray; a large black blotch an eye's diameter behind the obscure spot at upper angle of gill-opening.

occidentalis sp. nov., p. 293.

38. *Rœboides guatemalensis* (Günther).

Anacyrtus (*Rœboides*) *guatemalensis* Günther, Cat. Fish. Brit. Mus., V, 1864, 347 (Rio Chagres; Huamuchal; Lake Nicaragua); Vaillant, Bull. Mus. d'Hist. Nat., 1897, 221 (Rio Chagres).

Cynopotamus guatemalensis Garman, Bull. Essex Inst., XII, 1890, 13 (Rio Chagres).

Ræstes guatemalensis Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., XIV, 1891, 56.

Ræboides guatemalensis Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., XIV, 1891, 57; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 338; Regan, Biol. Cent. Amer., Pisces, 1908, 174 (Rio Chagres); Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXII, 1909, 101 (Rio Boqueron; Tabernilla, Atlantic slope, Panama Canal Zone).

Head 3.75 to 4.2; depth 2.65 to 2.95; D. 11; A. 47 to 52; scales 82 to 89, rarely 80 or 81.

Body deep, strongly compressed; the dorsal region elevated; profile deeply concave over eyes in adult, less so in young; head small; snout blunt, 3.34 to 4.5 in head; eye 3.1 to 3.8; interorbital 3.4 to 4.1; mouth large; upper jaw projecting; maxillary reaching posterior margin of pupil, 1.85 to 2.25 in head; premaxillary teeth in 3 more or less irregular series; the first series composed of 4 conical teeth on outer edge pointed directly outward, horn-like; the second series with pointed teeth, the anterior ones in advance of lower lip; the third series composed of tricuspid teeth; maxillary with about 6 small teeth on its inner anterior angle and with from 5 to 8 blunt teeth on its outer margin; lower jaw with 2 series, the first series with 2 conical teeth on outer margin pointed directly forward, the second series anteriorly with 4 tricuspid teeth, then with 2 or 3 smaller conical teeth at each side, then a larger tricuspid tooth, this one followed by several minute, conical teeth; gill-rakers rather short, 8 or 9 on lower limb of first arch; shoulder girdle with a sharp spine, reaching base of pectorals; lateral line complete, straight; scales small and thin; dorsal fin elevated anteriorly, its origin a little nearer tip of adipose than tip of snout; adipose fin well developed, over the base of about the eighth anal ray counting from the last ray forward; caudal fin naked, the lower lobe the larger; anal fin very long, its origin nearer tip of snout than the base of its last ray; ventral fins reaching past origin of anal; pectoral fins overlapping the ventrals, not much longer than the latter.

Color greenish brown above, silvery below; a bright silvery lateral band in which there is often a short longitudinal black bar under base of dorsal. An obscure shoulder spot near upper angle of gill-opening usually present; a large black caudal spot; pectorals greenish yellow; other fins greenish at base, becoming red at tips.

Of this species there are numerous specimens in the present collection, ranging in length from 40 to 150 mm. It is one of the most common fishes in the streams of the Atlantic slope of Panama, occurring everywhere from brackish water upward to the mountain streams.



ROEBOIDES GUATEMALENSIS (Günther).
From a specimen 130 mm. in length.

2924

It is eaten by the natives who fry it crisp in oil. Prepared in this way the bones and flesh are eaten together, making a very palatable dish.

Habitat: Atlantic slope of Panama northward to Guatemala.

39. *Rœboides occidentalis* sp. nov.

Type No. 8948, F. M. N. H.; length 115 mm.; Rio Cardenas, Corozal, Panama.

Head 3.35 to 4.1; depth 2.35 to 2.9; D. 11; A. 44 to 50; scales 72 to 80.

Body deep, strongly compressed; the dorsal region elevated; profile deeply concave over eyes in adult, less so in young; head small; snout blunt, 3.5 to 4 in head; eye 3 to 3.9; interorbital 3.45 to 3.9; mouth large; upper jaw projecting; maxillary reaching posterior margin of pupil, 1.7 to 2.2 in head; teeth as in preceding species; gill-rakers moderate, 10 or 11 on lower limb of first arch; shoulder girdle with a long, sharp spine reaching base of pectoral; lateral line straight, complete; scales small and thin; dorsal fin elevated anteriorly, its origin about midway between tip of snout and base of caudal or slightly nearer the former; adipose fin well developed, over about the seventh ray of anal counting from the last ray forward; caudal fin naked, the lower lobe the larger; anal fin very long, its origin about midway between tip of snout and base of its last ray; ventral fins reaching past origin of anal; pectoral fins overlapping the ventrals, a little longer than the latter.

Color greenish above, silvery below; with bright silvery lateral band; an obscure shoulder spot at upper angle of opercle; a larger and more distinct black spot about an eye's diameter behind the first; a black caudal spot present. Pectorals greenish; other fins greenish at base, reddish at tips.

We have numerous specimens, ranging in length from 30 to 170 mm. It is common in all the Pacific slope streams of Panama, from the head of tide water up to the mountain streams.

This species like the preceding is used as food.

Habitat: Pacific slope of Panama and probably southward to Colombia and Ecuador.

29. Genus *Brycon* Müller & Troschel.

PIPON; SARDINA.

Brycon Müller & Troschel, Horæ Ichthyologiæ, I, 1845, 15 (type *Brycon falcatus* Müller & Troschel).

Chalcinopsis Kner, Sitzungsbr. K. Bayer. Ak. Wiss. München., 1863, 226 (type *Chalcinopsis striatulus* Kner).

Body elongate, robust anteriorly, compressed posteriorly, covered with cycloid scales; dorsal fin over or slightly behind ventrals; mouth

large, premaxillary with 3 or 4 series of teeth, each tooth with from 3 to 5 cusps; teeth in lower jaw in 2 series, the first composed of large tricuspid teeth, the second series with 2 canine teeth situated behind anterior teeth in first series; maxillary with small tricuspid teeth; nostrils close together; gill-openings wide, the membranes slightly united, free from the isthmus; gill-rakers slender; fontanel present.

The species of this genus range from Guatemala, south. Four species are found in the region of the Canal Zone.

KEY TO THE SPECIES.

- a. Scales small, 64 to 80 in lateral series; anal fin long, its base much longer than head, with 32 to 37 rays.
- b. Teeth in lower jaw very large and strong, usually 8, rarely only 7 and occasionally 9, in outer series; teeth on outer edge of maxillary very small, 9 to 10 in number; 18 to 21 vertical rows of scales crossing back between dorsal and adipose.
 - striatulus*, p. 294.
- bb. Teeth in lower jaw notably smaller, 13 to 14 in outer series; teeth on outer edge of maxillary moderately developed, 12 to 13 in number; 21 to 25 vertical rows of scales crossing back between dorsal and adipose.
 - chagrensis*, p. 295.
- aa. Scales larger, 43 to 58 in lateral series; anal fin short, its base about equal to length of head, with 24 to 30 rays.
- c. Scales moderate, 53 to 58 in lateral series, 16 to 18 vertical rows crossing back between dorsal and adipose; upper jaw strongly projecting, exposing two series of premaxillary teeth anteriorly.
 - petrosus*, p. 297.
- cc. Scales large, 43 to 48 in lateral series, 12 to 14 vertical rows crossing back between dorsal and adipose; upper jaw only slightly in advance of the lower, the second series of premaxillary teeth well covered by lower lip.
 - argenteus*, p. 298.

40. Brycon striatulus (Kner).

Chalcinopsis striatulus Kner, Sitzungsab. K. Bayer. Ak. Wiss. München, 1863, 226 (Panama); Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München, 1866, 38, Pl. V, fig. 2 (New Granada and Panama on the Pacific slope); Günther, Cat. Fish. Brit. Mus., V, 1864, 337.

Brycon striatulus (in part) Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 337.

Head 3.6 to 4.45; depth 3.05 to 3.6; D. 11; A. 32 to 35; scales in lateral series 64 to 73.

Body elongate, compressed; profile slightly concave over eyes, slightly rounded in region of dorsal; head rather small; snout pointed, 3.5 to 4.3 in head; eye 3 to 4.6; interorbital 2.35 to 3.5; mouth moderate; upper jaw strongly projecting; maxillary scarcely reaching middle of eye, 2.05 to 2.3 in head; premaxillary teeth laterally in only 2 series, anteriorly in 4 series, the third series consisting of only 2 teeth; the fourth or transverse series situated just in front of the teeth in lower jaw, composed of 3 or 4 teeth; the series on outer edge of maxillary very small, only 9 or 10 in number; those in lower jaw very large and strong, usually 8, rarely 7 and occasionally 9 in first series; gill-rakers rather small, about 15 on lower limb of first arch; lateral line complete, curved downward; scales moderate, regularly placed, 18 to 21 vertical rows crossing back between dorsal and adipose, 4 or 5 longitudinal rows between lateral line and base of pectoral; dorsal fin inserted slightly nearer base of caudal than tip of snout; caudal fin forked, the lower lobe the longer; anal fin long, its base much longer than head, inserted slightly behind base of last ray of dorsal; ventral fins inserted midway between base of pectoral and origin of anal or slightly nearer the latter; pectoral fins inserted under margin of opercle, usually reaching nearly to base of ventrals.

Color steel blue above, silvery below; a black bar on shoulder behind margin of opercle; sides otherwise perfectly plain in our largest specimens. The smaller ones with indistinct blackish vertical bars and a large caudal spot. Young of 100 mm. and less in length with a dark lateral band. Fins unmarked at all ages.

This species is represented by 62 specimens, ranging from 45 to 365 mm. in length. It was taken in the Rio Chorrera at Chorrera, Rio Juan Diaz, a small stream near Panama, and in the Rio Bayano and Rio Tuyra basins.

Habitat: Pacific slope of Panama.

41. *Brycon chagrensis* (Kner).

Chalcinopsis chagrensis Kner, Sitzungsber. K. Bayer. Ak. Wiss. München., 1863, 223; Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München., 1864, 42, Pl. V, fig. 3 (Rio Chagres); Günther, Cat. Fish. Brit. Mus., V, 1864, 338; Vaillant, Bull. Mus. d'Hist. Nat., 1897, 22 (Rio Chagres).

Brycon striatulus (in part) Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 337; Eigenmann & Ogle, Proc. U. S. Nat. Mus., XXXIII, 1907, 30 (Aspinwal, now Colon); Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXIII, 1910, 4 (Panama Canal Zone).

Head 3.6 to 4.9; depth 3 to 3.65; D. 11; A. 32 to 37; scales in lateral series 70 to 80.

Body elongate, compressed; profile straight or slightly concave over eyes, slightly rounded in region of dorsal; head rather small; snout pointed, 3.2 to 4 in head; eye 2.6 to 4.6; interorbital 2.18 to 3.6; mouth moderate; upper jaw strongly projecting; maxillary usually not quite reaching middle of eye, 2 to 2.35 in head; premaxillary teeth laterally in only 2 series, anteriorly in 4 series, the fourth or transverse series situated just in front of teeth in lower jaw, composed of 3 or 4 teeth; the series on outer edge of maxillary moderately developed, 12 or 13 in number; teeth in lower jaw moderate, notably smaller than in *B. striatulus*, 13 or 14, rarely only 12, in first series; gill-rakers rather small, about 15 on lower limb of first arch; lateral line complete, curved downward; scales rather small, more or less irregularly placed, 21 to 25 vertical rows between dorsal and adipose, 4 or 5 longitudinal rows between lateral line and base of pectoral; dorsal fin inserted midway between tip of snout and base of caudal, or slightly nearer the latter; caudal fin forked, the lower lobe the larger; anal fin inserted behind base of last ray of dorsal, its base notably longer than head; ventral fins inserted a little nearer origin of anal than base of pectorals; pectoral fins inserted under margin of opercle failing to reach base of ventrals by 3 or 4 rows of scales in large examples, sometimes reaching ventrals in the smaller ones.

Color steel blue above, silvery below; a black bar on shoulder behind margin of opercle; sides with ill defined blackish bars, these not evident in specimens less than 110 mm. in length. The young with a dark lateral band. A caudal spot present, or rarely wanting in large specimens. Fins unmarked.

This species is represented by many specimens, ranging from 25 to 500 mm. in length. It is very common in all streams in the Rio Chagres Basin, ranging from the lowland waters to the highest mountain streams. It is the most important fresh water food fish of Panama. Its flesh is penetrated by numerous small bones, but it is of good flavor and much prized by the natives. It is much more abundant than its Pacific slope relative, *B. striatulus*.

This species differs from *B. striatulus* principally in the dentition. The scales are also a little smaller. The average in a lateral series for the present species in 9 specimens is 74+, while in the preceding species for the same number of specimens the average is 68+. In the present species from 12 to 15 vertical rows of scales cross the back, between the dorsal and adipose, while in the foregoing there are 18 to 21 rows. The color in the present species



BRYCON PETROSUS Meek & Hildebrand.
From a specimen 140 mm. in length.

is somewhat darker and the blackish bars on sides are usually more distinct.

An examination of specimens from Guatemala shows these to represent a distinct species and should be known as *Brycon guatemalensis* Regan. The teeth are like those of *B. striatulus*, but the scales are larger (53 or 54 in a lateral series).

Habitat: Atlantic slope of Panama.

42. *Brycon petrosus* Meek & Hildebrand.

Brycon petrosus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 184 (Upper Chagres, Panama).

Head 3.3 to 4.1; depth 3.15 to 3.9; D. 11, rarely 10; A. 24 to 30; scales in lateral series 53 to 58.

Body elongate, compressed, profile straight over eyes, somewhat elevated at nape; head moderate; snout pointed, 3.44 to 4 in head; eye 2.83 to 4.23; interorbital 2.15 to 4; mouth moderate; upper jaw strongly projecting; maxillary reaching slightly past anterior margin of pupil, 2.1 to 2.66 in head; premaxillary teeth laterally in only 2 series, the second series exposed at least anteriorly, not covered by lower lip; the last or transverse series rather close in front of teeth in lower jaw; the outer series of premaxillary teeth usually 14, rarely 16, in number; outer series in lower jaw with 8 strong teeth of about equal size and 2 or 3 smaller ones behind laterally; gill-rakers about 12 to 14 on lower limb of first arch; lateral line decurved, notably below median line of side; scales moderate, regularly placed, 16 to 18 vertical rows crossing back between dorsal and adipose; 3 complete rows between lateral line and base of pectoral; dorsal fin inserted a little nearer base of caudal than tip of snout; adipose fin half as far from base of upper caudal ray as from base of last dorsal ray; caudal fin forked, the lower lobe the longer; anal fin rather short, its base slightly longer than head, its origin a little behind base of last dorsal ray, slightly nearer base of caudal than base of pectoral; ventral fins usually reaching vent, inserted nearer origin of anal than base of pectoral; pectoral fins inserted under margin of opercle, usually failing to reach base of ventrals by 2 to 4 rows of scales.

Color silvery, bluish above, lighter below; sides plain silvery; an obscure shoulder spot present in the smaller specimens, wanting in all of our larger individuals; very young with a dark lateral band. A large black caudal spot present at all ages.

This species is represented by numerous specimens, ranging from 50 to 285 mm. in length. It is less abundant than *B. chagrensis* and does not grow as large. It was not found in the lowland waters but it is

common in the upper courses of rocky streams in the Rio Chagres Basin. From *B. argenteus* of the Pacific slope, its nearest relative, it differs mainly in the smaller scales.

Habitat: Atlantic slope of Panama.

43. *Brycon argenteus* Meek & Hildebrand.

Brycon argenteus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 84 (Rio Aruza, Darien).

Head 3.5 to 4.45; depth 2.96 to 3.84; D. 11, rarely 10; A. 24 to 28; scales in lateral series 43 to 48.

Body elongate, compressed, profile straight over eyes, somewhat elevated at nape; head small; snout pointed, 3.46 to 4.2 in head; eye 2.86 to 4.25; interorbital 2.4 to 3.5; mouth moderate; upper jaw a little in advance of the lower; maxillary reaching to or slightly past anterior margin of pupil, 2.1 to 2.44 in head; premaxillary teeth laterally in only 2 series, the second series well covered by the lower lip; the last or transverse series situated close in front of the teeth in lower jaw, touching them when mouth is closed; the outer series of premaxillary teeth 14 in number; first series in lower jaw with 8 strong teeth of about equal size and 2 or 3 smaller ones behind laterally; gill-rakers rather small, 12 to 14 on lower limb of first arch; lateral line decurved, below median line of side; scales large, regularly placed, 12 to 14 vertical series crossing back between dorsal and adipose; 2 longitudinal rows between lateral line and base of pectoral; dorsal fin inserted a little nearer base of caudal than tip of snout; adipose fin only half as far from base of upper caudal ray as base of last dorsal ray; caudal fin forked, the lower lobe the larger; anal fin short, its base about as long as head, its origin below or slightly behind base of last dorsal ray, a little nearer base of caudal than base of pectorals; ventral fins usually not quite reaching vent, inserted a little nearer origin of anal than base of pectorals; pectoral fins inserted under margin of opercle, sometimes reaching base of ventrals, but often failing to reach them by 2 or 3 rows of scales.

Color silvery, bluish above, pale silvery below; sides plain in large specimens, the smaller ones often with indistinct dark reticulations; very young with a dark lateral band. A large black caudal spot present; no opercular spot; a blackish spot or bar at shoulder, this indistinct in some of the larger specimens.

The present collection contains 340 specimens, ranging in length from 30 to 230 mm. This species was taken in the Rio Chorrera and in the Rio Bayano and Rio Tuyra basins. It is common in the upper courses of rocky streams, reaching a smaller size than *B. striatulus* and of less value as food.



BRYCON ARGENTEUS Meek & Hildebrand.
From a specimen 142 mm. in length.

2378

Closely related to *B. oligolepis* Regan (Ann. & Mag. Nat. Hist., Ser. 8, IX, 1913, 462). We have not seen the type of the latter, but have for comparison specimens from the type locality (Rio Condoto), identified by Dr. Eigenmann. The differences noted are: a. The more strongly projecting upper jaw of the latter, exposing 2 series of premaxillary teeth, while in the former the upper jaw projects but little and the second series of teeth is well covered by the lower lip. b. The last series of premaxillary teeth is situated well in front of the teeth in lower jaw, leaving a space between them when the mouth is closed. In *B. argenteus* the last series of premaxillary teeth are close in front of the teeth in lower jaw, touching the latter when the mouth is closed.

Habitat: Pacific slope of Panama.

30. Genus *Piabucina* Cuvier & Valenciennes.

Piabucina Cuvier & Valenciennes, Hist. Nat. Poiss., XXII, 1849, 161
(type *Piabucina erythrinoides* Cuvier & Valenciennes).

Body oblong, covered with large scales; ventral region rounded; mouth moderate; teeth in upper jaw in one series, tricuspid, those of lower jaw in two series; maxillary with few teeth; nostrils close together; gill-openings wide, the membranes not attached to the isthmus; lateral line wanting; dorsal and anal fins short; dorsal fin inserted behind ventrals.

Neither of the two species listed below grows large. Our largest specimens are only a little over 200 mm. in length.

KEY TO THE SPECIES.

- a. A dark lateral band extending from above posterior angle of opercle to base of caudal and situated on median line of side, this band broad at shoulder, becoming narrower, posteriorly often broken up into blotches, ending in a large caudal spot; body slender, the depth 4 to 4.6 in length; depth of caudal peduncle 2.16 to 2.7 in head; maxillary reaching middle of eye; origin of dorsal midway between margin of preopercle and tip of adipose. *panamensis*, p. 300.
- aa. A dark lateral band extending from posterior angle of opercle to base of caudal, situated notably below median line of side, anteriorly very obscure and not connected with the shoulder spot, becoming more distinct above ventrals, not broken up into spots posteriorly; no caudal spot; body rather robust, the depth 3.6 to 3.95 in length; depth of caudal peduncle 1.75 to 2 in head; maxillary reaching slightly past anterior margin of eye; origin of dorsal midway between tip of adipose and margin of opercle. *festæ*, p. 301.

44. *Piabucina panamensis* Gill.

Piabucina panamensis Gill, Proc. Ac. Nat. Sci. Phila., 1876, 336 (Rio Frijoles, Panama); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., XIV, 1891, 52; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 332; Regan, Biol. Cent. Amer., Pisces, 1907, 167 (Rio Tripoli, misprint for Rio Frijoles); Eigenmann, Repts. Princeton Univ. Exp. Patagonia, III, Pt. IV, 1910, 439; Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXIII, 1910, 3 (Gatun, Panama Canal Zone).

Head 3.5 to 4.2; depth 4 to 4.6; D. 8 or 9; A. 10 or 11; scales 28 or 30.

Body elongate, little compressed, dorsal and ventral outlines about evenly convex, the dorsal region not elevated; caudal peduncle compressed, its depth 2.16 to 2.7 in head; head low, not much deeper than wide at margin of preopercle; snout conical, 3.7 to 4.5 in head; eye 3.4 to 5.8; mouth moderate, lower jaw projecting; maxillary reaching about middle of eye; teeth tricuspid, in a single series in upper jaw, 2 series in lower jaw, the outer the larger and about 30 in number; gill-rakers short; scales large, regularly placed, 12 in median line in advance of dorsal; dorsal fin inserted about midway between margin of preopercle and tip of adipose; adipose fin well developed in all specimens at hand; caudal fin covered with small scales at base, its margin convex; anal fin with a sheath of scales at base, its margin convex; ventral fins inserted in advance of dorsal; pectoral fins a little longer than ventrals, failing to reach base of ventrals by 4 or 5 rows of scales, 1.45 to 1.6 in head.

Color brownish above, lighter below; a dark lateral band extending from above posterior angle of opercle to base of caudal, situated on median line of side. This band is broad at shoulder, gradually becoming narrower along side; posteriorly it is often broken up into spots. Dorsal fin with an obscure dark spot at base, fins otherwise unmarked. When swimming in the water, a large golden spot appears on the back, involving the base of the dorsal fin. This area becomes slightly darker than remainder of back in preserved specimens.

This species is represented in the present collection by 148 specimens, ranging from 60 to 205 mm. in length. It was taken at the following localities: a. On the Atlantic slope at Toro Point, Agua Clara, Rio Indio on Upper Chagres, Gorgona, Empire, Culebra and Porto Bello. b. Pacific slope at Corozal, Araján, Culebra, Rio Calobre, tributary of the Bayano, and Cerro Azul.

This fish is usually found in the upper courses of streams on rocky bottom where it is difficult to catch with a seine. However, it takes the hook readily when baited with fresh meat. Its distribution appears

to be limited to the vicinity of the Canal Zone. In the Rio Tuyra Basin it is replaced by *P. festæ*.

Habitat: Both slopes of Panama, except in the Rio Tuyra Basin.

45. *Piabucina festæ* Boulenger.

Piabucina festæ Boulenger, Boll. Mus. Torino, No. 346, XIV, 1899, 1 (Laguna della Pita, Darien, Panama); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1900, 3145; Regan, Biol. Cent. Amer., Pisces, 1907, 168; Eigenmann, Repts. Princeton Univ. Exp. Patagonia, III, Pt. IV, 1910, 439.

Head 3.7 to 4.25; depth 3.6 to 3.95; D. 8 or 9; A. 10 or 11; scales 27 or 28.

Body elongate, rather robust, the ventral outline a little more strongly convex than the dorsal, the dorsal region not elevated; caudal peduncle rather deep, compressed, its depth 1.75 to 2 in head; head low, a little deeper than wide at margin of preopercle; snout conical, 4 to 4.5 in head; eye 3.5 to 5; mouth rather small; lower jaw projecting; maxillary reaching a little past anterior margin of eye; teeth in upper jaw mostly tricuspid, in a single series, two series in lower jaw, the outer teeth the larger and about 20 in number, some of them with 3 cusps and some with 5; gill-rakers short and slender; scales large, regularly placed, 11 or 12 on median line in advance of dorsal; dorsal fin inserted about midway between margin of opercle and tip of adipose; adipose fin present in all Panama specimens, often poorly developed; caudal fin covered with small scales at base, its margin rather deeply concave, the lobes round and of equal length; anal fin with a sheath of scales at base, its margin convex; ventral fins inserted in advance of dorsal; pectoral fins somewhat longer than ventrals, failing to reach the base of the latter by 4 or 5 rows of scales, 1.25 to 1.4 in head.

Color brownish above, lighter below; sides with a dark lateral band, extending from posterior angle of opercle to base of caudal, situated below median line of side. Anteriorly it is very obscure, becoming broader and more distinct on middle of side, not broken up into spots and not ending in a caudal spot; a shoulder spot present but not connected with lateral band; fins unmarked. When swimming in the water there appears a bright golden streak in front of the dorsal. This area is unmarked in preserved specimens.

Of this species 54 specimens, ranging in length from 60 to 160 mm., were preserved and form the basis for the above description. It was found only in the Rio Tuyra Basin where it was secured in both ponds and streams. It does not confine itself as closely to rocky streams as the preceding species.

Habitat: Rio Tuyra Basin and southward to Colombia.

31. Genus *Luciocharax* Steindachner.

Ctenolucius Gill, Proc. Ac. Nat. Sci. Phila., 1861, 8 (no type designated).

Luciocharax Steindachner, Denkschr. K. Ak. Wiss. Wien, XXXIX, 1878, 67 (type *Luciocharax insculptus* Steindachner).

Belonocharax Fowler, Proc. Ac. Nat. Sci. Phila., 1906, 464 (type *Belonocharax beani* Fowler).

Body long, not much compressed; ventral surface rounded; jaws much produced; teeth present on both jaws and maxillary, in a single series, directed backward, a small patch present on roof of mouth near tip of upper jaw; lateral line incomplete; scales large, pectinate; dorsal and anal inserted far backward.

46. *Luciocharax beani* (Fowler).

Belonocharax beani Fowler, Proc. Ac. Nat. Sci. Phila., 1906, 464 (Rio Truando, tributary of the Rio Atrato).

Ctenolucius hujeta (non Valenciennes) Bean, Proc. U. S. Nat. Mus., XXXIII, 1908, 701 (Rio Truando).

Luciocharax striatus Boulenger, Ann. & Mag. Nat. Hist., Ser. 8, VII, 1911, 212 (Boca de Calima, Choco).

Head 2.5 to 3.25; depth 5.9 to 9.1; D. 10; A. 10 or 11; scales 47 to 50.

Body long, not much compressed; the back not elevated; head long, flat above; snout long, slender, beak-like, 2 to 2.5 in head; eye 7.7 to 10; interorbital 4.85 to 7.7; mouth large, slightly oblique; upper jaw projecting, ending in a fleshy point; lower lip developed into a flap on each side; maxillary slipping under suborbital, reaching opposite posterior margin of eye; teeth in the jaws sharply pointed, more or less lance-shaped, in a single series, all directed backward; the anterior ones in upper jaw somewhat enlarged and in advance of lower jaw; teeth in sides of jaws and maxillary small and very numerous; roof of mouth near tip of upper jaw with a small patch of conic teeth; gill-rakers poorly developed, 7 more or less developed on lower limb of first arch; lateral line present on 22 to 32 scales (in one specimen on only 16 scales); scales strongly striate and ctenoid, with pores; dorsal fin small, its origin half as far from base of caudal as from margin of preopercle; adipose fin well developed, a little nearer base of upper caudal rays than base of last dorsal ray; caudal fin forked, the lower lobe the larger; anal fin small, its origin under posterior rays of dorsal; ventral fins short, inserted midway between base of pectorals and origin of anal; pectoral fins equal to or slightly shorter than postorbital part of head, inserted midway between tip of lower jaw and base of ventrals.

Color steel blue above, silvery-white below; sides with alternating dark and pale stripes. The pale stripes occupy the middle of each row of scales and the black ones are between the rows, occupying a portion of 2 rows of scales. Base of caudal with a jet black spot, preceded by a pale area. Fins unmarked, the dorsal caudal and anal a little darker than the others.

There are over 100 specimens of this species in the present collection, ranging in length from 70 to 325 mm. It was taken in the Rio Tuyra, and Rio Mamoni basins and in the Rio Marte Arnade and Rio Juan Diaz.

We have for comparison specimens from the Rio Atrato Basin with which our specimens seem to agree perfectly.

Habitat: Pacific slope of Panama and both slopes of Colombia.

32. Genus *Hoplias* Gill.

Hoplias Gill, Proc. U. S. Nat. Mus., XXVI, 1903, 1015 (type *Esox malabaricus* Bloch).

Macrodon Müller & Troschel, Horæ Ichth., 1842, 6 (type *Esox malabaricus* Bloch). (Preoccupied.)

Body elongate, terete, slightly compressed; mouth large, with conical teeth, some canine-like; palatines with teeth; maxillary for most part slipping under suborbital; no occipital process; no fontanel; air bladder present; no adipose fin; dorsal and anal fins short.

KEY TO THE SPECIES.

- a. Scales in lateral line 42 to 44; 11 rows across caudal peduncle from one lateral line to the other; 5 complete rows between lateral line and base of anal. *microlepis*, p. 303.
- aa. Scales in lateral line 39 to 41; 9 rows across caudal peduncle from one lateral line to the other; 4 complete rows between lateral line and base of anal. *malabaricus*, p. 305.

47. *Hoplias microlepis* (Günther). Perro Pesca or Pejeperro.

Macrodon microlepis Günther, Cat. Fish. Brit. Mus., V. 1864, 282 (Rio Chagres; Western Ecuador); Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd Ser., 2, 1889, 102 (Obispo; Rio Chagres); Eigenmann, Ann. N. Y. Acad. Sci., 1889, 102; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 330; Boulenger, Boll. Mus. Torino, No. 329, XIII, 1898, 1 (Rio Daule and Rio Vincés, Ecuador).

Macrodon trahira var. *microlepis* Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1880, 101 (Guayaquil).

Hoplias microlepis Starks, Proc. U. S. Nat. Mus., XXX, 1906, 772 (Guayaquil); Regan, Biol. Cent. Amer., Pisces, 1907, 167 (Rio Chagres; western Ecuador); Eigenmann, Repts. Princeton Univ. Exp. Patagonia, III, Pt. IV, 1910, 447.

Head 2.85 to 3.4; depth 4 to 5; D. 14, rarely 13; A. 10, rarely 11; scales in lateral line 42 to 44.

Body elongate, not much compressed, dorsal region not elevated; head long and low, slightly convex above; interorbital 3.2 to 5 in head; snout 3.45 to 4.6; eye 4.75 to 8.25; mouth large, lower jaw projecting; maxillary reaching beyond posterior margin of eye, mostly slipping under suborbital; teeth present on both jaws, and on palatines, the latter all small; some of the anterior teeth in jaws much enlarged, somewhat flattened, with very sharp cutting edges; gill-rakers poorly developed, 5 below angle on anterior arch; lateral line complete, straight, situated on median line of side; scales moderate, regularly placed, cycloid, 15 to 18 on median line in advance of dorsal; 11, rarely 10, rows of scales across caudal peduncle from one lateral line to the other; 5 complete rows between the lateral line and anal fin; dorsal fin inserted midway between tip of upper jaw and base of caudal, or slightly nearer the former; adipose wanting; caudal fin convex; anal fin inserted posteriorly, the longest ray reaching nearly to base of lower caudal ray; ventral fins inserted under base of pectorals, slightly nearer base of caudal than tip of lower jaw; pectoral fins inserted slightly behind margin of preopercle, failing to reach base of ventrals by 4 or 5 rows of scales.

Color of large specimens very dark brown above, lighter below, uniform, without band or blotches; young much paler, mottled with brown and with a more or less distinct dark lateral band. The dark mottlings of the young later appear to become concentrated into dark blotches along the side. The dark lateral band is much more persistent in some specimens than in others. Fins all with dark spots forming more or less distinct wavy bars.

There are 175 specimens, ranging from 27 to 460 mm. in length, in the present collection. It was found in all streams visited on both slopes of Panama, except in the Rio Tuyra Basin where it is replaced by *H. malabaricus*. A very abundant fish in lowland streams, usually preferring shallow water where there is an abundance of vegetation. It is called, "Perro Pesca" = dog fish, by the natives because of its large sharp teeth and its habit of snapping at objects coming near it. Care must be exercised in picking specimens from the net, as it is able to inflict painful wounds with its sharp teeth and powerful jaws. This fish, although used to some extent as food, is not regarded as of good flavor and is of minor importance.

We have for comparison specimens from western Ecuador, which seem to be identical with the Panama specimens.

Habitat: Both slopes of Panama, except in the Rio Tuyra Basin, and the western slope of Ecuador.

48. *Hoplias malabaricus* (Bloch).

Esox malabaricus Bloch, Naturgesch. der Ausland. Fische, Pt. 8, 1794, 149, Pl. 392 (Tranquebar, locality wrongly given).

Synodus malabaricus Bloch & Schneider, Syst. Ichth., 1801, 397.

Synodus tareira Bloch & Schneider, Syst. Ichth., 1801, 398, Pl. 79.

Macrodon tareira Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 1846, 508 (Bahia; San Francisco; Amazon; Maracaibo).

Erythrinus trahira Agassiz, Spix, Piscium Brasil., 1829, Pl. 18 (Bahia).

Macrodon trahira Müller & Troschel, in Schomburgk, Reisen in Britisch-Guiana, Fische, III, 1848, 632.

Erythrinus macrodon Agassiz, Spix, Piscium Brasil., 1829, 43, Pl. 18 (Alma, Prov. Bahia; San Francisco).

Erythrinus microcephalus Agassiz, Spix, Piscium Brasil., 1829, 44 (San Francisco).

Erythrinus brasiliensis Agassiz, Spix, Piscium Brasil., 1829, 45, Pl. 20 (Peruaguacu).

Macrodon guavina Valenciennes, Humboldt Observ. Zool., II, 1833, 179, Pl. 48, fig. 1.

Macrodon auritus Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 1846, 519 (Montevideo).

Macrodon teres Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 1846, 521 (Lake Maracaibo).

Macrodon patana Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 1846, 522 (Cayenne).

Macrodon aimara Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 1846, 523, pl. 586 (Cayenne).

Macrodon ferox Gill, Ann. Lyc. Nat. Hist. N. Y., VI, 1858, 51 (Trinidad, W. I.).

Macrodon intermedius Günther, Cat. Fish. Brit. Mus., V, 1864, 282 (Cipo River).

Macrodon malabaricus Eigenmann & Eigenmann, Cal. Ac. Sci., 2nd Ser., 2, 1889, 102.

Hoplias malabaricus Gill, Proc. U. S. Nat. Mus., XXVI, 1903, 1015.

Head 2.15 to 3.3; depth 4.3 to 5; D. 13 or 14; A. 10 or 11; scales in lateral line 39 to 41.

Body elongate, not much compressed, dorsal region not elevated; head long and low, slightly convex above; interorbital space 3.65 to

4.25 in head; snout 3.7 to 4.37; eye 4.65 to 6.8; mouth large; lower jaw projecting; maxillary reaching past posterior margin of eye, mostly slipping under suborbital; teeth as in preceding species; gill-rakers poorly developed, 5 below angle on anterior arch; lateral line complete, straight, occupying median line of side; scales large, regularly placed, cycloid, 15 to 17 on median line in advance of dorsal; 9 scales across caudal peduncle from one lateral line to the other; 4 complete rows of scales between lateral line and anal fin; dorsal fin inserted midway between tip of upper jaw and base of caudal or slightly nearer the former; adipose fin wanting; caudal fin convex; anal fin inserted posteriorly, the longest rays not quite reaching base of lower caudal rays; ventral fins inserted under base of dorsal, a little nearer base of caudal than tip of lower jaw; pectoral fins inserted behind margin of preopercle, failing to reach base of ventrals by 4 or 5 rows of scales.

Color as in preceding species.

Of this species 8 specimens were preserved. They range in length from 85 to 295 mm. All are from the Rio Tuyra Basin.

This species is closely related to the preceding, differing mainly in the slightly larger scales. Our specimens were compared with specimens from the Rio Atrato Basin, with which they appear to agree perfectly.

Habitat: Rio Tuyra Basin; both slopes of Colombia; Ecuador, and south to Brazil.

Family VII. *Gymnotidæ*.

Body elongate, more or less eel-shaped; with or without scales; vertebræ many; skull with or without a frontal fontanel; parietal fontanel always present; mouth with or without teeth; margin of upper jaw formed by maxillaries and premaxillaries; air-bladder in 2 parts, connected by a small tube; vent well forward, never behind tips of pectorals, usually under head; dorsal fin wanting, or represented by a filament; caudal fin present or more usually absent, the tail terminating in a pointed appendage when fin is wanting; anal fin very long; ventral fins wanting; pectoral fins present, small.

KEY TO THE GENERA.

- a. Frontal fontanel wanting. *Gymnotus*, p. 307.
- aa. Frontal and parietal fontanels present.
 - b. Caudal fin and dorsal filament wanting.
 - c. Orbital margin free; teeth present in both jaws, in 2 more or less distinct patches in upper jaw and in a single patch in lower jaw. *Sternopygus*, p. 308.

- cc. Orbital margin not free; eye covered by a transparent membrane.
- d. Teeth wanting; origin of anal about the length of pectoral fin behind gill-opening. *Hypopomus*, p. 309.
- dd. Teeth present in both jaws; origin of anal under or slightly behind base of pectorals. *Eigenmannia*, p. 311.
- bb. Caudal fin and dorsal filament present; mouth large, its angle little, if any, in front of eyes. *Sternarchus*, p. 312.

33. Genus *Gymnotus* Linnæus.

Gymnotus Linnæus, Syst. Nat., Ed. X, 1758, 246 (type *Gymnotus carapo* Linnæus).

Size moderate, not exceeding 600 mm. in length. No frontal fontanel; no caudal fin; a dorsal filament; no electrical organs; cylindrical anteriorly, somewhat compressed posteriorly; head large and depressed, the top quite flat; gape not reaching the eyes; lower jaw protruding; teeth small, conical, in one row (which is sometimes irregular) in each jaw; eyes small and covered by membrane, without free orbital margin; scales cycloid and very small; lateral line complete and paralleling the main axis of the body; pectorals small; anal long, its origin back of vertical from the tip of the pectoral. (Ellis.)

Of this genus only a single widely distributed species is known.

49. *Gymnotus carapo* Linnæus.

Gymnotus carapo Linnæus, Syst. Nat., Ed. X, 1758, 246, and Ed. XII, 1766, 427; Meek, Field Mus. Nat. Hist. Pub., Zool. Ser., VII, 1907, 135 (Los Amates and Lake Amatitlan, Guatemala); Ellis, Memoir. Carnegie Mus., VI, 1913, 117 (Guatemala, south to the Rio de la Plata and the West Indies).

Gymnotus fasciatus Pallas, Spicil. Zool., VII, 1769, 35; Schomburgk, Fishes of Guiana, 1843, 184, Pl. 19 (Rio Branco).

Gymnotus albus Pallas, Spicil. Zool., VII, 1769, 36 (Surinam).

Gymnotus brachyurus Bloch, Syst. Ichthyol. 1787, Taf. 157, fig. 1.

Gymnotus putaol Lacépède, Hist. Nat. Poiss., II, 1800, 176.

Carapus fasciatus Cuvier, Règne Animal, Ed. I, II, 1817, 237.

Carapus brachiurus Cuvier, Règne Animal, Ed. I, II, 1817, 237.

*Carapus inæquilabiatu*s Valenciennes, in d'Orbigny, Voy. Amér. Mérid., V, Pt. 2, 1847, 11, Pl. 14 (La Plata).

Giton fasciatus Kaup, in Dumeril, Analyt. Ichthyol., 1856, 201; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 340 (Guatemala to Rio de la Plata).

"Head 7.25 (old individuals) to 11 (young individuals); depth 8.5 to 14 in length to end of the anal; anal rays 200 to 260.

"Snout 2.5 to 3; interorbital 2.25 to 3 in head; eye 4 (young) to 7 in the snout, 4.25 to 6 in the interorbital, 10 to 6 in the head.

"Body cylindrical; head depressed; width of head 1.25 to 1.6, depth of head at base of the occipital process 1.3 to 1.8 in the greatest depth; anus near the vertical from a point the length of the snout behind the eye; dorsal profile almost straight; ventral profile slightly convex.

"Snout very slightly pointed in young specimens, blunt in adults; mouth rather large; gape straight, reaching about two-thirds of the distance to almost below the eye; upper jaw included; caudal peduncle one-half the length of the snout or less; pectorals 2.25 to 3 in the head; origin of the anal behind pectorals, on the vertical from a point about 1.5 times the snout behind the head.

"Ground-color of alcoholic specimens varies from a light slate-gray in young specimens to a light orange in adults; a series of transverse white stripes crossing the body in young individuals, which widen and become yellow with age so that the adults are yellow, barred with black; dorsal parts washed with a dark chocolate-brown containing numerous black spots; fins translucent, mottled with black or brown.

"In life the body is translucent, flesh color or pale yellow, varying to a distinct pink in the parts rich in blood. The stripes and markings are blue or green, giving the fish a purplish or olive-green cast. This color may be deepened or lightened slightly by the expansion and contraction of chromatophores.

"The general marking of the species varies considerably, specimens from clear water being darker and more striped than those from muddy water. Some specimens from Guatemala and from the Upper Paraguay are almost without markings." (Ellis)

This species was not taken in Panama, but it is here included because it has been recorded from Central and South America, thus coming within the range of the present work.

Habitat: Guatemala south to the Rio de la Plata, and the West Indies.

34. Genus *Sternopygus* Müller & Troschel.

Sternopygus Müller & Troschel, *Horæ Ichthyol.*, III, 1849, 13 (type *Gymnotus macrurus* Block & Schneider).

Differing from all other Gymnotids in the free orbital margin. Body elongate, compressed; head moderate; snout short; jaws equal, or the upper a little in advance of the lower, the latter included at sides; teeth minute, in 2 more or less distinct patches in upper jaw, in a single patch



STERNOPYGUS DARIENSIS sp. nov.
From a specimen 240 mm. in length.

in lower jaw; frontal and parietal fontanels present; caudal peduncle round or compressed, without caudal fin; scales small, cycloid; lateral line complete; origin of anal in pectoral region; posterior air bladder conic. Size moderate or rather large.

59. *Sternopygus dariensis* sp. nov.

Type No. 8949, F. M. N. H.; length 300 mm.; Marrigante, Rio Tuyra, Panama.

Head 5.95 to 7.7 in length to end of anal; depth 6.65 to 7.8; A. 256 to 292.

Body elongate, more or less eel-shaped, compressed; head small, its upper profile usually slightly concave; snout rather slender, not much deeper than wide, its length 2.2 to 3 in head; eye small, with a free orbital margin, 3.1 to 7.25 in snout; interorbital 4.85 to 6.66 in head; mouth moderate, the gape reaching about half way to eye; upper jaw a little in advance of the lower, the latter included at sides; teeth in the jaws villiform, those of the upper jaw separated into two patches by a median line; gill-slit scarcely as long as snout; vent 3 or 4 times diameter of eye behind vertical from posterior margin of orbit; caudal peduncle varying in length, from notably shorter than head to a little longer than head, rather robust, compressed; lateral line complete, following the outline of the back; scales very small, cycloid; origin of anal below or a little behind base of pectorals, the longest rays a little shorter than snout; pectoral fins small, 2.1 to 2.75 in head.

Color grayish brown, the back slightly darker than the rest of body; sides with numerous dusky punctulations. Fins unmarked.

This species is represented by 25 specimens, ranging from 124 to 810 mm. in length. All were taken below the head of tide water at Marrigante on the Rio Tuyra. We have designated as the type a specimen 300 mm. in length.

This species differs from *S. macrurus*, its nearest relative, in the slightly concave profile of head, more slender snout, smaller eye, narrower interorbital, in the shorter and much heavier tail, and in the slightly more posterior position of the vent.

35. Genus *Hypopomus* Gill.

Hypopomus Gill, Proc. Ac. Nat. Sci. Phila., 1864, 152 (type *Rhamphichthys mülleri* Kaup).

Brachyrhamphichthys Günther, Cat. Fish. Brit. Mus., VIII, 1870, 6 (type *Rhamphichthys artedi* Kaup).

Body elongate, compressed; size small; head short; snout blunt; frontal and parietal fontanels well developed; mouth small; teeth wanting; eyes covered by a transparent membrane; scales small, cycloid; lateral line complete; no caudal fin; origin of anal about the length of pectoral fin behind vertical from gill-opening.

51. *Hypopomus brevirostris* (Steindachner).

Rhamphichthys brevirostris Steindachner, Sitzb. K. Ak. Wiss. Wien, LVIII, 1868, 254, Pl. II, fig. 2 (Guaporé); Günther, Cat. Fish. Brit. Mus., VIII, 1870, 6; Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1880, 89 (Rio Guaporé, Amazon stream near Santarem, and Rio Cauca).

Brachyrhamphichthys brevirostris Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., XIV, 1891, 62.

Hypopomus brevirostris Eigenmann & Kennedy, Proc. Ac. Nat. Sci. Phila., 1903, 530 (Campo Grande, Arroyo Chagalalina); Ellis, Memoir. Carnegie Mus., VI, 1913, 134, fig. 7; Eigenmann & Fisher, Indiana Univ. Studies, No. 25, 1914, 236 (Rivers of Colombia).

Hypopomus occidentalis Regan, Ann. & Mag. Nat. Hist., Ser. 8, XIV, 1914, 32.

Head in length to end of anal fin 6.8 to 9.3; depth 6.8 to 9; A. 213 to 238.

Body elongate, rather strongly compressed; caudal filament ribbon-shaped, pointed; upper profile of head and body gently convex; head short; snout blunt, 3 to 3.55 in head; eye small, covered with a transparent membrane, 9 to 12 in head; interorbital 4 to 4.35; mouth small; jaws subequal, the lower slightly included; maxillary about twice the length of eye; teeth wanting; no mental filaments; lateral line becoming obscure posteriorly; scales small, cycloid; caudal filament 1.12 to 1.2 in length to end of anal; vent under preopercular margin, from 2 to 3.5 times diameter of eye behind vertical from posterior margin of orbit; origin of anal fin a little in advance of tips of pectorals, or about the snout's length behind base of these fins; pectoral fins short, 1.65 to 2 in head.

Color brownish or buff, with darker markings of varying sizes, sometimes forming more or less distinct cross-bars on anterior portion of body.

This fish is represented by 4 specimens ranging from 68 to 162 mm. in length. Two of our specimens are from the Rio Chagres Basin and the other two from the Rio Bayano Basin.

Habitat: Both slopes of Panama and Colombia and south to the Rio de la Plata.

36. Genus *Eigenmannia* Jordan & Evermann.

Cryptops Eigenmann, Ann. N. Y. Ac. Sci., VII, 1894, 626 (type *Sternopygus humboldtii* Steindachner = *Sternarchus virescens* Valenciennes). (Name preoccupied.)

Eigenmannia Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 341. (Substituted for *Cryptops*.)

This genus is distinguished from *Sternopygus* by the absence of a free orbital margin. Body elongate, compressed; head rather small; snout blunt; mouth small; jaws equal, or the lower included; a large frontal and parietal fontanel present; eyes medium, covered by a transparent membrane; teeth in upper jaw in 2 almost confluent patches, those of lower jaw in 2 lateral patches; scales small, cycloid; lateral line complete; origin of anal back of vertical from origin of pectorals; caudal filament moderate or long. Size moderate, not exceeding 400 mm.

52. *Eigenmannia virescens* (Valenciennes).

Sternarchus virescens Valenciennes, in d'Orbigny, Voy. Amér. Mérid., V, Pt. 2, 1847, 11, Pl. 13, fig. 2.

Sternarchus virescens Müller & Troschel, in Schomburgk, Reisen in Britisch-Guiana, Fische, III, 1848, 640 (Guiana); Günther, Cat. Fish. Brit. Mus., VIII, 1870, 7 (Surinam).

Sternopygus lineatus Müller & Troschel, in Schomburgk, Reisen in Britisch-Guiana, Fische, III, 1848, 640 (Guiana).

Sternopygus tumifrons Müller & Troschel, Horæ Ichthyol., III, 1849, 14.

Sternopygus humboldtii Steindachner, Denkschr. K. Ak. Wiss. Wien, XXXIX, 1878, 71, Pl. XIV (Rio Magdalena).

Cryptops virescens Eigenmann, Ann. N. Y. Ac. Sci., VII, 1894, 626.

Cryptops lineatus Eigenmann, Ann. N. Y. Ac. Sci., VII, 1894, 635.

Cryptops humboldtii Eigenmann, Ann. N. Y. Ac. Sci., VII, 1894, 625.

Eigenmannia humboldtii Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 341.

Head 6.05 to 7.15 in length to end of anal fin; depth 5.7 to 7; A. 165.

Body elongate, compressed; dorsal profile of head and body convex; head short; snout blunt, its length 2.85 to 3.3 in head; eye moderate, 4.9 to 5.7; interorbital 3 to 3.2; mouth small; jaws subequal, the lower included, at least on sides; maxillary about equal to length of eye; teeth in the upper jaw in 2 nearly confluent patches, those in lower jaw in 2 lateral patches; vent about one-half diameter of eye behind vertical from posterior margin of orbit; caudal filament in our small specimen flat, ribbon-shaped and more than half the length of anal, lost in the

larger specimen; origin of anal slightly behind origin of pectorals, the longest rays but little shorter than eye and snout; pectorals of moderate length, 1.17 to 1.2 in head.

Color grayish buff; sides with dark points, forming an indistinct dark area at beginning of lateral line and an indefinite dark streak on lateral line, and short bars below base of anal rays; fins unmarked.

Of this species we have only 2 specimens and the largest one is without a tail. The smallest one measures 150 mm. in total length. Both are from Marrigante, below the head of tide water on the Rio Tuyra.

We have at hand for comparison many specimens from more southern localities. Our uninjured specimen appears to differ somewhat from all the others that have been examined in the apparently deeper body, shorter anal fin and the compressed caudal filament, which is considerably longer than half the anal. It is, therefore, probable that our specimens represent a new variety or species, but our material is too meagre to establish this fact.

Habitat: Rio Tuyra south to the Rio de la Plata.

37. Genus *Sternarchus* Bloch & Schneider.

Sternarchus Bloch & Schneider, Syst. Ichthyol., 1801, 497, Pl. 94 (type *Gymnotus albifrons* Linnæus).

Body elongate, compressed; head large, naked; snout short, not tubular; fontanel present; eyes without free orbital margin; mouth large, its angle little if any in advance of eyes; teeth in patches on both jaws; scales cycloid; lateral line complete; caudal fin present, distinct; anal fin long, but not reaching caudal fin, its origin at or a little in advance of vertical from gill-opening.

53. *Sternarchus rostratus* Meek & Hildebrand.

Sternarchus rostratus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 85 (Rio Grande near Cana).

Head 6.7 in length to base of caudal; depth 8.25.

Body compressed throughout; head rather low, its greatest depth 1.8 in its length, its upper profile slightly concave; snout not greatly produced, blunt, very slightly compressed, its length somewhat greater than distance from anterior margin of eye to upper angle of gill-opening, 2.3 in head; eye 18.5; interorbital 5.6; mouth rather large, its angle under about middle of eye; upper jaw a little in advance of the lower; gill-opening a small slit in advance of pectorals; lateral line complete; mucus pores numerous and distinct on back and sides; vent under margin of preopercle; dorsal filament present; caudal fin distinct,



STERNARCHUS ROSTRATUS Meek & Hildebrandt.
From a specimen 120 mm. in length.

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rounded, not much longer than interorbital width; origin of anal slightly in advance of gill-opening, its longest rays equal to or a little shorter than snout; pectoral fins equal to half length of head.

Color uniform brownish, without dark punctulations; a very distinct yellowish stripe on median line of snout and back, disappearing at origin of dorsal filament. Fins unmarked.

Of this species only a single specimen was secured, measuring 126 mm. in length. It was taken in the Rio Grande, tributary of the Rio Tuyra, several miles above Cana. Several others were seen, floating down stream after a discharge of dynamite, but before they could be reached they had apparently recovered from the shock and quickly disappeared.

We compared our specimen with several from the Rio Cauca, at Cali, Colombia, and found them to be identical.

Order III. Haplomi.

THE PIKE-LIKE FISHES.

Body elongate; scales cycloid, extending on head; lateral line wanting; fin rays soft; dorsal fin single, placed posteriorly; ventral fins abdominal. Opercles well developed; mesocoracoid absent; hypercoracoid and hypocoracoid separate; pharyngeal bones distinct.

Family VIII. Pœciliidæ.

THE KILLIFISHES.

Body oblong to more or less elongate; depressed anteriorly, compressed posteriorly, covered with rather large cycloid scales; head usually flat above; mouth protractile, bordered above by the premaxillaries; jaws with teeth, incisor-like to villiform; gill-membranes more or less connected, free from the isthmus; gill-rakers short and thick; dorsal fin single, of soft rays only; ventral fins abdominal; caudal fin usually rounded or truncate.

The species of this family are very numerous; some of them are viviparous. Those which occur in the area under consideration in this work are all viviparous, except the ones belonging to the genus *Rivulus*.

Mr. Regan of the British Museum has lately revised the subfamily *Pæciliina*, basing his classification of the genera on the modified anal

fin of the males. Since, with two exceptions, all the species treated of here belong to this subfamily, we have followed for the most part Mr. Regan's classification. However, in as much as the modified anal fin of the males vary so essentially in different species, its use as a generic character seems to us to lead to too many divisions, resulting in nearly as many genera as species. It is, therefore, our opinion that this character should be regarded of specific, rather than of generic importance.

KEY TO THE GENERA.

- a. Males with the anal fin advanced and modified into an intromittent organ. Species viviparous.
- b. Ventral fins similar in both sexes.
- c. Mouth not wholly transverse, the cleft partly lateral; teeth conical, immovable.
- d. Distal portion of produced rays of anal fin in male directed backward, usually with one or more retrorse spines or hooks.
Gambusia, p. 314.
- dd. Distal portion of produced rays of anal fin in male directed forward, with or without antrorse hooks. *Priapichthys*, p. 319.
- cc. Mouth transverse; teeth slightly compressed, movable; the intromittent organ long and slender, without hooks or serrations at apex. *Paciliopsis*, p. 324.
- bb. Ventral fins in the male enlarged, the second ray notably produced; teeth in the jaws movable; the first prolonged ray of anal fin in male bearing a small antrorse hook at apex. *Mollienisia*, p. 326.
- aa. Anal fin in the males not modified into an intromittent organ. Species oviviparous. *Rivulus*, p. 330.

38. Genus *Gambusia* Poey.

Gambusia Poey, Memorias, I, 1855, 382 (type *Gambusia punctata* Poey).
Gambusia Regan, Proc. Zool. Soc. Lond., 1913, 981.

Body elongate, moderately compressed in the female; mouth small, the branches of the lower jaw firmly united; teeth fixed, conical, in bands, the outer ones slightly the larger; branchiostegals 6; anal fin of female more or less in advance of the dorsal; anal of male much advanced, its anterior rays modified into an intromittent organ; alimentary canal short; vertebræ about 32; viviparous.

This genus, as restricted by Regan, includes species in which the modified anal of the male is about $\frac{1}{3}$ the length of the body of the fish and is formed of three rays.

"The distal segments of the first prolonged ray are produced into processes directed more or less towards its apex; the anterior branch of the second prolonged ray is slender distally and at some distance from the end has an antrorse projection which may be termed the 'elbow'; the posterior branch of this ray ends in a retrorse pointed hook or barb, and the segments immediately proximal to the elbow of the anterior branch are produced backwards into serræ; the third prolonged ray ends in a hook more or less similar to that of the second." (Regan)

The males of this genus and related genera are smaller than the females, and more elongate; they are apparently fewer in number. All *Gambusia* are small, and as a net sufficiently small to capture females will permit the males to pass through it, the few males taken by the collector may not indicate their true ratio. Many of the species of this genus live in swamps and lowland streams, but a few species throughout Mexico and Central America are found in clear mountain streams at as high an altitude as any fishes are found. *Gambusia* feed chiefly on insects and small crustacea. To some of the species are credited the eating of mosquito larvæ.

We here tentatively refer to this genus 2 species, *G. episcopi* and *G. cascajalensis*, that do not have any definite retrorse hooks on the distal portion of the intromittent organ, but they agree in other respects with this genus.

KEY TO THE SPECIES.

- a. Intromittent organ of male with 2 strong retrorse hooks at apex, and anteriorly with strong serrations; each scale with a dark dot, forming lines along the rows of scales; dorsal and caudal with black spots, forming bars. *nicaraguensis*, p. 316.
- aa. Intromittent organ of male without retrorse hooks or strong serrations at apex; no dark lines along the rows of scales; anal fin with a black spot at base, which may or may not be extended to tip of rays.
- b. Body rather robust, the depth 3.2 to 4.1 in length; caudal peduncle 1.15 to 1.6 in head; origin of dorsal in female over or slightly anterior to vertical from middle of anal; anal fin not falcate; skin underneath the scales strongly pigmented, marking the margins of the scales; sides with more or less distinct dark spots or bars. Largest females 52 mm. in length. *episcopi*, p. 317.
- bb. Body slender, the depth 3.7 to 4.5 in length; caudal peduncle 1.7 to 2 in head; origin of dorsal in female over posterior rays of anal; anal more or less falcate; the rows of scales very indistinctly marked; sides without spots or bars. Largest female 62 mm. in length. *cascajalensis*, p. 318.

54. *Gambusia nicaraguensis* Günther.

Gambusia nicaraguensis Günther, Cat. Fish. Brit. Mus., VI, 1866, 336, and Trans. Zool. Soc. London, 1868, 483, Pl. 82, fig. 3 (Lake Nicaragua); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 682; Regan, Biol. Cent. Amer., Pisces, 1907, 96 (Lake Nicaragua; El Hule, Mexico), and Proc. Zool. Soc. London, 1913, 985, fig. 168 A (Lake Nicaragua; El Hule and Coaxacoalcos, Mexico).

Paragambusia nicaraguensis Meek, Field Col. Mus. Pub., Zool. Ser., V, 1904, 133 (Otopa; Boca del Rio; El Hule; Obispo; Perez).

Head 3.3 to 3.8; depth 3.3 to 3.8; D. 7 or 8; A. 10 or 11; scales 29 to 31.

Body elongate, compressed; upper profile from snout to dorsal straight or slightly convex; head rather low, flat above; snout short, 2.7 to 3.8 in head; eye 2.8 to 3.5; interorbital 2 to 2.9; mouth very small, the gape extending only about half way to eye; teeth in jaws in villiform bands; gill-rakers short, about 14 on lower limb of first arch; scales moderate, cycloid, extending forward to eyes; caudal peduncle strongly compressed, its least depth 1.5 to 1.8 in head; origin of dorsal in female over or slightly behind base of last ray of anal, or about midway between posterior margin of eye and tip of caudal, in male notably behind base of last ray of anal and about midway between tip of snout and tip of caudal; caudal fin rounded; anal fin in female inserted somewhat nearer tip of snout than tip of caudal, its outer margin concave, in adult male it is inserted about midway between tip of snout and base of caudal, the longest modified ray 2.6 to 2.8 in body, the first produced ray with strong serrations on distal portion and the posterior branch of second and third produced rays each with a strong retrorse hook at apex; ventral fins small, reaching origin of anal in female, and past origin of anal in male; pectoral fins moderate, 1.5 to 1.85 in head.

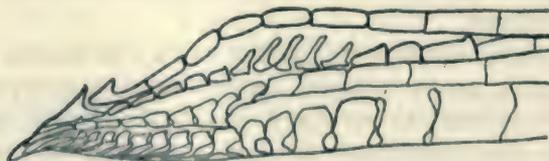


FIG. 4. DISTAL PART OF INTROMITTENT ORGAN OF *Gambusia nicaraguensis* Günther. (Greatly magnified.)

Color greenish; each scale on upper part of sides with a dark dot, forming lines along the rows of scales. Dorsal and caudal with black spots forming bars; other fins unmarked.

Of this species we have over 100 specimens. The largest female is 45 and the largest male 27 mm. in length. Nearly all of our specimens

are from brackish water on the Atlantic coast. We have a single female specimen from brackish water from the Pacific coast, which we doubtfully refer to this species.

Habitat: Southern Mexico south to Panama.

55. *Gambusia episcopi* Steindachner.

Gambusia episcopi Steindachner, Sitzb. K. Ak. Wiss. Wien, LXXVII, 1878, 387, Pl. II, figs. 3 & 4 (Obispo, Panama); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 683 (Ditches on the Isthmus of Panama, Obispo Station); Garman, Mem. Mus. Comp. Zool., XIX, 1895, 88 (Panama Railroad between Gorgona and Matachin); Regan, Biol. Cent. Amer., Pisces, 1907, 96.

Gambusia latipunctata Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 87 (Araijan, Panama).

Head 3.1 to 3.5; depth 3.2 to 4.1; D. 8 or 9; A. 9 or 10; scales 26 to 28.

Body rather robust; profile from snout to nape straight, from nape to dorsal slightly convex; head flat above; snout rather short 3.2 to 4 in head; eye 3 to 3.7; interorbital 2 to 2.6; mouth moderate, the cleft reaching about half the distance to eye; teeth in the jaws pointed, in bands, the outer ones scarcely enlarged; scales large, cycloid, extending forward to eyes, 6 longitudinal rows between anterior part of base of dorsal and base of anal; caudal peduncle strongly compressed, its least depth, 1.15 to 1.6 in head; origin of dorsal in female over middle of base of anal, or slightly anterior to this point, and somewhat nearer anterior margin of eye than tip of caudal; in the adult male the origin of the dorsal is a little nearer end of snout than tip of caudal; caudal fin rounded; anal fin in female usually inserted a little nearer end of snout than tip of caudal, the anterior rays scarcely produced; in the adult male the origin of the anal is slightly nearer base of caudal than end of snout, the modified portion of anal failing to reach base of caudal by about the length of postorbital part of head, equal to or a little longer than head, 3.4 to 3.85 in length of body, the apex scarcely bent backward, no hooks, the two branches of the second ray and the third ray of about equal length and the anterior ray only slightly shorter than the second and third; ventral fins rather small, reaching vent in female, reaching to or past origin of anal in male; pectoral fins reaching slightly past base of ventral, 1.3 to 1.5 in head.

Color rather variable, apparently depending largely upon the clearness of the water in which they live. The sexes similarly colored, olivaceous, with dusky punctulations, which are mostly on the skin underneath the scales, making it appear as if the scales were margined with dark; this dark coloration is much more prominent on some in-

dividuals than others; sides with more or less distinct dark spots. In the specimens in which they are most distinct they form short, vertical bars, and in others they appear as quadrate spots. Dorsal fin with black chromatophores preceding each ray, forming a dark bar near the base; interradiial membranes between the posterior rays of anal with black chromatophores, forming a dark spot at base of fin, these chromatophores may or may not be extended on the rays and up the fin. All intergradations from an obscure spot at base of the rays to a prominent spot, with the black extending nearly to the tips of the rays, occur.

A fairly common species on both slopes of Panama, occurring mainly in the upper courses of creeks. Numerous specimens are at hand. The

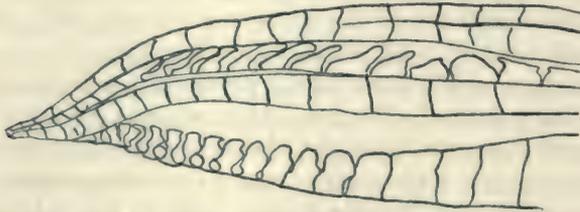


FIG. 5. DISTAL PART OF INTROMITTENT ORGAN OF *Gambusia episcopi* Steindachner.
(Greatly magnified.)

largest female is 52 and the largest male 23 mm. in length. It was not taken in the Rio Tuyra or Rio Bayano basins.

Further study of our material convinces us that the form we described as *Gambusia latipunctata* in 1913 intergrades with the present species and is therefore not valid.

Habitat: Both slopes of Panama, north of the Rio Bayano.

56. *Gambusia cascajalensis* Meek & Hildebrand.

Gambusia cascajalensis Meek & Hildebrand, Field Mus. Nat. Hist.

Pub., Zool. Ser., X, 1913, 86 (Rio Cascajal, Porto Bello, Panama).

Head 3.2 to 3.9; depth 3.7 to 4.5; D. 7 or 8; A. 10; scales 28 to 30.

Body rather slender; the profile straight over the head, slightly convex from nape to dorsal; head rather flat above; snout moderate, 3.1 to 3.35 in head; eye 2.8 to 3.25; interorbital 2.1 to 2.4; mouth rather small, the cleft extending about one-third the distance to eye; teeth in the jaws pointed, in bands, the outer ones slightly enlarged; scales moderate, cycloid, extending forward on snout and on base of caudal fin, 7 longitudinal rows between anterior part of base of dorsal and base of anal; caudal peduncle strongly compressed, its least depth 1.7 to 2 in head; origin of dorsal in female over posterior rays of anal, and about midway between middle of eye and tip of caudal, in the male its origin

is slightly nearer tip of caudal than tip of snout; caudal fin rounded; anal fin in female inserted a little nearer tip of snout than tip of caudal, the anterior rays somewhat produced; in the adult male the origin of the anal is about equidistant from middle of eye and base of caudal, the modified portion rather short, not nearly reaching base of caudal, its structure as in *G. episcopi*; ventral fins reaching to or slightly past vent in the female and well past the origin of the anal in the male; pectoral fins reaching a little past base of ventrals, 1.2 to 1.5 in head.

Color plain olivaceous; the dark pigment underneath the scales marking the rows of scales, which are so prominent in *G. episcopi*, is very indistinct in the present species; sides without spots or bars. The tip of dorsal black; anal fin with a black spot at base, which is usually extended on 2 to 5 rays of the fin.

Of this species there are numerous specimens in the present collection. The largest female at hand is 62 and the largest male 43 mm. in length. Only a few of our specimens are from the Pacific slope of Panama, and it appears to be comparatively rare in the Rio Chagres Basin, but it is abundant in some small coastal streams at Porto Bello. It was not taken in the Rio Tuyra or Rio Bayano basins.

Habitat: Both slopes of Panama, north of the Rio Bayano.

39. Genus *Priapichthys* Regan.

Priapichthys Regan, Proc. Zool. Soc. London, 1913, 991 (type *Gambusia annectens* Regan).

This genus differs from *Gambusia* in that the modified anal fin of the male is longer, its tip nearly reaching the caudal fin, and it is differently formed; the terminal part is hooked forward and the prolonged rays taper distally and have no specially modified segments, except the usual serræ of the posterior branch of the second; the first prolonged ray does not extend to the apex, and the hook is supported by the anterior branch of the second and third rays. (Regan) Origin of the dorsal fin above the anal. We have tentatively referred one species (*P. panamensis*), which does not possess definite antrorse hooks on the intromittent organ, to this genus.

KEY TO THE SPECIES.

- a. First produced ray of intromittent organ with a recurved spur below its apex, directed upward and forward; the apex of this organ curved forward; male with a jet black spot about the size of pupil on sides slightly in advance of vertical from origin of dorsal; dorsal with a dusky spot at base on posterior one-fourth of fin.

- b. Body posteriorly with 6 to 8 dark cross-bars, present in both sexes. *tridentiger*, p. 320.
- bb. Body in females plain, no cross-bars, male with very indistinct cross-bars. *tridentiger cana*, p. 321.
- aa. First produced ray of intromittent organ without a recurved spur below its apex.
- c. First produced ray of anal anteriorly serrate below apex, and bearing a hook at apex directed downward and forward, the anterior branch of the second produced ray curved forward at apex; a dark area at base of anterior rays of anal. *dariensis*, p. 321.
- cc. Intromittent organ without hooks or serrations, the apex curved forward; a dark area about vent. *panamensis* sp. nov., p. 322.

57. *Priapichthys tridentiger* (Garman).

Gambusia tridentiger Garman, Mem. Mus. Comp. Zool., XIX, 1895, 89, Pl. IV, fig. 10, teeth (Isthmus of Panama); Regan, Biol. Cent. Amer., Pisces, 1907, 95.

Priapichthys tridentiger Regan, Proc. Zool. Soc. London, 1913, 992.

Head 3.55 to 4; depth 3.1 to 5.35; D. 7 or 8; A. 9 or 10; scales 28 to 30.

Body compressed; profile straight from snout to nape, then convex to dorsal; head flat above; snout short, 3.75 to 4.3 in head; eye 2.85 to 3.34; interorbital 1.9 to 3; mouth small, cleft reaching about one-third the distance to eye; teeth in jaws pointed, in bands, the outer series somewhat enlarged; scales moderate, cycloid, extending forward to eyes; caudal peduncle strongly compressed, its least depth 1.45 to 2 in head; origin of dorsal in female over the posterior rays of the anal and about equidistant from posterior margin of eye and tip of caudal, or slightly nearer the former, in the male its origin is about midway between posterior margin of eye and base of caudal; caudal fin rounded; anal fin in female inserted somewhat nearer base of caudal than posterior margin of eye, its posterior margin concave at least in large examples; in the adult male the anal fin is inserted notably nearer tip of snout than base of caudal, the longest produced ray failing to reach base of caudal by about an eye's diameter, 2 to 2.3 in length of body; the apex of the intromittent organ curved forward, the first produced ray with a spur a short distance below its apex which is directed downward and forward; ventral fins rather small, reaching vent in female, and past origin of anal in the male; pectoral fins reaching slightly past base of ventrals, 1.2 to 1.9 in head.

Color of female olivaceous; scales with pale margins, next to the margins is a dark area formed by dusky points; sides of caudal portion

of body, *i.e.*, from anal fin backward, with from 6 to 8 dark cross-bars; a dark line from last anal ray to base of caudal; a dark area at base of anterior rays of anal, not extending on fin; posterior rays of anal with a dusky spot near middle and another at tips; dorsal with a dusky spot on posterior one-fourth near base of rays. Color of male very similar, but the cross-bars less distinct, and a jet black spot about the size of the pupil present on side slightly in advance of vertical from origin of dorsal;

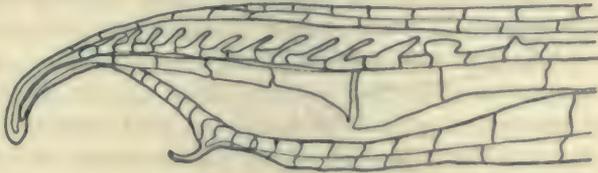


FIG. 6. DISTAL PART OF INTROMITTENT ORGAN OF *Priapichthys tridentiger* (Garman).
(Greatly magnified.)

no dark spot at base of anterior rays of anal. Specimens from Taboga Island paler with the cross-bars less distinct in both sexes.

Of this species we have numerous specimens from both slopes of Panama, but none from the Rio Tuyra Basin. The largest female is 45 and the largest male 20 mm. in length.

Habitat: Both slopes of Panama, and Taboga Island.

58. *Priapichthys tridentiger cana* (Meek & Hildebrand).

Gambusia cana Meek & Hildebrand, Field. Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 87 (Rio Satiganti, Cana, Panama).

Head 3.8 to 4.25; depth 3.2 to 4.35; D. 7 or 8; A. 10; scales 29 to 31.

This variety agrees with *P. tridentiger* in all respects, except in color. In the female there are no dark cross-bars on posterior part of body. In the male the characteristic dark spot of *P. tridentiger* on side above the base of anal is present, but the cross-bars are less distinct.

This form is represented by 68 specimens from the Rio Satiganti, one of the upper tributaries of the Rio Tuyra. The largest female is 40 and the largest male 23 mm. in length.

59. *Priapichthys dariensis* (Meek & Hildebrand).

Gambusia dariensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 88 (Rio Capeti).

Head 3.4 to 4.15; depth 3.4 to 4.5; D. 7 or 8; A. 9 or 10; scales 28 to 31.

Body moderately compressed; dorsal profile straight over head, slightly convex from nape to dorsal; head flat above; snout short, 3.3 to 4.15 in head; eye 3 to 4.35; interorbital 2.2 to 2.4; mouth small, the gape

reaching about one-third the distance to eye; teeth in the jaws pointed, in narrow bands, the outer ones somewhat enlarged; scales moderate, cycloid, extending forward to the eyes; caudal peduncle strongly compressed, its least depth 1.4 to 1.7 in head; origin of dorsal in female just behind base of last ray of anal and about equidistant from posterior margin of eye and tip of caudal or slightly nearer the latter; in the male this fin is somewhat nearer posterior margin of eye than tip of caudal; caudal fin rounded; anal fin in the female inserted about equidistant from posterior margin of eye and base of caudal, its posterior margin nearly straight; in the adult male this fin is inserted a little nearer tip of snout than base of caudal, the longest modified ray 2.6 to 2.7 in body; the first ray strongly serrate, with a hook at apex directed downward and forward, the anterior branch of second produced ray curved forward, the second branch shorter; ventral fins rather small, reaching origin of anal in female and past this point in male; pectoral fins 1.1 to 1.4 in head.

Color of female plain olivaceous; scales on back and upper part of sides with dark punctulations; no black spot on sides or on fins; a dark area at base of anterior ray of anal, and a dark line from anal fin to base

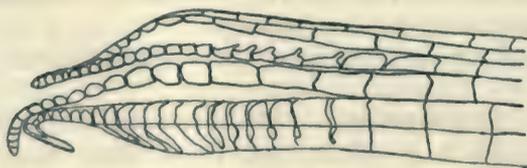


FIG. 7. DISTAL PART OF INTROMITTENT ORGAN OF *Priapichthys dariensis* (Meek & Hildebrand). (Greatly magnified.)

of caudal. The male with a variable number (often as many as 20) of narrow, dark cross-bars on sides; otherwise essentially as in females.

There are over 100 specimens of this species in the present collection. The largest female is 36 and the largest male 27 mm. in length. This species was taken in the Rio Juan Diaz, Rio Bayano, and Rio Tuyra basins.

60. *Priapichthys panamensis* sp. nov.

Type No. 8950, F. M. N. H.; length 24 mm.; Chame Point, Panama.

Head 3.55 to 4; depth 3.65 to 4.3; D. 8; A. 10; scales 29 to 31.

Body moderately compressed; profile very gently convex from snout to origin of dorsal; head broad, flat above; snout short, 3.75 to 4.5 in head; eye 2.65 to 3.3; interorbital 1.75 to 2.4; mouth small, the cleft

reaching about one-third the distance to eye; teeth pointed, in bands in the jaws, the outer ones slightly enlarged; scales moderate, cycloid, extending to tip of snout and on base of caudal; caudal peduncle strongly compressed, its least depth 1.5 to 1.8 in head; origin of dorsal in female over base of last ray of anal, and about midway between posterior margin of eye and base of caudal; in the male the origin of the dorsal is about midway between tip of snout and base of caudal; caudal rather pointed; anal fin in female inserted considerably nearer end of snout than tip of caudal, its posterior margin convex; origin of anal in adult male is about half as far from end of snout as from tip of caudal, the produced portion failing to reach base of caudal by about the length of post-orbital part of head, its length 2 to 2.25 in body, the anterior branch of the second produced ray the longest, directed forward at apex, the first produced ray a little longer than the third, no spur; ventral fins reaching to or slightly past vent in female, and notably past origin of anal in male; pectoral fins reaching at least to middle of ventrals, 1 to 1.4 in head.

Color of the sexes similar, grayish green; posterior part of body with 4 or 5 indistinct, dark cross-bars; a dark line from anal to base of

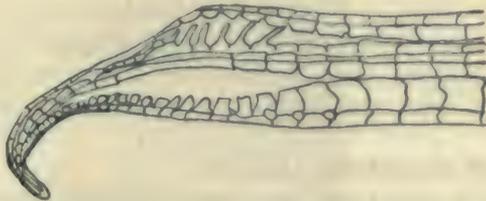


FIG. 8. DISTAL PART OF INTROMITTENT ORGAN OF *Priapichthys panamensis* sp. nov. (Greatly magnified.)

caudal; dorsal fin with dark chromatophores at base of the posterior rays and again at the tips of these rays; usually with a more or less distinct dark area about vent.

Of this species we have 37 specimens. The largest female is 37 and the largest male 24 mm. in length. One specimen is from the Rio Chame and all the others from a brackish pool at Chame Point on the Pacific coast.

In general appearance this fish resembles *Priapichthys tridentiger*, but the intromittent organ of the male is quite different, the caudal fin is more pointed and bears more scales on its base, the color is paler, and the cross-bars are fewer.

Type a male 24 mm. in length, from Chame Point.

40. Genus *Pæciliopsis* Regan.

Pæciliopsis Regan, Proc. Zool. Soc. London, 1913, 996 (type *Pæcilia presidionis* Jordan & Culver).

Body elongate, compressed; head more or less depressed; mouth small, the cleft transverse; teeth in the jaws in 2 series or bands, depressable, the outer ones largest, slightly compressed; the intromittent organ long and slender, without hooks or serrations at apex; ventral fins not modified in the male.

KEY TO THE SPECIES.

- a. The three produced rays of anal, as well as both branches of the second, all of about equal length and reaching to apex of intromittent organ, failing quite notably to reach base of caudal when deflexed; no dark area over vent; young of 60 mm. and less in length with dark cross-bars on posterior part of body; fins unmarked.
elongatus, p. 324.
- aa. The first and the anterior branch of the second produced ray of anal fin in male of about equal length and extending to apex of intromittent organ, the posterior branch of the second and the third produced ray notably shorter; intromittent organ when deflexed reaching nearly or quite to base of caudal; a dark area over vent; indistinct cross-bars on body; fins dusky, the dorsal with blackish basal band and dark edge.

isthmensis, p. 325.

61. *Pæciliopsis elongatus* (Günther).

Pæcilia elongata Günther, Cat. Fish. Brit. Mus., VI, 1866, 342 (Panama), and Trans. Zool. Soc. London, VI, 1869, 484, Pl. LXXXV, fig. 2 (Panama); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 697; Gilbert & Starks, Mem. Cal. Ac. Sci., 1904, 50 (Brackish sloughs about Panama); Regan, Biol. Cent. Amer., Pisces, 1907, 102.

Mollienisia elongata Regan, Proc. Zool. Soc. London, 1913, 1013 (Panama).

?*Heterandria colombianus* Eigenmann & Henn, Indiana Univ. Studies, No. 16, 1912, 27 (Rio Dagua, Colombia); Regan, Proc. Zool. Soc. London, 1913, 996.

?*Pæciliopsis colombianus* Henn, Ann. Carnegie Mus., X, 1916, 120 (Rio Dagua, Colombia).

Head 3.4 to 4.4; depth 3.4 to 4; D. 8 to 10, usually 9; A. 8 or 9; scales 28 to 33.

Body elongate, robust, posteriorly compressed; head depressed, flat above; snout broad, 3.8 to 4.55 in head; eye 3.33 to 4.6; interorbital 2 to 2.2; mouth transverse; teeth in outer series close-set, slightly com-

pressed or pointed, curved inward, this series is followed by a narrow band of minute teeth; scales large, cycloid, 8 or 9 rows between base of dorsal and anal; origin of dorsal in female variable, usually about midway between end of snout and tip of caudal, and posterior to vertical from origin of anal; its origin in the male is at about the same point as in female, but the fin is higher; caudal fin scaly at base, its margin rounded; anal fin in female usually inserted about midway between tip of snout and base of caudal; anal fin in adult male inserted nearer end of snout than base of caudal, the modified portion very long, slender, more or less needle-shaped, 2.35 to 2.7 in length; ventral fins similar in both sexes, usually failing to reach vent in large females, reaching opposite base of anal in males; pectoral fins moderate, 1 to 1.25 in head.

Color of sexes similar, olivaceous. Large specimens without cross-bars; young of 60 mm. and less in length with narrow, dark cross-bars on posterior portion of sides. Fins unmarked.

Of this species we have 80 specimens. The largest female is 150 and the largest male 60 mm. in length. It was taken by us only in brackish water about the city of Panama where it is fairly common.

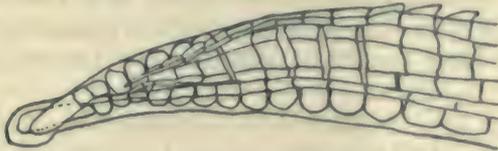


FIG. 9. DISTAL PART OF INTROMITTENT ORGAN OF *Paeciliopsis elongatus* (Günther).
(Greatly magnified.)

We have examined 2 female specimens, paratypes, of *P. colombianus* (Eigenmann & Henn). We do not find that they differ essentially from the present species. However, in the absence of male specimens of the former their identity with *P. elongatus* remains doubtful.

Habitat: Pacific coast of Panama and probably of Colombia.

62. *Paeciliopsis isthmensis* Regan.

Paeciliopsis isthmensis Regan, Proc. Zool. Soc. London, 1913, 997
(Colon, Panama).

Head 3.5 to 3.7; depth 2.5 to 3; D. 9 or 10; A. 10; scales 26 to 28.

Body robust; mouth small; teeth in narrow bands; interorbital width 1.8 to 2 in head; eye 3 to 3.2; origin of dorsal fin midway between anterior margin of the eye and base of caudal, its longest ray 1.5 in head; origin of anal below fourth or fifth ray of dorsal, its first branched ray 1.3 in head; pectoral a little shorter than the head; least depth of caudal peduncle 1.3 to 1.5 in head; in the male the origin of the dorsal is

midway between the tip of the snout and base of caudal, or nearer the former; the modified anal reaching quite to caudal fin.

Color olivaceous, scales dark edged; a blackish spot above the vent; fins dusky, the dorsal with a blackish basal band and a dark edge. The male with indistinct cross-bars on the body. Females 35 to 60 mm. in length; males 35 to 42.

This species was not taken by us at Colon. It is probably identical with the species described by Meek* as *Pacilia pittieri* from Costa Rica.

41. Genus *Mollienisia* LeSueur.

Mollienisia LeSueur, Jour. Acad. Nat. Sci. Phila., 1821, 3, Pl. III (type *Mollienisia latipinna* LeSueur).

Body oblong to rather robust; mouth small, transverse, with weak jaws; teeth small, in bands, the outer series in each jaw movable; branchiostegals 5; anal fin of female slightly in advance to slightly behind dorsal; dorsal fin of males often very high; dorsal fin of 7 to 16 rays; anal fin of male modified into an intromittent organ, the first prolonged ray bearing a small antrorse spine at or near its end, the last ray bearing a process directed outward and towards the base of the fin; intestinal canal long and with numerous convolutions; vertebræ about 17+18.

KEY TO THE SPECIES.

- a. Dorsal fin with 7 to 11 rays.
- b. Origin of dorsal slightly in advance of anal.
- c. Dorsal fin with 10 or 11 rays; anal with 10 rays; dorsal and caudal fins spotted with black. *sphenops*, p. 326.
- cc. Dorsal fin with 7 or 8 rays; anal fin with 8 or 9 rays; dorsal fin with a dark spot on its base, the rest of dorsal and caudal fin unspotted. *caucana*, p. 329.
- bb. Origin of dorsal slightly behind that of anal; dorsal and caudal with a series of transverse spots. *cuneata*, p. 329.
- aa. Dorsal rays 11 to 13; origin of dorsal a little nearer base of caudal than end of snout. *formosa*, p. 330.

63. *Mollienisia sphenops* (Cuvier & Valenciennes). Paribiba.

Pacilia sphenops Cuvier & Valenciennes, Hist. Nat. Poiss., XVIII, 1846, 130, Pl. 526 (Vera Cruz, Mexico); Günther, Cat. Fish. Brit. Mus., VI, 1866, 343 (Vera Cruz, Mexico); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 694; Regan, Biol. Cent. Amer., Pisces, 1907, 102 (Streams near Panama).

*Meek, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1912, 71.

Xiphophorus gillii Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München, X, 1864, 28, Pl. IV, fig. 1 (Rio Chagres, Panama).

Platyæcilus mentalis Gill, Proc. Ac. Nat. Sci. Phila., 1876, 335 (Panama); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 686.

Pæcilia boucardi Steindachner, Sitzb. K. Ak. Wiss. Wien, LXXVI, 1878, 386, Pl. III, figs. 2 & 3 (Colon, Panama); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 695; Gilbert & Starks, Mem. Cal. Acad. Sci., 1904, 51 (Streams near Panama).

Pæcilia gillii Garman, Mem. Mus. Comp. Zool., XIX, 1895, 63 (Panama).

Molliensia sphenops Regan, Proc. Zool. Soc. London, 1913, 1012, fig. 173, F (in part); Henn, Ann. Carnegie Mus., X, 1916, 136 (Cartagena, Colombia).

Head 3.15 to 4; depth 2.65 to 3.75; D. 10 or 11; A. 10; scales 27 to 30.

Body compressed; head depressed, flat above; snout broad, its length 3.2 to 4 in head; eye 3.1 to 3.9; interorbital 1.85 to 2.4; mouth small, the cleft transverse; teeth in the outer series slender, movable, somewhat broadened and hooked at apex; inner teeth in a band, small, tricuspid; scales moderate, cycloid, 8 longitudinal rows between base of dorsal and anal; origin of dorsal in female a little in advance of anal, and somewhat nearer end of snout than tip of caudal, its base about equal to length of longest rays; in the male this fin is much higher and the base is equal to about two-thirds the length of the longest rays; caudal fin scaly at base, its margin rounded; anal fin in female inserted about equidistant from end of snout and tip of caudal, the anterior rays not produced; in the male this fin is inserted equidistant from end of snout and base of caudal, the produced portion 1.2 to 1.45 in head, the first and the two branches of the second produced ray of about equal length, the anterior ray bearing a small antrorse hook at apex, the third with a process directed downward and backward at its apex; in advance of the intromittent organ lies a sort of hood which is not attached to the distal portion of this organ; ventral fins normal in the female, reaching vent; in the male the first articulated ray is produced, reaching notably beyond base of anal; pectoral fins rather long, 1.05 to 1.7 in head.

Color olivaceous, dorsal and caudal fins with dark dots. The color of specimens from salt and brackish water is more variable than those taken in fresh water. The markings on Atlantic slope specimens are more distinct than on those from the Pacific side. The color markings of specimens from Colon agree with those from Vera Cruz, Mexico; most of the specimens have a black spot on each scale forming lines along the rows. These spots are seldom present on the Pacific side specimens and when present are not very distinct. The males often have

the basal half of the dorsal and caudal fins black, the distal half of the latter often yellow, a condition not conspicuous on west coast specimens.

The fresh water individuals are much more uniform in color, and usually smaller than those from salt and brackish water. Those taken from fresh water might be regarded as a variety under the name *Mollienisia sphenops gillii* (Kner & Steindachner).

This species is represented by numerous specimens in the present collection. The largest females are 100 and the largest males 78 mm. in length. It occurs abundantly in quiet ponds and arms of the rivers and creeks of both slopes of Panama, but not in the Rio Tuyra Basin.

The males of this species are so large that they are pretty certainly caught along with the females and do not escape through the meshes of the net, as has been stated of other viviparous species of this family, in explanation of the small number of male specimens occurring in collections. For this reason we have counted 2,142 specimens collected at various points and on various dates during two periods of the two years during which these collections were made. Among this number there are 579 males or nearly 3.7 females to every male. The disparity of males to females is, however, believed, in reality, to be greater than these figures indicate, for this species was many times taken in such abundance that only a small number of them was preserved. In such

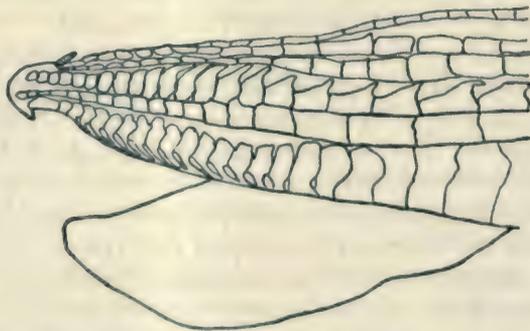


FIG. 10. DISTAL PART OF INTROMITTENT ORGAN OF *Mollienisia sphenops* (Cuvier & Valenciennes). (Greatly magnified.)

cases, due to the fact that the males are more brightly colored and thus more conspicuous, it is quite probable that more than their proportionate number was selected, although we do not remember that any particular attention was given to this matter at the time.

Habitat: Coasts and rivers from Sinaloa, Mexico, both slopes of Panama, south to eastern Colombia, Venezuela and the Leeward Islands.

64. *Mollienisia caucana* (Steindachner).

Girardinus caucanus Steindachner, Denkschr. K. Ak. Wiss. Wien, XLII, 1880, 87, Pl. VI, figs. 4 & 5 (Caceres, Colombia), and Denkschr. K. Ak. Wiss. Wien, LXXII, 1902, 146 (Baranquilla, Colombia).

Pæcilia caucana Regan, Biol. Cent. Amer., Pisces, 1908, 190.

Mollienisia sphenops Regan, Proc. Zool. Soc. London, 1913, 1012 (in part).

Head 3.35 to 3.7; depth 3.6 to 4; D. 7 or 8; A. 8 or 9; scales 28 to 30.

Body compressed; head slightly depressed, flat above; snout rather broad, 3.2 to 4.4 in head; eye 3 to 3.75; interorbital 2.3 to 2.7; mouth small, the cleft transverse; teeth and scales as in preceding species; origin of dorsal in female over origin of anal, a little nearer end of snout than tip of caudal; slightly more anteriorly situated in male; caudal fin scaly at base, the margin rounded; anal fin in female inserted a little nearer end of snout than tip of caudal; in the male this fin is inserted somewhat nearer end of snout than base of caudal, the modified portion usually about equal to length of head, its structure apparently identical with that of the preceding species; ventral fins in females reaching vent, the outer ray produced in males, reaching beyond base of anal; pectoral fins moderate, 1.2 to 1.66 in head.

Color of the sexes similar, olivaceous; dorsal fin with a dark blotch at base of the middle rays; fins otherwise unmarked.

This species is represented by 22 specimens in the present collection. The largest female is 35 and the largest male 30 mm. in length. It was taken by us at only two places, Aruza and Cituro, in the Rio Tuyra Basin. This is the only species of *Mollienisia* collected in that river basin.

This species is apparently closely related to *M. sphenops*, but differs in color, and in the number of dorsal and anal rays.

Habitat: Pacific slope of southeastern Panama and the eastern slope of Colombia.

65. *Mollienisia cuneata* (Garman).

Pæcilia cuneata Garman, Mem. Mus. Comp. Zool., XIX, 1895, 62, Pl. V, fig. 3 (Turbo, Gulf of Darien).

Head 4; D. 8 to 10; A. 9 or 10; scales 28 or 29.

Body short and deep; caudal peduncle deep; head depressed, broad and flat; snout as long as eye; mouth wide, the jaws weak and loosely joined; outer series of teeth slender, oar-shaped, movable; inner bands small, pointed; eye half interorbital space, its length $3\frac{1}{2}$ in head; origin of dorsal over third ray of anal, midway from base of caudal to head:

anal of female small, its third ray the longest; modified anal of male shorter than the head; ventrals small, not reaching anal; caudal deep, its posterior margin rounded.

Color brownish, bases of scales dark; dorsal region dark, the ventral region silvery; dorsal with one to several transverse series of small spots of black, the fin sometimes black tipped; caudal with small spots of black on basal half, or with a couple of clouded transverse bands; the fins uniform or punctulate. (Garman.)

This species was not seen by us.

66. *Mollienisia formosa* (Girard).

Limia formosa Girard, Proc. Ac. Nat. Sci. Phila., 1859, 115 (Palo Alto, Mexico).

Mollienisia formosa Günther, Cat. Fish. Brit. Mus., VI, 1866, 349; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 699; Regan, Proc. Zool. Soc. Lond., 1913, 1012 (Tampico, Mexico; Colon, Panama).

Head 3.3 to 4; depth 2.5 to 3; D. 11 to 14; A. 9 or 10; scales 26 to 28.

Body rather robust; eye 3 to 3.5 in head; interorbital 1.7 to 2; origin of dorsal a little nearer the base of caudal than the end of the snout; origin of anal below fourth ray of dorsal; pectoral shorter than the head; caudal fin rounded; least depth of caudal peduncle, 1.3 to 1.6 in head; modified anal of male 1.3 in head.

Color olivaceous; scales with brown spots; dorsal fin with transverse series of blackish spots, other fins plain.

This species is recorded from Colon by Regan. It does not occur in our collections.

Habitat: Atlantic slope of Mexico and Central America.

42. Genus *Rivulus* Poey.

Rivulus Poey, Memorias, II, 1858, 307 & 383 (type *Rivulus cylindraceus* Poey).

Cynodonichthys Meek, Field Col. Mus. Pub., Zool Ser., V, 1904, 101 (type *Cynodonichthys tenuis* Meek).

Slender fishes with subterete body; mouth small, the branches of the lower jaw firmly united; teeth conical, in bands, the outer ones enlarged and curved; one or two teeth on each side usually enlarged and canine-like; margin of eyes not free; pectorals obtuse, low; caudal rounded or subtruncate; dorsal small, over posterior part of the much longer anal; oviparous; air bladder large; alimentary canal short, about $\frac{2}{3}$ to $\frac{3}{4}$ length of body.

KEY TO THE SPECIES.

- a. Dorsal fin with 7 rays; anal with 11 or 12 rays; depth 5 to 6 in length. *elegans*, p. 331.
aa. Dorsal fin with 9 or 10 rays; anal with 13 or 14 rays; depth 4.35 to 4.9 in length. *brunneus*, p. 331.

67. *Rivulus elegans* Steindachner.

Rivulus elegans Steindachner, Denkschr. K. Ak. Wiss. Wien, XLII, 1880, 85, Pl. VI, fig. 6 (Rio Cauca); Regan, Ann. & Mag. Nat. Hist., Ser. 8, X, 1912, 498 (Rio Condoto, Colombia), and Ann. & Mag. Nat. Hist., Ser. 8, X, 1913, 471; Henn, Ann. Carnegie Mus., X, 1916, 108 (Rio Condoto and Rio Truando, Colombia).

Head 3.33 to 3.85; depth 5 to 6; D. 7; A. 11 or 12; scales 33 to 35.

Body long, slender, posteriorly compressed; head depressed, wider than deep; snout broad, 3.5 to 4.3 in head; eye 3 to 3.75; interorbital broad, 2.15 to 2.6; mouth rather small, oblique; lower jaw projecting; teeth in the jaws in bands, the outer ones enlarged, curved inward; scales cycloid, with prominent circuli, 7 or 8 longitudinal rows of scales between base of dorsal and anal; origin of dorsal over posterior one-fourth of anal, and about midway between gill-opening and tip of caudal or slightly nearer the former, the base of the last ray a little behind vertical from base of last anal ray; caudal fin strongly rounded; anal fin inserted notably nearer tip of caudal than tip of snout, the length of its base scarcely equal to the greatest width of head; ventral fins small, about as long as diameter of eye, reaching origin of anal; pectoral fins moderate, not reaching base of ventrals, 1.3 to 1.8 in head.

Color brownish, sides more or less speckled with dark spots. Most of our specimens with a dark ocellus at base of upper rays of caudal; lower lobe of caudal with or without a black stripe extending from under side of caudal peduncle to end of caudal rays, forming an intramarginal bar. Dorsal and anal more or less dusky.

There are 22 specimens in the present collection, ranging in length from 26 to 38 mm. All were taken in small brooks near the water shed on the Atlantic slope at Culebra.

R. elegans is very probably identical with *R. godmani* Regan.

Habitat: Panama, south to Colombia.

68. *Rivulus brunneus* Meek & Hildebrand.

Rivulus brunneus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 86 (Toro Point, Canal Zone, Panama).

Head 3.3 to 3.7; depth 4.35 to 4.9; D. 10, rarely 9; A. 13 or 14, rarely 12; scales 34 to 38.

Body rather robust, posteriorly compressed; head depressed, wider than deep; snout short, 3.65 to 4.25 in head; eye 3.2 to 3.8; interorbital 2.2 to 2.65; mouth small, the cleft scarcely lateral; teeth pointed, in bands in the jaws, the outer ones somewhat enlarged, curved inward; scales rather small, cycloid, the circulae strongly developed; 8 longitudinal rows of scales between base of dorsal and base of anal; origin of dorsal over middle of base of anal or slightly posterior to this point, and somewhat nearer tip of caudal than posterior margin of eye, the base of its last ray slightly behind vertical from base of last ray of anal; caudal fin rounded; anal fin inserted midway between the tip of snout and tip of caudal or slightly nearer the former, its margin convex, the length of the base equal to the greatest width of head; ventral fins small, about as long as diameter of eye, reaching vent; pectoral fins moderate, failing quite notably to reach base of ventrals, 1.6 to 1.8 in head.

Color brownish, sides more or less speckled with darker; dorsal and caudal with or without faint, dark spots; a black stripe from under side of caudal peduncle to end of caudal rays usually present, forming an intramarginal bar; on some specimens there is a similar bar on the upper lobe of the caudal fin, although less distinct. In life the upper parts of the body are grayish with shades of pink, and the belly is pale and also has a shade of pink. The fins are all reddish, and the base of caudal and anal are deep red.

Of this species we have 17 specimens, ranging in length from 35 to 50 mm. All are from the upper course of a small creek at Toro Point.

Order IV. Acanthopterygii.

THE SPINY-RAYED FISHES.

Spines normally present in the anterior part of the dorsal and anal fins; border of the mouth formed by the premaxillary; ventral fins usually thoracic; anterior vertebræ unmodified; opercular bones all present.

Family IX. Mugilidæ.

Body elongate, more or less compressed; mouth small, terminal or inferior; teeth, if present, small, various in form; premaxillaries protractile; gill-openings wide, the membranes free from the isthmus; gill-rakers usually long and slender; gills 4, a slit behind the fourth;

lateral line usually absent, never complete; scales large, extending forward on head; dorsal fins 2, well separated, the first composed of 4 rather strong spines; second dorsal with one spine and from 7 to 10 soft rays; caudal fin forked; anal fin with 2 or 3 spines and 7 to 11 soft rays; ventral fins abdominal, each with one spine and 5 branched rays; pectoral fins placed high.

The genera *Agonostomus* and *Joturus* comprise fresh water species and are dealt with in the present paper. The marine species of this family will be discussed in another work.

KEY TO THE GENERA.

- a. Snout scarcely in advance of upper lip; teeth in lower jaw in a continuous band; dorsal spines rounded, not prominently compressed. *Agonostomus*, p. 333.
- aa. Snout projecting beyond upper lip; teeth in lower jaw in two lateral patches, not confluent anteriorly; dorsal spines notably compressed. *Joturus*, p. 336.

43. Genus *Agonostomus* Bennett.

Agonostomus Bennett, Proc. Comm. Zool. Soc., I, 1831, 166 (type *Agonostomus telfairii* Bennett).

Neomugil Valliant, Bull. Soc. Philom. Paris, IV, 1894, 73 (type *Neomugil digueti* Valliant.)

Body elongate, compressed; mouth terminal in young, subinferior in adult, the cleft extending laterally to or past front of eye, the lower lip not greatly thickened; teeth in bands on jaws, vomer and palatines, those on jaws with lance-shaped apices or serrated margins; first dorsal with 4 rounded spines; anal spines 2, the first one minute, often hidden in the skin; stomach not gizzard-shaped. Inhabiting tropical rivers, some of them living in mountain torrents.

The American species of this genus have been described in current works as having pointed teeth in the jaws. This is certainly not true of the specimens at hand, either from Panama or Cuba. The outer series in each jaw is mostly composed of lance-shaped teeth and the inner ones nearly all have a serrated margin.

KEY TO THE SPECIES.

- a. Body comparatively slender, the depth 3.7 to 3.85 in its length in specimens about 150 mm. long; mouth rather small, the maxillary reaching to or slightly past vertical from anterior margin of eye. *monticola*, p. 334.

- aa. Body somewhat deeper, the depth 3.1 to 3.3 in length in specimens about 150 mm. long; mouth large, the maxillary reaching nearly to vertical from middle of eye. *macracanthus*, p. 335.

69. *Agonostomus monticola* (Bancroft).

Mugil monticola Bancroft, in Griffith's Edition Cuvier's Animal Kingdom, Fishes, 1836, 367, Pl. 36 (West Indies).

Agonostoma monticola Günther, Cat. Fish. Brit. Mus., III, 1861, 464 (West Indies).

Agonostoma nasutum Günther, Cat. Fish. Brit. Mus., III, 1861, 463 (Rio San Geronimo, Guatemala), and Trans. Zool. Soc. London, 1868, 444, Pl. 70, fig. 1.

Neomugil digueti Valliant, Bull. Soc. Philom., IV, 1894, 73 (Lower California).

Agonostomus monticola Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 819, fig. 347; Regan, Biol. Cent. Amer., Pisces, 1907, 66; Meek, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1914, 118 (both slopes of Costa Rica).

Agonostomus nasutus Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 819; Regan, Biol. Cent. Amer., Pisces, 1907, 68, Pl. X, fig. 4.

Head 3.4 to 4.1; depth 3.1 to 4.1; D. IV-I, 8; A. II, 10; scales 39 to 43.

Body compressed; upper profile gently convex; head rather small; snout conical, 3.2 to 4.1 in head; eye 3 to 4.9; interorbital 2.85 to 3.4; mouth moderate, nearly horizontal; upper jaw somewhat in advance of the lower; upper lip various, thin, moderately thick, or very thick, its upper margin elevated or not at tip of snout; maxillary reaching to or a little past vertical from anterior margin of eye, 2.6 to 3.2 in head; teeth in bands on jaws, vomer and palatines, the jaw teeth mostly with serrate margins, some with lance-shaped apices; gill-rakers rather short, 17 to 20 on lower limb of first arch; scales rather large, ctenoid, extending forward to interorbital area, about 12 rows between anterior rays of second dorsal and anal; origin of first dorsal notably nearer tip of snout than base of second dorsal, the anterior 2 spines of equal length posteriorly when deflexed, the first one somewhat longer than eye and snout; origin of second dorsal nearer origin of the first dorsal than base of caudal, the outer margin of the fin concave; caudal fin with small scales on basal half, moderately forked; anal fin similar to second dorsal, but a little longer, its origin slightly in advance of second dorsal, with 2 spines, the first one minute and hidden in the skin in adult; ventral fins inserted under middle of pectorals, a little nearer origin of anal than tip of snout; pectoral fins placed high, of about the same length as ventrals, 1.32 to 1.5 in head.

Color bluish black above; sides mostly silvery, the margin of scales brown; pale below. Very young often with a dark lateral band, which later becomes only faintly visible. A dark caudal spot present at all ages, but most distinct in young. The spines of first dorsal black, the membranes yellowish green; second dorsal and caudal yellowish green at base; ventrals yellow; pectorals plain translucent. Very young sometimes with reddish fins.

There are 118 specimens, ranging from 40 to 255 mm. in length, in the present collection which we have identified as this species. These were collected at various points on both slopes of Panama, mostly in the lowland streams, some even were taken in brackish water, and a few are from upland streams. On the Atlantic slope it was taken at several points in the Chagres Basin and in small coastal streams at Porto Bello and Toro Point. On the Pacific slope it was found everywhere, except in the Rio Tuyra Basin.

After careful study of our material, together with specimens from Cuba and Guatemala, we find it impossible to retain the two nominal species, *A. monticola* and *A. nasutus*. The only reason for keeping the two separate heretofore apparently was the alleged difference in the thickness of the upper lip. We, however, find that in our large series this is a variable character upon which no reliance can be placed. We have specimens with a thin upper lip, some with a thick lip, and nearly all stages between. These occur indiscriminately on both slopes, and in the same rivers and pools. However, the thick-lipped form occurs more frequently among our Pacific slope specimens than among those from the Atlantic.

Habitat: Mexico; Central America; both slopes of Panama and the West Indies.

70. *Agonostomus macracanthus* Regan.

Agonostomus macracanthus Regan, Ann. & Mag. Nat. Hist., Ser. 7, XIX, 1907, 65, and Biol. Cent. Amer., Pisces, 1907, 69, Pl. XI, fig. 1 (Rio Guacalate, Guatemala).

Head 3.4 to 3.55; depth 3.1 to 3.3; D. IV-I, 8; A. II, 12; scales 41 to 42.

Body compressed, rather deep; head low; snout conical; 3.25 to 3.55 in head; eye 4.34 to 4.9; interorbital 3.05 to 3.25; mouth rather large, slightly oblique; the upper jaw projecting; the upper lip quite thick; maxillary reaching nearly to vertical from middle of eye, 2.44 to 2.6 in head; teeth as in preceding species; gill-rakers short, about 20 on lower limb of first arch; scales large, ctenoid, extending forward to interorbital region, about 12 rows between anterior rays of second dorsal and

anal; origin of first dorsal about midway between tip of snout and base of caudal, the first spine equal to or shorter than the second, not longer than eye and snout; origin of second dorsal notably nearer origin of first dorsal than base of caudal, margin of fin concave; caudal fin with small scales on basal half, moderately forked; anal fin similar to second dorsal but a little longer, with 2 spines, the first one minute and often hidden in the skin, its origin under or slightly in advance of second dorsal, midway between base of ventrals and base of caudal; ventral fins inserted under middle of pectoral, somewhat nearer origin of anal than tip of snout; pectoral fins placed high, of about the same length as the ventrals, 1.4 to 1.65 in head.

Color bluish black above; sides silvery, with margin of scales brown; pale below. An indefinite dark lateral streak, with a silvery one above it, most evident on posterior part of body; a dark caudal spot present. Spines of first dorsal black, the membranes greenish; second dorsal, caudal and distal half of anal dusky; ventrals and pectorals plain in spirits, except that the upper ray of pectoral is black.

There are only 2 specimens of this species in the present collection, respectively 173 and 205 mm. in length. Both specimens were taken at the base of a waterfall near the mouth of the Rio Indio, a tributary of the Upper Chagres.

This species differs from the preceding principally in the somewhat deeper body and in the notably larger mouth.

Habitat: Rio Guacalate, Guatemala; Rio Chagres, Panama.

44. Genus *Joturus* Poey.

Joturus Poey, *Memorias*, II, 1861, 263 (type *Joturus pichardi* Poey).

Xenorhynchichthys Regan, *Ann. & Mag. Nat. Hist.*, Ser. 8, II, 1908, 461 (type *Joturus stipes* Jordan & Gilbert).

Snout protruding beyond upper lip; teeth in lower jaw in two lateral patches which do not meet anteriorly; dorsal spines compressed. In other respects essentially as in *Agonostomus*. One species known, living at the foot of waterfalls and rapids.

71. *Joturus pichardi* Poey.

Joturus pichardi Poey, *Memorias* II, 1861, 263 (Cascades throughout Cuba); Jordan & Evermann, *Bull. U. S. Nat. Mus.*, XLVII, 1896, 821; Regan, *Biol. Cent. Amer.*, Pisces, 1907, 70; Meek, *Field Mus. Nat. Hist. Pub.*, Zool. Ser., X, 1914, 117 (both slopes of Costa Rica). *Agonostoma globiceps* Günther, *Ann. & Mag. Nat. Hist.*, Ser. 4, XIV, 1874, 370 (Myzantla, Vera Cruz).

Joturus stipes Jordan & Gilbert, Proc. U. S. Nat. Mus., V, 1882, 373 (Rio Bayano, Panama).

Xenorhynchichthys stipes Regan, Ann. & Mag. Nat. Hist., Ser. 8, II, 1908, 461 (Rio Iroquois, Costa Rica).

Head 4 to 4.27; depth 3.2 to 3.9; D. IV-I, 9; A. II, 11; scales 43 to 45.

Body elongate, compressed; the dorsal region somewhat elevated; profile from snout to first dorsal evenly convex; head rather low and broad; snout conical, projecting beyond upper lip, 2.75 to 3.4 in head; eye small, 4 to 6.5; interorbital broad, 1.93 to 2.7; mouth moderate, horizontal, inferior; lower jaw included; maxillary reaching about to vertical from middle of eye, 2.3 to 3.1 in head; teeth in the jaws compressed, with serrate margins, those of the upper jaw in a narrow, continuous band, those of the lower jaw in 2 lateral patches, not meeting anteriorly; vomerine teeth in a transverse patch; palatine teeth minute, in a very narrow band; pterygoid teeth, if present, very minute; gill-rakers short, about 30 below angle on first arch; scales large, ctenoid, extending forward to nostrils, 12 to 14 longitudinal rows between base of second dorsal and anal; origin of first dorsal a little nearer base of last ray of second dorsal than tip of snout, the spines notably compressed, the first one reaching slightly past tip of the second when deflexed, equal to about two-thirds length of head; second dorsal, caudal and anal mostly covered with small scales; origin of second dorsal somewhat nearer origin of first than base of caudal, its outer margin concave; caudal fin forked, the lobes of about equal length; anal fin similar to second dorsal, its origin under or slightly in advance of origin of second dorsal, and about midway between base of ventrals and base of caudal; ventral fins inserted under middle of pectorals, about midway between tip of snout and origin of anal; pectoral fins somewhat longer than ventrals, 1.1 to 1.3 in head.

Color in life, of a specimen about 200 mm. in length, very dark green above, with the base of scales green and the margin black; sides lighter green with the margin of the scales brown; pale below. Dorsal fins black at base with broad yellowish green margins; caudal and anal black at base, otherwise irregularly blotched with black and yellow; ventrals and pectorals dark at base and yellowish at tips. The young have two oblique bars on each lobe of the caudal and two similar ones on second dorsal and anal. In large examples these markings completely disappear.

We have 26 specimens of this species, ranging from 150 to 460 mm. in length. Most of our specimens were taken by a discharge of dynamite below a waterfall near the mouth of the Rio Indio, a tributary of the Upper Chagres. The others were taken by natives with hook and

line at Gatun, at the "Spill-way," which creates an artificial waterfall. We did not obtain it on the Pacific slope, although it is recorded from the Rio Mamoni.

This fish is said to reach a length of one meter and is much valued as food.

Habitat: Southern Mexico to Panama and Cuba.

Family X. Cichlidæ.

THE MOJARRAS.

Body elongate, compressed, covered with ordinary scales, which are usually ctenoid; lateral line interrupted under soft portion of dorsal, reappearing lower down on caudal peduncle; mouth large or small, terminal to subinferior; teeth conical, incisor-like, or lobate; vomer and palatines without teeth; premaxillaries freely protractile; the maxillary usually slipping under the broad preorbital; nostril single on each side; dorsal fin single, the spinous portion usually longer than the soft portion; gill-membranes usually connected and free from the isthmus; air bladder present; ventral fins I, 5, thoracic; anal fin with 3 or more spines, the soft portion smaller, though similar to that of dorsal; branchiostegals 5 or 6; no pseudobranchiæ.

A large family of fresh water fishes inhabiting the lowland streams of Mexico and the waters of Central and South America and Africa. Only a few species occur in Panama.

KEY TO THE GENERA.

- a. Anal fin with 3 spines.
- b. First gill-arch normal, without a lamelliform lobe above angle; snout usually shorter than postorbital part of head. *Æquidens*, p. 338.
- bb. First gill-arch with a lamelliform lobe above angle; snout much longer than postorbital part of head. *Geophagus*, p. 340.
- aa. Anal fin with more than 3 spines.
- c. Teeth all conical. *Cichlasoma*, p. 342.
- cc. The outer series of teeth in both jaws compressed, incisor-like. *Nectroplus*, p. 348.

45. Genus *Æquidens* Eigenmann & Bray.

Æquidens Eigenmann & Bray, Ann. N. Y. Ac. Sci., VII, 1894, 616 (type *Acara tetramerus* Heckel).

Body robust, compressed; mouth small, the premaxillary not greatly protractile; gill-rakers minute; margin of lower lip free at sides; teeth conical, none of them canine-like; anal spines 3; upper portion of anterior gill-arch without a lamelliform lobe.

This genus contains a large number of species which inhabit the waters of South America, one species only occurring as far north as Panama.

72. *Æquidens cœruleopunctatus* (Kner & Steindachner).

Acara cœruleopunctata Kner & Steindachner, Sitzungsber. K. Bayer. Ak. Wiss. München, 1863, 222, and Abhandl. K. Bayer. Ak. Wiss. München, X, 1864, 16, Pl. II, fig. 3 (Rio Chagres, Isthmus of Panama); Günther, Trans. Zool. Soc. London, VI, 1869, 449 (Rio Chagres); Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1880, 56 (Rio Cauca); Regan, Ann. & Mag. Nat. Hist., Ser. 7, XV, 1905, 336, and Biol. Cent. Amer., Pisces, 1906, 16 (Rio Chagres, Panama; N. W. Ecuador).

Æquidens cœruleopunctatus Eigenmann & Bray, Ann. N. Y. Ac. Sci., VII, 1894, 616; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 1514.

Head 2.6 to 2.78; depth 2 to 2.3; D. XIV or XV, 9 to 11; A. III, 7 or 8.

Body robust; anterior profile strongly convex; head short and heavy; snout blunt, 2.53 to 3.8 in head; eye 3 to 4.45; interorbital much broader than eye, except in very young; preorbital broader than eye in large examples, but notably narrower than eye in young; mouth terminal, rather small; the maxillary failing to reach eye, 3.1 to 3.8 in head; lips not thickened, the margin of lower lip free at sides only; teeth in the jaws conical, forming a band in each jaw; gill-membranes broadly connected across isthmus; gill-rakers short, about 8 on lower arm of first arch; lateral line interrupted under anterior rays of soft portion of dorsal, reappearing on third row below its original course; scales rather large, cycloid, 1½ to 2 rows between lateral line and middle of base of dorsal; dorsal fin long, its origin over posterior margin of opercle, the spines rather short and strong, the last one 2.2 to 3.3 in head, the soft portion much elevated in large examples, the produced rays often reaching nearly to tip of caudal, none of the rays much produced in the young and not reaching far beyond base of caudal; caudal fin scaly at base, its margin convex; anal fin with 3 strong spines, the soft portion similar to that of dorsal; ventral fins inserted a little behind base of pectorals, reaching origin of anal in young, a few of the rays produced in adult reaching opposite the soft portion of anal; pectoral fins rather long, .97 to 1.15 in head.

Color in life of a large example: Back bluish black, pale brownish below; sides with 4 indistinct cross-bars, a dark blotch on sides below last half of spinous portion of dorsal; cheeks with 2 distinct blue-green lines and numerous spots of the same color; these spots are also present on sides and breast; base of caudal with a large black spot. Dorsal fin bluish black, the soft rays with a tinge of deep red and with a yellow margin; caudal fin reddish blue with darker spots; anal fin dark blue, the last rays reddish at tips; ventral fins slate; pectorals greenish. The dark cross-bars on sides more numerous and more distinct in young. Cheeks, sides and chest without blue-green lines or spots; fins all paler and without red.

Considerable variation in color is evident among our specimens. Individuals taken in muddy streams are much duller, and do not possess any blue-green lines and spots.

Of this species there are numerous specimens in the present collection, ranging in length from 25 to 157 mm. One of the most abundant species in the streams of Panama, occurring on both slopes, from tide water to the highest mountain streams.

Habitat: Both slopes of Panama and south to Colombia, and Ecuador.

46. Genus *Geophagus* Heckel.

Geophagus Heckel, Ann. Wiener Mus., II, 1840, 383 (type *Geophagus altifrons* Heckel = *Sparus surinamensis* Bloch).

Satanoperca Günther, Cat. Fish. Brit. Mus., IV, 1862, 312 (type *Geophagus acuticeps* Heckel).

Body oblong, compressed; mouth moderate; jaws with conical teeth; premaxillary moderately protractile; outer gill-arch with a compressed lamelliform lobe above, gill-rakers at or near its margin; margin of lower lip not free at its middle; caudal fin emarginate to slightly forked; anal spines 3.

One species of this genus is known to occur in Panama, its range not extending northward far beyond the Canal Zone.

73. *Geophagus crassilabris* Steindachner.

Geophagus (*Satanoperca*) *crassilabris* Steindachner, Sitzb. K. Ak. Wiss. Wien, LXXIV, 1876, 65, Pl. VII (Vicinity of Candelaria, Isthmus of Panama).

Satanoperca crassilabris Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 1542.

Geophagus crassilabris Pellegrin, Étude Pois. Fam. Cichlidés, Lille, 1904, 160 (Isthmus of Panama); Regan, Biol. Cent. Amer., Pisces, 1906, 16.

Head 2.46 to 3.13; depth 2.35 to 2.95; D. XVI, 9 or 10; A. III, 7 or 8; scales 29 to 31.

Body rather deep, compressed; the back elevated; anterior profile distinctly convex in young, straight in adults not possessing a nuchal hump, concave in specimens with nuchal hump; head deep; snout long and pointed in adult, much shorter and more blunt in young, equal to half length of head in specimens about 125 mm. in length, much greater than half length of head in large specimens and much shorter than half head in very young, 1.6 to 4 in head in specimens ranging from 30 to 263 mm. in length; eye circular, placed high, lower margin of pupil about on level with upper angle of gill-opening, 2.95 to 5.85 in head; preorbital broad, about 2 times diameter of eye in large examples, equal to or a little less than diameter of eye in very young; mouth moderate, horizontal; maxillary failing to reach anterior margin of eye, 2.6 to 3.65 in head; jaws equal or the upper slightly projecting; the lips thickened, the lower with a fleshy lobe on each side; teeth conical, in bands in each jaw; gill-membranes broadly connected across isthmus; gill-rakers short, about 13 on lower limb of first arch; lateral line interrupted under soft portion of dorsal, reappearing on the third row of scales below its original course; scales of moderate size, feebly ctenoid, from 2 to 3½ rows between lateral line and middle of base of dorsal; dorsal fin long, its origin over posterior margin of opercle, the spines rather short and strong, the last one 2.7 to 3.3 in head, the soft portion varying greatly in length among different individuals, usually reaching base of caudal, a few of the rays occasionally produced and reaching far beyond this point; caudal fin scaly at base, its margin concave; anal fin short, the spines strong, the soft portion similar to that of dorsal; ventral fins inserted slightly behind base of pectorals, reaching to or past vent; pectoral fins moderate, 1.2 to 1.5 in head.

Color in life greenish brown above, yellowish below. Sides in young with well defined black cross-bars, these less distinct in adult; very young also with a black lateral band. Lips and gill-membranes blue in adult. Dorsal, caudal, anal and ventrals reddish yellow in adult, more greenish in young; pectorals greenish.

This fish is represented by numerous specimens, ranging from 30 to 263 mm. in length. It is common in the streams on both slopes of Panama.

There is considerable variation with respect to the development of the soft portion of the dorsal and anal fins and the number of rows of scales between the lateral line and base of dorsal, but our large series is ample to show that these are only individual variations.

Habitat: Isthmus of Panama.

47. Genus *Cichlasoma* Swainson.

Cichlasoma Swainson, Nat. Hist. Class. Fishes, Amph. and Rept., II, 1839, 230 (type *Sciæna bimaculata* Linnæus).

Theraps Günther, Cat. Fish. Brit. Mus., IV, 1862, 284 (type *Theraps irregularis* Günther).

Parapetenia Regan, Ann. & Mag. Nat. Hist., Ser. 7, XVI, 1905, 324 (type *Acara adspersa* Günther).

Body ovate to oblong, compressed; mouth rather small to large; premaxillary moderately protractile, the maxillary slipping under the preorbital; fold of the lower lip continuous or not; teeth conical, to slightly compressed in a few species; a few anterior teeth canine-like in species with large mouths; anal spines IV to XI.

To this genus belong many species, some are deep, others more or less elongate. In many of the species the mouth is small, the gape horizontal or nearly so, and the anterior teeth conical to slightly compressed. In others the mouth is terminal, oblique, and with some of the anterior teeth enlarged and canine-like. The efforts to break this group into several genera or subgenera have not met with much success, since the characters on which they have been based are too variable and overlap. Only five species are known to occur in central and eastern Panama.

KEY TO THE SPECIES.

- a. The outer series of teeth in the jaws somewhat enlarged, and regularly increased in size anteriorly; mouth small or moderate; the maxillary not reaching past vertical from anterior margin of eye.
- b. Lower lip narrow, its margin not free at symphysis; teeth all sharply pointed.
- c. A large black blotch present at base of caudal, and usually with another large black blotch on sides under tips of pectorals; sides without distinct cross-bars; lateral band present only in very young; scales in lateral series 31 to 33; lower lateral line on third row of scales below upper lateral line.

maculicauda, p. 343.

- cc. Young with cross-bars; adults with a single series of black blotches along middle of sides; spot at base of caudal comparatively small; black dots on rows of scales, forming dark lines; scales in lateral series 34 to 41; lower lateral line present on fifth row of scales below upper lateral line; 6 or 7 rows of scales between lateral line and base of anterior dorsal spines; anal with 6 or 7 spines.

tuyrense, p. 344.

- ccc. Body with cross-bars, forming a series of blotches on upper lateral line and a larger series on middle of sides; each scale with a dark spot; scales in lateral series 30 to 32; 4 rows of scales between lateral line and base of anterior dorsal spines; anal spines 5. *!sieboldii*, p. 345.
- bb. Lower lip broad, continuous, and free at symphysis; teeth rather blunt; young with dark cross-bars, these less distinct in adult; sides with a large, black blotch under posterior part of spinous portion of dorsal; a small black spot at base of upper half of caudal. *calobrense*, p. 346.
- aa. The anterior pair of teeth in each jaw enlarged; mouth rather large; the maxillary reaching past vertical from anterior margin of eye; sides with a dark lateral band, ending in a jet black caudal spot. *umbriferum*, p. 347.

74. *Cichlasoma maculicauda* Regan.

Cichlasoma maculicauda Regan, Ann. & Mag. Nat. Hist., Ser. 7, XVI, 1905, 227 (Lake Yzabal and Rio Motagua, Guatemala; Rio Chagres, Panama), and Biol. Cent. Amer., Pisces, 1906, 19, Pl. II, fig. 3.

Head 2.7 to 3.23; depth 1.75 to 2.1; D. XVII or XVIII, 11 or 12;

A. VI, 9 or 10; scales 31 to 33.

Body deep, compressed; anterior profile a little concave in large specimens possessing a slight nuchal hump, convex in others; head deep; snout moderate, 2.1 to 4 in head; eye 2.8 to 4.3; mouth small, terminal, slightly oblique; maxillary failing to reach anterior margin of eye, 3.4 to 4 in head; the lips not thickened, the lower one not free at middle; teeth in the jaws pointed, in 2 more or less definite series, the outer and anterior ones enlarged; gill-membranes united across isthmus; gill-rakers short, about 9 or 10 on lower limb of first arch; scales moderate, ctenoid, 5 or 6 rows between lateral line and middle of base of dorsal; lateral line interrupted under soft portion of dorsal, reappearing on the third row of scales below its original course; origin of dorsal over or slightly in advance of base of pectoral, the spines strong, the last one 1.8 to 2.5 in head, the soft portion pointed, a few of the rays somewhat produced in large examples, always reaching notably past base of caudal, its base with small scales; caudal fin scaly at base, its margin convex, more strongly so in adult than in young; anal fin with 6 strong spines, the soft portion similar to that of dorsal; the outer rays of the ventral fins somewhat produced, reaching to or past origin of anal; pectoral fins moderate, 1.14 to 1.3 in head.

Color yellowish-green to brownish, without distinct cross-bars. Lateral band present only in young (25 mm.), which also have a black

band at base of dorsal. A large black blotch present at base of caudal, and most specimens with a black blotch on middle of side under tip of pectoral. An occasional specimen also has many small dark spots on sides. Fins plain translucent, or dusky; the vertical fins often with small dark spots.

There are 237 specimens, ranging from 20 to 250 mm. in length, in the present collection. All are from the lower Chagres and its tributaries. It was frequently found abundant in very brackish water, and in Panama its range seems to be limited to the brackish and sluggish streams of the Atlantic slope.

The parents appear to guard their young for quite some time after hatching. On one occasion it was noticed that two large fishes, evidently of this species, were hovering very closely to numerous small ones, at a place where the water was quite shallow. An attempt was made to surround them with a seine. However, the adults by their very quick movement made their escape. A large number of young was taken. Only a few minutes after the seine was hauled the two large fishes reappeared and a second attempt at capturing them failed. The young were all of about equal size, ranging from 20 to 24 mm. in length.

Habitat: Lake Yzabal, Guatemala, south to Rio Chagres, Panama.

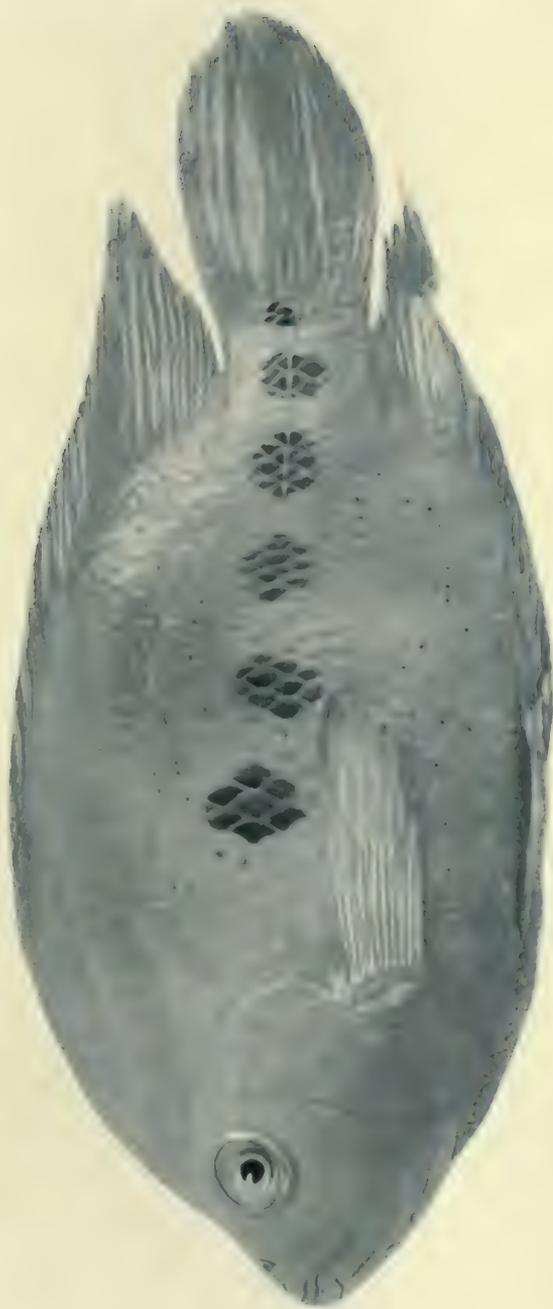
75. *Cichlasoma tuyrense* Meek & Hildebrand.

Heros margaritifera var. Steindachner, Denksch. K. Ak. Wiss. Wien, XLI, 1879, 161 (Rio Mamoni, Chepo).

Cichlasoma tuyrense Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 89 (Rio Tuyra, Boca de Cupe, Panama).

Head 2.75 to 3.45; depth 1.77 to 2.1; D. XVI to XVIII, usually XVII, 11 or 12; A. VI or rarely VII, 8 or 9; scales 34 to 41.

Body deep, compressed; anterior profile nearly straight in young, strongly convex in adult; no nuchal hump; head deep; snout moderately pointed, 2.2 to 3.4 in head; eye 3.33 to 4.3; mouth rather small, terminal, slightly oblique; maxillary failing to reach anterior margin of eye, 2.8 to 3.7 in head; the lips not thickened, the lower one not free at middle; teeth in the jaws pointed, in bands, the outer one somewhat enlarged; gill-membranes broadly connected across isthmus; gill-rakers short, about 8 on lower limb of first arch; scales rather small, weakly ctenoid, 6 or 7 rows between lateral line and middle of base of dorsal; lateral line interrupted under soft portion of dorsal, reappearing on the fifth row of scales below its original course; origin of dorsal over posterior margin of opercle, the spines strong, the last one 1.86 to 2.33 in head; the soft portion with small scales at base, pointed and reaching well past base of caudal in adult; caudal fin scaly at base, its posterior margin strongly



CICHLASOMA TUYRENSE Meek & Hildebrand.
From a specimen 200 mm. in length.

convex; anal with 6 or 7 strong spines, the soft portion similar to that of dorsal; ventral fins more or less produced, reaching to or past origin of anal; pectoral fins equal to or slightly shorter than head.

Color brownish; sides in young with dark cross-bars as wide as interspaces, in adult with a series of black blotches along median line of sides; black dots on rows of scales forming dark lines, these most distinct in large examples. Base of caudal with a short black bar or spot; the vertical fins usually with dark spots; ventral fins dusky.

This species is represented by 114 specimens, ranging from 29 to 300 mm. in length. It was taken only in the Rio Bayano and Rio Tuyra basins.

Our largest specimen sometime during its career had the lower lobe of the caudal fin broken off at its base. The fin regenerated and again formed normal rays, except that at the time of capture they had not grown as long as the uninjured portion.

This species probably resembles *C. sieboldii* (Kner & Steindachner). The last named species was based on specimens from the west slope of Panama. Our fish, however, differs so notably in several respects from the species as described that we are unable to identify our specimens with it. The body in the present species is slightly deeper; eye larger; scales in lateral line more numerous; last dorsal spine is notably longer; the pectoral fin is longer; the caudal fin is always notably rounded; and there is a single series of black blotches placed along middle of side and none on upper lateral line.

Habitat: Rio Bayano and Rio Tuyra basins.

76. *Cichlasoma sieboldii* (Kner & Steindachner).

Heros sieboldii Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München, X, 1864, 13, Pl. II, fig. 2 (New Grenada, west slope, Panama).

Cichlasoma sieboldii Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 1516; Regan, Ann. & Mag. Nat. Hist., Ser. 7, XVI, 1905, 235.

"Depth of body about $2\frac{1}{3}$ in length, length of head about $3\frac{1}{4}$. Snout as long as postorbital part of head. Diameter of eye 4-5 in length of head and $1\frac{1}{2}$ - $2\frac{1}{2}$ in interorbital width. Maxillary not extending to below eye; jaws equal anteriorly, fold of lower lip not continuous; cheek with 5 series of scales; 8 or 9 gill-rakers on lower part of anterior arch. Scales 30-32, $4/13$, $2\frac{1}{2}$ between lateral line and base of anterior part of soft dorsal. Dorsal XVII 11, the spines increasing in length to the last, which is about $\frac{1}{3}$ the length of head; soft fin, when laid back, extending nearly to middle of caudal. Anal V, 8. Pectoral $\frac{3}{5}$ - $\frac{3}{4}$ the length of head; ventral extending to the vent. Caudal sub-

truncate or slightly rounded. Caudal peduncle about $\frac{4}{5}$ as long as deep. Reddish brown, each scale with a dark spot; 5 or 6 dark cross-bars forming a series of blotches on the upper lateral line and a second larger series on the middle of the side; vertical fins dark greyish with series of blackish spots." (Regan.)

This species was not seen by us. The above description is an exact copy from Regan, *Annals and Magazine of Natural History*, Ser. 7, Vol. XVI, 1905, p. 235.

If the type of this species actually came from Panama, it is rather singular that it was not obtained there by us. *C. tuyrense* is more closely related to this species than any other taken by us, but there are such important differences that it is scarcely possible that the two are confused.

Habitat: Pacific slope of Panama.

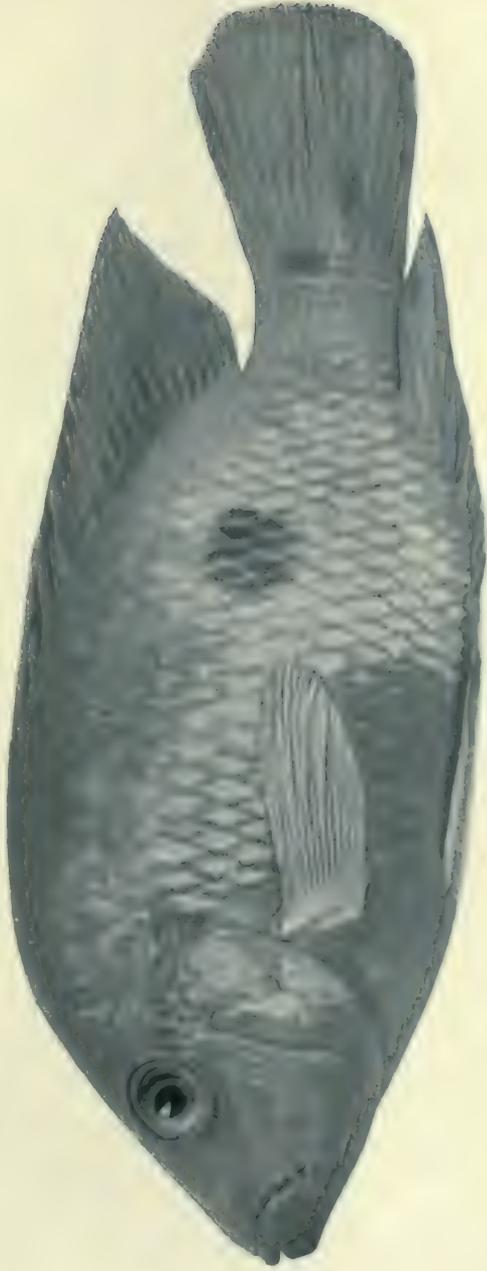
77. *Cichlasoma calobrense* Meek & Hildebrand.

Cichlasoma calobrense Meek & Hildebrand, *Field Mus. Nat. Hist. Pub., Zool. Ser.*, X, 1913, 90 (Rio Calobre, Panama).

Head 2.73 to 2.9; depth 2.13 to 2.7; D. XVII, 10 to 12; A. VI, 7 or 8; scales 28 to 31.

Body moderately elongate, compressed; head deep; snout tapering, longer than postorbital part of head (except in young less than 55 mm. in length), 1.87 to 2.75 in head; eye 3.1 to 4.58; mouth moderate, terminal, nearly horizontal; maxillary reaching vertical from anterior margin of eye, 2.5 to 3.3 in head; the lips large, the lower one broad, continuous and free at middle; teeth in the jaws bluntly conical, the outer ones somewhat enlarged, and with brown tips; gill-membranes connected across isthmus; gill-rakers short, about 11 or 12 on lower limb of first arch; scales rather large, feebly ctenoid, 3 or 4 rows between lateral line and middle of base of dorsal; lateral line interrupted under soft portion of dorsal, reappearing on third row of scales below its original course and usually considerably in advance of end of upper lateral line; origin of dorsal over posterior margin of opercle, the spines strong, graduated, the last one 2.2 to 3 in head; the soft portion with only a few scales at base on interradiated membranes, the middle rays somewhat produced, reaching well beyond base of caudal; caudal fin with scales on basal half, its margin always convex; anal fin with 6 strong graduated spines, the soft portion similar to that of dorsal; ventral fins rather long and pointed, the longest rays reaching opposite second or third anal spine; pectoral fins not quite reaching origin of anal, 1.18 to 1.47 in head.

Color brownish. Young with dark cross-bars and a more or less distinct dark lateral band; the dark bars less distinct in adult, and the



CICHLASOMA CALOBRENSE Meek & Hildebrand.
From a specimen 186 mm. in length.

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CICHLASOMA UMBRIFERUM Meek & Hildebrand
From a specimen 160 mm. in length.

lateral band wanting. A large black blotch on middle of side, under posterior part of spinous portion of dorsal; a small black caudal spot at base of upper half of caudal; cheeks, opercle and anterior portion of sides often with small rusty spots. Vertical fins sometimes with small dark spots; ventral and anal fins usually bluish black.

We have 69 specimens of this species, ranging from 33 to 212 mm. in length. These are from the Rio Bayano and Rio Tuyra basins.

78. *Cichlasoma umbriferum* Meek & Hildebrand.

Cichlasoma umbriferum Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 88 (Rio Cupe, Cituro, Panama).

Head 2.5 to 2.83; depth 2.2 to 2.5; D. XVI or XVII, 11 or 12; A. VI, 8 or 9; scales 30 to 32.

Body moderately elongate; anterior profile nearly straight, and oblique; head rather large; snout tapering, a little shorter than post-orbital part of head, 2.8 to 3.2 in head; eye 3.4 to 4.7; mouth moderate, terminal, slightly oblique; maxillary reaching nearly or quite to vertical from anterior margin of pupil, 2 to 2.25 in head; the lips not notably thickened, the lower one of moderate width, continuous and free at middle; teeth in the jaws pointed, the anterior pair in each jaw somewhat enlarged; gill-membranes connected across isthmus; gill-rakers short, about 9 on lower limb of first arch; scales rather large, ctenoid, 5 or 6 rows between lateral line and middle of base of dorsal; lateral line interrupted under soft portion of dorsal, reappearing on third row of scales below its original course; origin of dorsal over or slightly in advance of posterior margin of opercle; the spines rather strong, graduated, the last one 2.65 to 3.65 in head; the soft portion with a sheath of scales at base and with small scales on interradiial membranes, the rays not much produced, not reaching very far beyond base of caudal; lower half of caudal fin rather densely scaled, the margin strongly convex; anal fin with 6 strong, graduated spines, the soft portion similar to that of dorsal; ventral fins inserted slightly behind base of pectorals, a few of the rays somewhat produced and reaching a little past origin of anal; pectoral fins moderate, not reaching tips of ventrals, 1.3 to 1.52 in head.

Color from light brown to bluish black; sides without cross-bars, except in young up to 50 mm.; a dark lateral band, extending from eye to upper half of base of caudal, ending in a jet black caudal spot; lower part of sides often with bluish spots, these most evident on light colored specimens. Vertical fins with dark and bluish spots; ventral fins bluish black; pectoral fins plain translucent.

We have 40 specimens of this species, ranging from 28 to 236 mm. in length. All are from the Rio Tuyra Basin.

48. Genus *Neetroplus* Günther.

Neetroplus Günther, Trans. Zool. Soc. London, VI, 1869, 469 (type *Neetroplus nematopus* Günther).

Body ovate to elongate, compressed; mouth small; the anterior teeth in each jaw compressed and incisor-like. In other respects like *Cichlasoma*.

This genus contains three species, one each in Nicaragua, Costa Rica, and Panama.

79. *Neetroplus panamensis* Meek & Hildebrand.

Neetroplus panamensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 90 (Rio Mandingo, Bas Obispo, Canal Zone, Panama).

Head 2.9 to 3.1; depth 2 to 2.25; D. XVII (rarely XVIII), 9 or 10; A. VI (rarely VII), 7; scales 27 to 30.

Body rather short, compressed; head moderate; snout blunt, equal to or shorter than postorbital part of head, 2.4 to 3 in head; eye 3 to 3.84; mouth small, terminal; maxillary failing to reach anterior margin of eye, 3.25 to 3.75 in head; cheeks with 3 rows of rather large scales; lips thin, the lower one free only at sides; teeth in the jaws distinctly compressed, incisor-like, with reddish brown tips; gill-membranes broadly connected across isthmus; gill-rakers short, 7 or 8 on lower limb of first arch; scales moderate, ctenoid, $2\frac{1}{2}$ to 3 rows between lateral line and middle of base of dorsal; lateral line interrupted under soft portion of dorsal, reappearing on third row of scales below its original course; origin of dorsal over margin of opercle, the spines graduated, the last one 2.3 to 2.8 in head; the soft portion scaly at base, pointed, a few of the middle rays produced, reaching to distal fourth of caudal; caudal fin scaly at base, its margin evenly convex; anal fin with 6 or rarely 7 strong, graduated spines, the soft portion similar to that of dorsal; ventral fins with the outer rays produced, often reaching opposite the 4th or 5th anal spine; pectoral fins not quite reaching origin of anal, 1.1 to 1.24 in head.

Back bluish black; sides reddish or brownish. Young with blackish bars, these obscure or wanting in adult; a prominent dark blotch on middle of sides below posterior portion of spinous dorsal, and sometimes with a series of irregular black blotches on lower part of side from above base of pectorals to base of caudal; vertical fins dark, tinged with red in adult; ventral fins always pale blue.

There are 42 specimens, ranging from 65 to 103 mm. in length, in the present collection.

Habitat: Rio Chagres Basin.



NEETROPLUS PANAMENSIS Meek & Hildebrand.
From a specimen 100 mm. in length.

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Family XI. Gobiidæ.

Body oblong or elongate; teeth various, usually small; premaxillaries protractile; gill-openings usually rather small, the membranes attached to the isthmus; opercle unarmed; preopercle unarmed or with a short spine; orbital margin not free, continuous with skin of head; lateral line wanting; scales present or wanting; dorsal fins 2, separate or connected, the first composed of 2 to 8 slender spines; the second dorsal preceded by a single weak spine; margin of caudal fin convex; anal usually similar to second dorsal; ventral fins close together, separate or united, when united forming a sucking disc, consisting of I, 5 or rarely of I, 4 rays, inserted under base of pectorals; pectoral fins with a broad subvertical base.

Most of the representatives of this family are marine, but some of them enter fresh water and rivers. Only the latter of the Panama species are discussed in the present paper.

KEY TO THE GENERA.

- a. Ventral fins separate.
- b. Vomer with villiform teeth; gill-openings extending forward to below eyes. *Philypnus*, p. 350.
- bb. Vomerine teeth wanting; gill-openings not extending forward to below eyes.
- c. Head very broad; eyes lateral; jaws anteriorly of equal length; teeth compressed at apices; gill-rakers numerous, well developed, in 2 series on each arch. Intestinal canal long; species herbivorous. *Dormitator*, p. 353.
- cc. Head narrower; eyes lateral or not; lower jaw more or less projecting; teeth all pointed; gill-rakers few, poorly developed. Intestinal canal short; species carnivorous.
- d. Preopercle with a small, sharp, concealed spine at its lower posterior angle. *Eleotris*, p. 356.
- dd. Preopercle unarmed.
- e. Scales very small, 100 or more in a lateral series. *Guavina*, p. 360.
- ee. Scales larger, usually fewer than 40 in a lateral series.
- f. Dentary bones broad, expanded, meeting under posterior angle of mouth, leaving an oval-shaped, naked patch at chin. *Leptophilypnus* gen. nov., p. 361.
- ff. Dentary bones narrow, not nearly meeting under posterior angle of mouth.
- g. Head broad depressed; eyes superior; head and chest naked. *Microeleotris* gen. nov., p. 362.

- gg. Head compressed; eyes lateral; head (with the exception of snout) and chest scaly. *Hemieleotris* gen. nov., p. 364.
- aa. Ventral fins united, forming a sucking disc.
- h. Teeth in the jaws in narrow bands; ventral disc longer than wide, free from abdomen; shoulder girdle with 2 or more dermal flaps projecting into gill-cavity. *Awaous*, p. 365.
- hh. Teeth in upper jaw in a single, close-set series, slender, tricuspid, bicuspid or simple, curved inward; lower jaw with 2 series of teeth, the outer series nearly horizontal, partly or completely hidden in the gums, second series erect, pointed; ventral disc circular, more or less adnate to abdomen; no dermal flaps on shoulder girdle. *Sicydium*, p. 369.

49. Genus *Philypnus* Cuvier & Valenciennes.

Philypnus Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 255 (type *Gobiomorus dormitor* Lacépède).

Lembus Günther, Cat. Fish. Brit. Mus., I, 1859, 505 (type *Lembus maculatus* Günther).

Body elongate, anteriorly subcylindrical, posteriorly compressed; head more or less depressed above; mouth large; lower jaw projecting; teeth small, in bands on jaws and on vomer; gill-opening large, extending forward to under eye; scales rather small, ctenoid, covering body and most of head; dorsal fins 2, well separated, with VI-I, 9 rays; caudal fin rounded; anal fin with I, 9 or I, 10 rays.

This genus consists of but two species, both of which usually inhabit lowland streams.

KEY TO THE SPECIES.

- a. Scales small, 61 to 64 in lateral series from upper angle of gill-opening to base of caudal; anal rays I, 9; vertical fins with rather large black spots, forming cross-bars. *dormitor*, p. 350.
- aa. Scales larger, 56 to 59 in lateral series; anal rays I, 10; vertical fins with small and less distinct blackish spots.

maculatus, p. 352.

80. *Philypnus dormitor* (Lacépède).

Gobiomorus dormitor Lacépède, Hist. Nat. Poiss., II, 1798, 599 (Martinique, from a drawing by Plumier); Jordan & Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, 482.

Platycephalus dormitator Bloch, Syst. Ichthyol., 1801, Pl. 60, t. 12 (Martinique).

Eleotris dormitatrix Cuvier, Règne Animal., Ed. 2, II, 1829, 246; Günther, Cat. Fish. Brit. Mus., III, 1861, 119.

Philypnus dormitator Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 255; Poey, Memorias, II, 1860, 381; Regan, Biol. Cent. Amer., Pisces, 1906, 5.

Eleotris longiceps Günther, Proc. Zool. Soc. London, 1864, 151 (Nicaragua).

Philypnus dormitor Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2194; Meek, Field Col. Mus. Pub., Zoöl. Ser., V, 1904, 226 (Mexico), and Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1914, 129 (Atlantic slope of Costa Rica).

Head 3.2 to 4.3; depth 4.65 to 6.2; D. VI-I, 9; A. I, 9; scales 61 to 64.

Body elongate, nearly as wide as deep anteriorly, compressed posteriorly; head long, somewhat depressed, its width at preopercular margin 1.55 to 2.3 in its length; the cheeks rounded; snout long, depressed, 2.95 to 3.6 in head; eye 4.75 to 7.8; interorbital 3.7 to 6.65; mouth large, oblique; lower jaw projecting; maxillary reaching middle of eye, 2.05 to 2.5 in head; teeth small, pointed, all depressable except the outer ones, in bands on jaws and on vomer; gill-rakers undeveloped; gill-arches with small, elevated patches of pointed teeth; lateral line wanting; scales small, ctenoid; origin of spinous dorsal about an eye's diameter behind base of pectorals, the spines weak and rather variable in length, but never reaching origin of soft dorsal when deflexed; origin of soft dorsal an eye's diameter in advance of origin of anal, the margin convex; caudal fin scaly at base, its margin rounded; anal fin similar to soft dorsal; ventral fins inserted slightly behind base of pectorals, rather short, not nearly reaching vent; pectoral fins reaching to or beyond tips of ventrals, 1.53 to 1.74 in head.

Color brownish. Young with a dark lateral band, becoming more obscure with age. Back and sides often with marbling of dark brown, and sometimes with dark bars. Fins all more or less reddish in life. The dorsals, caudal, and usually the pectorals and anal with rather large dusky spots, so arranged as to form cross-bars.

In the present collections there are 118 specimens, ranging from 40 to 359 mm. in length. It is most common in the brackish and fresh waters of the lowland streams, but stragglers occur in the upper courses of the Chagres and its tributaries. It usually inhabits shallow water where it lies quietly among the vegetation, presumably in wait for its prey. The alimentary canal is short, and without blind sacs. It feeds on crustaceans, fishes, water beetles and apparently any other aquatic animal life of suitable size. In Panama it is of little importance as a food fish.

Habitat: Atlantic coast streams, from Texas south to Brazil, and the West Indian Islands.

81. *Philypnus maculatus* (Günther).

Lembus maculatus Günther, Cat. Fish. Brit. Mus., I, 1859, 505 (Andes of Ecuador).

Philypnus lateralis Gill, Proc. Ac. Nat. Sci. Phila., 1860, 123 (Cape San Lucas); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2195 (Rio Presidio, Mazatlan).

Eleotris lateralis Günther, Cat. Fish. Brit. Mus., III, 1861, 122 (Cape San Lucas).

Eleotris lembus Günther, Cat. Fish. Brit. Mus., III, 1861, 121 (Western Ecuador).

Gobiomorus lateralis Eigenmann & Fordice, Proc. Ac. Nat. Sci. Phila., 1885, 69.

Gobiomorus maculatus Eigenmann & Fordice, Proc. Ac. Nat. Sci. Phila., 1885, 70.

Philypnus maculatus Regan, Biol. Cent. Amer., Pisces, 1906, 5; Meek, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1914, 130 (Pacific slope of Costa Rica).

Head 2.75 to 3.6; depth 4.25 to 5; D. VI-I, 9; A. I, 10 or rarely I, 11; scales 56 to 59.

Body elongate; not much deeper than wide anteriorly, compressed posteriorly; head long, somewhat depressed, its width at preopercular margin 1.73 to 2.2 in its length; cheeks nearly vertical; snout long, depressed, 2.86 to 3.4 in head; eye 4.35 to 7.25; interorbital 3.95 to 6; mouth large, oblique; lower jaw projecting; maxillary reaching middle of eye, 2.2 to 2.4 in head; teeth small, pointed, all depressable except the outer ones, in bands on jaws and on vomer; gill-rakers undeveloped; gill-arches with small, elevated patches of pointed teeth; lateral line wanting; scales a little larger than in preceding species, ctenoid; origin of spinous dorsal about an eye's diameter behind base of pectorals, the spines weak and variable in length, sometimes reaching origin of soft dorsal when deflexed; origin of soft dorsal an eye's diameter in advance of origin of anal, the rays variable in length, the margin convex; caudal fin scaly at base, its margin rounded; anal fin similar to soft dorsal; ventral fins inserted slightly behind base of pectorals, rather short, failing to reach vent; pectoral fins reaching to or past tips of ventrals, 1.4 to 1.84 in head.

Color brownish. Young with a dark lateral band or blotches along side, the blotches usually persisting. Fins with much red in life; the dorsals, caudal and usually the anal with dusky spots, which are, however, notably smaller and less distinct than in the preceding species; pectoral fins without spots or bars.

There are 425 specimens in the present collection, ranging from 40

to 290 mm. in length. This fish is abundant in all the lowland streams of the Pacific slope of Panama. In this region it is more abundant than its Atlantic congener. What is stated regarding the habits of the foregoing species applies equally as well to the present species.

This fish is closely related to its Atlantic slope congener, from which it can, however, be readily separated by the larger scales, by the constant presence of one more ray in the anal fin and by the smaller and less distinct dark spots on the vertical fins. The body is also slightly deeper anteriorly and the head is narrower.

Habitat: Pacific slope streams from Lower California south to Ecuador.

50. Genus *Dormitator* Gill.

Prochilus Cuvier, Règne Animal, Ed. 1, II, 1817, 294 (type *Sciæna macrolepidota* Bloch = *Sciæna maculata* Bloch). (Name preoccupied.)

Dormitator Gill, Proc. Ac. Nat. Sci. Phila., 1862, 240 (type *Eleotris gundlachi* Poey = *Sciæna maculata* Bloch).

Body elongate, compressed; head broad, flat above; interorbital broad; snout obtuse; mouth moderate, oblique; the jaws anteriorly of equal length; teeth in jaws small, in bands, with compressed tips, none on vomer; gill-openings extending forward to margin of preopercle; gill-rakers well developed, numerous, each arch bearing 2 series; scales present on entire body, upper surface of head, snout and on cheeks and opercles; dorsal fins 2, well separated, the first with 7 feeble spines; caudal fin rounded; ventral fins close together, but separate, with I, 5 rays. The vertical fins notably higher in males than in females. This genus, as here understood, consists of two closely related species, which, owing to a great deal of variation among individuals, can scarcely be separated.

KEY TO THE SPECIES.

- a. Snout short and very broad, its length 4 to 4.35 in head in specimens from 60 to 80 mm. in length; mouth very oblique, margin of upper jaw usually slightly above level of lower margin of eye; scales 31 to 35, usually 33, in lateral series, 8 to 11 longitudinal rows between anterior part of base of second dorsal and anal; ventral fins long, reaching to or past vent, 1.04 to 1.43 in head; pectoral fins reaching vertical from origin of anal, 1 to 1.23 in head. *maculatus*, p. 354.
- aa. Snout slightly longer and somewhat narrower, 3.85 to 4.2 in head in specimens 60 to 80 mm. in length; mouth somewhat less oblique, margin of upper jaw on or below level of lower margin of eye; scales 34 to 37, usually 35, in lateral series, 11 or 12 longitu-

dinal series between anterior part of base of second dorsal and anal; ventral fins rather short, failing to reach vent, 1.55 to 1.9 in head; pectorals scarcely reaching vertical from vent, 1.3 to 1.45 in head. *latifrons*, p. 355.

82. *Dormitator maculatus* (Bloch).

Sciæna maculata Bloch, Naturgesch. der Ausland. Fische, 1790, Pl. 299, fig. 2 (West Indies).

Eleotris mugiloides Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 226 (Martinique; Surinam).

?*Eleotris grandisquama* Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 229 (America,—locality unknown); Günther, Cat. Fish. Brit. Mus., III, 1861, 113.

Eleotris sima Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 232 (Vera Cruz).

Eleotris somnolentus Girard, Proc. Ac. Nat. Sci. Phila., 1858, 169 (near mouth of Rio Grande).

Eleotris omocyanus Poey, Memorias, II, 1860, 269 (Havana).

Eleotris gundlachi Poey, Memorias, II, 1860, 272 (Cuba).

Eleotris maculata (in part) Günther, Cat. Fish. Brit. Mus., III, 1861, 112 (Trinidad; Demerara; Surinam).

Dormitator lineatus Gill, Proc. Ac. Nat. Sci. Phila., 1863, 271 (Savannah).

Dormitator gundlachi Poey, Synopsis, 1868, 396 (Cuba).

Dormitator omocyanus Poey, Synopsis, 1868, 396 (Cuba).

Dormitator maculatus (in part) Jordan & Gilbert, Bull. U. S. Nat. Mus., XVI, 1883, 632; (in part) Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2196; Regan, Biol. Cent. Amer., Pisces, 1905, 8.

Head 2.95 to 3.55; depth 2.8 to 3.34; D. VII–I, 8 or rarely 9; A. I, 10 or rarely 11; scales 31 to 35.

Body rather robust, compressed; head flat above, its upper profile straight or slightly concave over eyes; snout very short and broad, its length 3.85 to 4.35 in head; eye lateral, 4.2 to 4.8; interorbital broad, 2.3 to 3.2; mouth broad, strongly oblique, margin of upper jaw slightly above level of lower margin of eye; jaws anteriorly of equal length; width of mouth at its posterior angles notably longer than snout; maxillary reaching vertical from anterior margin of eye, 2.95 to 3.4 in head; teeth all small, somewhat compressed at tips, in a band in each jaw; gill-membranes attached to the isthmus, the openings extending forward to margin of preopercle; gill-rakers well developed, a double series on each arch, about 45 in anterior series on lower limb of first arch; scales cycloid on upper surface of head, cheeks, chest and predorsal region, elsewhere ctenoid; snout and cheeks completely covered with scales,

usually 33 in a lateral series (average for 14 specimens 33); 8 to 11 rows between base of second dorsal and base of anal; origin of first dorsal midway between tip of snout and base of last ray of second dorsal, the spines weak, usually reaching to or past first ray of second dorsal; origin of second dorsal slightly in advance of origin of anal, the rays varying in length, the posterior ones the longest, often reaching base of caudal; caudal fin scaly at base, its margin strongly convex; anal fin similar to second dorsal; ventral fins rather long, reaching vent and sometimes to or past origin of anal, 1.04 to 1.43 in head; pectoral fins long, usually reaching vertical from origin of anal, 1 to 1.23 in head.

Color variable, usually very dark blue above, yellowish green bars below. Young with oblique, yellowish green bars on sides, and often with a more or less distinct dark lateral band. Sides of head with from 2 to 5 dark lines, these sometimes continued on body. Dorsals and sometimes the anal with dark spots forming bars; caudal fin dusky; distal half of anal usually rusty red, the margin white; ventrals and pectorals yellowish green.

There are at hand 179 specimens of this species, ranging in length from 35 to 115 mm. Our specimens are all from stagnant brackish ponds and streams.

Intestinal canal equal to about twice the length of body; air bladder thin, adnate to the back. Stomach contents, mud, algæ and other plant tissue.

Habitat: Atlantic coast and rivers from North Carolina to southern Brazil and the West Indies.

83. *Dormitator latifrons* (Richardson).

Eleotris latifrons Richardson, Voyage "Sulphur," Fishes, 1837, 57, Pl. 35, figs. 4 & 5 (probably from Pacific coast of Central America).

Eleotris maculata (in part) Günther, Cat. Fish. Brit. Mus., III, 1861, 112 (Guayaquil).

Dormitator microphthalmus Gill, Proc. Ac. Nat. Sci. Phila., 1863, 170 (Panama).

Eleotris maculata (non Bloch) Günther, Trans. Zool. Soc. London, VI, 1869, 440 (Huamuchal).

Dormitator maculatus (non Bloch) Jordan & Gilbert, Proc. U. S. Nat. Mus., IV, 1881, 232 (Cape St. Lucas); (in part) Jordan & Gilbert, Bull. U. S. Nat. Mus., XVI, 1883, 632; (in part) Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2196.

Dormitator latifrons Eigenmann & Fordice, Proc. Ac. Nat. Sci. Phila., 1885, 72 (Pacific coast of Central America); Regan, Biol. Cent. Amer., Pisces, 1905, 9.

Scarcely distinguishable from *D. maculatus*. Head 3 to 3.64; depth 2.86 to 3.7; D. VII-I, 8; A. I, 9; scales 34 to 37.

Body as in *D. maculatus*; the snout somewhat longer and narrower, comparing specimens of like size, 2.7 to 4.5 in head; mouth rather less oblique, the margin of upper jaw on or below level of lower margin of eye; width of mouth at its posterior angles not much longer than snout; maxillary scarcely reaching vertical from anterior margin of eye, 3.15 to 3.55 in head; gill-rakers apparently more numerous than in *D. maculatus*, about 70 to 90 in anterior series on lower limb of first arch; scales rather small, usually 35 in a lateral series (average for 14 specimens, 35.2+), 11 or 12 rows between base of second dorsal and base of anal; fins rather lower than in *D. maculatus*, ventrals failing to reach vent, 1.55 to 1.9 in head; pectorals scarcely reaching vertical from vent, 1.3 to 1.45 in head.

Of this species 71 specimens, ranging in length from 40 to 235 mm., were preserved. It was taken only in the lower courses of streams, seldom far above the head of tide. It was not taken in the Rio Tuyra Basin, but this is very probably due to the fact that little seining was done in the lower parts of this basin. In only one place, the Rio Abaco (a small stagnant, coastal stream), near Panama, was it taken in abundance.

Habitat: Pacific coast and rivers, from California to Ecuador.

51. Genus *Eleotris* Bloch & Schneider.

Eleotris Gronow, Zooph. Gronov., 1763, 83 (nonbinomial).

Eleotris Bloch & Schneider, Syst. Ichth., 1801, 65 (type *Gobius pisonis* Gmelin).

Body elongate, subcylindrical anteriorly, compressed posteriorly; head low, more or less depressed above, mostly covered with scales, which are usually more or less embedded; mouth rather large, oblique; lower jaw projecting; preopercle with a single concealed spine at its lower posterior angle; teeth small, in bands in the jaws, none on vomer; gill-opening not extending forward to under eyes; scales moderate or small; dorsal fins 2, well separated; caudal fin rounded; ventral fins separate.

KEY TO THE SPECIES.

- a. Scales small, 63 to 75 (most frequently 67 to 69) in lateral series, about 22 rows between base of second dorsal and base of anal; color bluish black above; no dark lines along rows of scales; ventral surface of head and body marbled or spotted with light and dark markings. *picta*, p. 357.

- aa. Scales somewhat larger, 59 to 68 (most frequently 64) in a lateral series, about 18 rows between base of second dorsal and base of anal; color brownish, paler below than above; rows of scales everywhere with dark lines; ventral surface of head and body uniform brownish. *pisonis*, p. 358.
- aaa. Scales rather large, 44 to 54 in a lateral series, about 12 rows between base of second dorsal and base of anal; color as in *E. pisonis*. *isthmensis* sp. nov., p. 359.

84. *Eleotris picta* Kner & Steindachner.

Eleotris picta Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München, X, 1864, 18, Pl. III, fig. 1 (Rio Bayano, Panama); Regan, Biol. Cent. Amer., Pisces, 1906, 8.

Culius æquidens Jordan & Gilbert, Proc. U. S. Nat. Mus., IV, 1881, 461 (Rio Presidio near Mazatlan).

Eleotris pictus Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2201.

Head 3 to 3.25; depth 4.45 to 5.55; D. VI-I, 8; A. I, 8; scales 63 to 75.

Body elongate, subcylindrical anteriorly, compressed posteriorly; head depressed above, the profile concave over eyes; snout rather short and broad, 3.56 to 4.95 in head; eye 5.55 to 8.85; interorbital 3.3 to 5.35; mouth large, oblique; the lower jaw projecting; maxillary not quite reaching posterior margin of eye in young, but reaching past this point in adults; cheeks with small, partly embedded scales, visible only in young; chin, cheeks and snout in young with lines of pores, forming a net work, these visible only in specimens of less than 100 mm. in length; a concealed preopercular spine, directed downward and slightly forward; teeth small, pointed, in bands; gill-rakers undeveloped; gill-membranes attached to the isthmus; scales very small (average in lateral series, for 27 specimens, 69—), about 22 longitudinal series between soft dorsal and anal, those on anterior part of body more or less embedded (in very large examples they are more or less embedded over the entire body); scales on sides posteriorly distinctly ctenoid, except in very large specimens, in which they become smoother; origin of first dorsal about midway between end of snout and tips of rays of second dorsal, the spines weak, the longest not much longer than snout; origin of second dorsal about an eye's diameter in advance of origin of anal, the margin of the fin convex; caudal fin with small scales on base, the margin strongly convex; anal fin similar to second dorsal; ventral fins rather small, inserted under base of pectorals; pectoral fins moderate, reaching well beyond the tips of the ventrals, 1.36 to 1.77 in head.

Color bluish black above, paler below; ventral surface of head and body marbled or spotted with light and dark markings. These markings become obscure in large examples (250 mm. and more in length). No dark lines along the rows of scales. Fins all with dark and pale markings, forming alternating dark and pale bars, these also become obscure and disappear in large individuals.

This species is represented by 56 specimens, ranging from 60 to 440 mm. in length. It is common, but not abundant, in the lowland streams on the Pacific coast of Panama eastward to the Rio Bayano, but it was not taken in the Rio Tuyra.

The alimentary canal is short, no pyloric cœca; air bladder thin, adnate to the back. One specimen, 370 mm. in length, had swallowed a fish (*Philypnus maculatus*) 210 mm. in length. The head of this morsel was at the vent and partly digested, and the tail was visible in the mouth.

This species is closely related to *E. pisonis*, from which it apparently differs only in the characters mentioned in the key.

Habitat: West coast and streams, from California to Panama and Ecuador.

85. *Eleotris pisonis* (Gmelin).

Gobius pisonis Gmelin, Linn. Syst. Nat., 1788, 1206 (based on *Eleotris capite plagioplateo* Gronow, Mus. Ichth., II, 1757, 168, which in turn was based on *Amore pixuma* Marcgrave & Piso, Hist. Brasil., IV, 1648, 166 (Brazil)).

Gobius amorea Walbaum, Artedi Piscium, III, 1792, 205 (based on *Eleotris capite plagioplateo* Gronow).

Eleotris pisonis Schneider, in Bloch's Syst. Ichthyol., 1801, 68; Eigenmann & Fordice, Proc. Ac. Nat. Sci. Phila., 1885, 75; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2200; Regan, Biol. Cent. Amer., Pisces, 1905, 7.

Eleotris gyrimus Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 220, Pl. 356 (Martinique; San Domingo; Surinam).

Culius perniger Cope, Proc. Am. Phil. Soc., 1870, 473 (Brazil).

Culius belizianus Sauvage, Bull. Soc. Philom. Paris, 1879, 55 (Belize; Cayenne).

Head 2.9 to 3.23; depth 4.12 to 6; D. VI-I, 8; A. I, 8; scales 59 to 68.

Body elongate, anteriorly subcylindrical, posteriorly compressed, a little deeper and somewhat more robust than in *E. picta*, this difference being most evident in a comparison of specimens of like size; head somewhat depressed above, the profile concave over eyes; snout broad, 3.85

to 4.85 in head; eye 5.13 to 6.4; interorbital 3.65 to 6; mouth rather large, oblique; the lower jaw projecting; maxillary scarcely reaching middle of eye in young, reaching past this point in adult, 2.44 to 3.25 in head; cheeks with partly embedded scales; chin, cheeks and snout with rows of pores, forming a net-work, these most distinct in young; a concealed preopercular spine, directed downward and forward; teeth small, pointed, in bands; gill-rakers undeveloped; gill-membranes attached to the isthmus; scales small (average in lateral series, for 16 specimens, 64+), about 18 longitudinal rows between base of second dorsal and anal, those on anterior part of body more or less embedded, but less so than in *E. picta*; scales on posterior part of body distinctly ctenoid, those on anterior part of body and abdomen smooth; origin of first dorsal midway between end of snout and tips of rays of second dorsal, the spines short and weak, reaching second dorsal when deflexed; origin of second dorsal an eye's diameter in advance of origin of anal; caudal fin with small scales on base, its margin convex; anal fin similar to second dorsal; ventral fins rather small, inserted under base of pectorals; pectoral fins moderate, reaching well beyond tips of ventrals, 1.3 to 1.54 in head.

Color rusty brown above, pale brown below; rows of scales everywhere with dark lines. Dorsal fins and sometimes the caudal and anal also with dark and yellow spots or bars; pectoral and ventral fins yellowish green.

This species is represented by 16 specimens, ranging from 45 to 125 mm. in length. It was found in the lower courses of the Rio Chagres and its tributaries, small coastal streams at Porto Bello and in the upper courses of the Rio Trinidad. It is much less abundant and apparently reaches a smaller size in Panama than its Pacific coast congener. It was always found in strictly fresh water.

Habitat: Atlantic coast and rivers, from Florida to southern Brazil, and the West Indies.

86. *Eleotris isthmensis* sp. nov.

Type No. 8951, F. M. N. H.; length 85 mm.; Mindi, Canal Zone, Panama.

Head 2.85 to 3.25; depth 4.2 to 5.4; D. VI-I, 8; A. I, 8; scales 44 to 54.

Body elongate, anteriorly subcylindrical, posteriorly compressed; head somewhat depressed above, the profile slightly concave over eyes; snout broad, 4.1 to 5 in head; eye 4.22 to 5.8; interorbital 3.8 to 5.2; mouth rather large, oblique; the lower jaw projecting; maxillary reaching to or past middle of eye, 2.6 to 3.3 in head; cheeks with partly em-

bedded scales; chin, cheeks and snout with rows of pores, forming a net work, these most distinct in young; a concealed preopercular spine, directed downward and forward; teeth small, pointed, in bands; gill-rakers undeveloped; gill-membranes attached to isthmus; scales rather large (average in lateral series, for 25 specimens, 48—), about 12 longitudinal rows of scales between base of second dorsal and anal, all the scales ctenoid, except the small scales in advance of dorsal and on abdomen; origin of first dorsal midway between end of snout and tips of rays of second dorsal, the spines short and weak, reaching origin of second dorsal; origin of second dorsal an eye's diameter in advance of anal; caudal fin with small scales at base, its margin strongly convex; anal fin similar to second dorsal; ventral fins rather small, inserted under base of pectorals; pectoral fins rather long, reaching well beyond the tips of ventrals, 1.13 to 1.45 in head.

Color uniform brownish, somewhat paler below than above. Rows of scales with dark stripes; dorsal fins and caudal and sometimes the anal with light and dark spots or bars; ventrals and pectorals plain dusky brown.

We have 57 specimens of this species, ranging from 19 to 85 mm. in length. All are from the lowland streams, ditches and ponds on the Atlantic coast. A few of the specimens were taken in strictly fresh water, but the majority of them are from brackish and salt water.

This species differs from *E. pisonis* principally in the notably larger scales. We have designated as the type a specimen 85 mm. in length from Mindi, Canal Zone.

52. Genus *Guavina* Bleeker.

Guavina Bleeker, Esquisse d'un Syst. Nat. Gobioïd., 1874, 302 (type *Eleotris guavina* Cuvier & Valenciennes).

This genus is related to *Eleotris*, from which it differs in the structure of the skull, the absence of the preopercular spine and in the very small scales, usually 100 or more in a lateral series.

87. *Guavina guavina* (Cuvier & Valenciennes).

Eleotris guavina Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 223 (Martinique); Günther, Cat. Fish. Brit. Mus., III, 1861, 124 (Demerara); Regan, Biol. Cent. Amer., Pisces, 1905, 7.

Guavina guavina Eigenmann & Fordice, Proc. Ac. Nat. Sci. Phila., 1885, 73; Jordan & Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, 483; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2198.

Head 3.25 to 3.6; depth 4.65 to 5.5; D. VII-I, 10; A. I, 10; scales 95 to 115.

Body subcylindrical anteriorly, compressed posteriorly; head somewhat depressed, wider than deep, the upper profile slightly convex; snout blunt, 3.3 to 3.8 in head; eye small, 4.9 to 6.15; interorbital 2.7 to 3.33; mouth rather large, oblique; the lower jaw projecting; maxillary reaching a little past middle of eye, 2.22 to 2.35 in head; cheeks and most of head with scales; teeth small, pointed, in bands; gill-rakers little developed; gill-membranes attached to the isthmus; scales very small, those on anterior part of body and head and abdomen smooth, those on posterior part of body ctenoid; origin of first dorsal about midway between tip of snout and base of last ray of second dorsal, the spines rather short and weak, reaching nearly or quite to second dorsal; origin of second dorsal about an eye's diameter in advance of origin of anal, the posterior rays reaching nearly or quite to base of caudal; caudal fin short, with small scales at base, its margin rounded; anal fin similar to second dorsal; ventral fins rather small, inserted under base of pectorals; pectoral fins rather short, reaching but little past tips of ventrals, 1.3 to 1.7 in head.

Color bluish black above, brownish below. Fins in spirits dusky or black; the dorsals, anal and ventrals all with pale margin.

There are 5 specimens, ranging from 105 to 185 mm. in length, in the present collection. These were taken in brackish ditches and creeks at Colon and Toro Point.

Habitat: Atlantic coast and rivers from Mexico to Brazil and the West Indies.

53. *Leptophilypnus* gen. nov.

Type *Leptophilypnus fluviatilis* sp. nov.

Body shaped as in *Philypnus*. The head, chest and predorsal region naked; mouth large, oblique; eyes not wholly lateral; interorbital narrow; dentary bones meeting under posterior angle of mouth; leaving an oval-shaped naked area at chin; preopercular spine wanting; teeth all small, pointed, in broad bands in the jaws, none on vomer. Gill-opening extending forward nearly to vertical from posterior margin of eye. Readily distinguished from all other *Eleotridinæ* by the broad and expanded dentary bones. Carniverous.

88. *Leptophilypnus fluviatilis* sp. nov.

Type No. 8952, F. M. N. H.; length 46 mm.; Mindi, Canal Zone, Panama.

Head 3.06 to 3.4; depth 5.25 to 5.86; D. VI-I, 9; A. I, 9; scales 30 to 34.

Body elongate, anteriorly subcylindrical, posteriorly compressed; head as wide as deep, its width at preopercular margin 1.7 to 2 in its length, the upper profile straight or slightly convex; snout rather broad, 3.7 to 4.1 in head; eye moderate, partly superior, 4.15 to 5.86; interorbital narrow, 8.75 to 10; mouth large, oblique; the lower jaw strongly projecting; maxillary reaching to or past middle of eye, 2 to 2.5 in head; teeth all small, pointed, in a broad band in each jaw; gill-membranes rather narrowly connected with the isthmus, the opening extending forward to vertical from posterior margin of eye; scales rather large, thin, weakly ctenoid, none on head, chest or predorsal region, 7 or 8 rows between base of second dorsal and base of anal; origin of first dorsal about midway between tip of snout and base of last ray of second dorsal, the spines weak, the longest reaching opposite first or second ray of second dorsal when deflexed; origin of second dorsal slightly in advance of origin of anal, the rays rapidly increasing in length posteriorly, the longest reaching base of caudal in our largest examples, proportionately shorter in the smaller ones; caudal fin with only a few scales at base, the margin rounded; anal fin similar to second dorsal; ventral fins rather long, reaching nearly or quite to vent; pectoral fins reaching opposite origin of anal, 1.12 to 1.38 in head.

Color olivaceous; back and sides with dark points and blotches; 4 or 5 saddle-like bars on back; a series of elongate blotches on median line of side; caudal spot present. Dorsals and caudal with dark bars; anal fin dusky; other fins unmarked.

We have 40 specimens of this species, ranging from 38 to 64 mm. in length. These were all taken in a very muddy brackish creek at Mindi near the Atlantic coast of the Canal Zone.

The intestinal canal is short; the air bladder thin, adnate to the back. The ovaries in specimens (captured on Jan. 28, 1911) only 45 mm. in length are distended with well developed eggs, showing that individuals of this size are mature.

54. *Microleotris* gen. nov.

Type *Microleotris panamensis* sp. nov.

Body elongate, anteriorly depressed, caudal peduncle compressed; head low and broad; eyes superior; interorbital narrow; mouth large, oblique; lower jaw strongly projecting; gill-openings extending forward to vertical from posterior margin of eyes; no preopercular spine; teeth all small, pointed, in bands on the jaws, none on vomer; scales large, ctenoid, head, chest and part of abdomen naked; dorsal fins 2, well separated; caudal fin rounded; ventral fins separate, I, 5. Carniverous.

KEY TO THE SPECIES.

- a. Scales in lateral series 33 to 36; second dorsal with I, 8 rays; anal I, 8. *panamensis* sp. nov., p. 363.
- aa. Scales in lateral series 30 to 32; second dorsal with I, 9 rays; anal I, 9. *mindii* sp. nov., p. 364.

89. *Microeleotris panamensis* sp. nov.

Type No. 8953, F. M. N. H.; length 50 mm.; Rio Juan Diaz, Panama.

Head 3.25 to 3.6; depth 4.75 to 5.5; D. VI-I, 8; A. I, 8; scales 33 to 36.

Body anteriorly depressed; caudal peduncle compressed; head depressed, notably wider than deep, its width at preopercular margin 1.25 to 1.42 in its length; the upper profile slightly convex; snout tapering, its length 3.4 to 4 in head; eye rather small, superior, 4 to 5.64; interorbital narrow, 5.5 to 7.25 in head; mouth rather large, oblique; the lower jaw strongly projecting; maxillary scarcely reaching middle of eye, 2.04 to 2.8 in head; teeth all small, pointed, in bands in the jaws; gill-membranes rather narrowly attached to the isthmus, the openings extending forward to vertical from posterior margin of eye; scales large, ctenoid, none on head, chest and abdomen, 7 or 8 rows between base of dorsal and base of anal; origin of first dorsal about midway between tip of snout and base of last ray of second dorsal, the spines short and weak, reaching second dorsal when deflexed; origin of second dorsal slightly in advance of origin of anal, the rays short; caudal fin not scaly at base, its margin evenly convex; anal fin similar to second dorsal; ventral fins short, failing to reach vent, inserted under base of pectorals; pectoral fins moderate, 1.18 to 1.4 in head.

Color grayish brown above, pale below. Body above and on sides spotted and marbled with dark markings; back sometimes with a few dark saddle-like bars; sides often with quadrate blotches; a more or less distinct caudal spot present. Dorsals, caudal, and usually the pectorals spotted and barred with dark markings; anal and ventrals pale or dusky.

This species is represented by 38 specimens, ranging from 30 to 58 mm. in length. These were taken in fresh water, not far above the head of tide, in the Rio Chorrera near Chorrera and in the Rio Juan Diaz at Juan Diaz on the Pacific slope.

The intestinal canal is short. The stomachs examined contained small molluscs, principally snails. The ovaries in two specimens, each about 45 mm. in length, taken on April 4, 1911, were distended with well developed eggs, showing that fish of this size are mature.

A specimen 50 mm. in length from the Rio Juan Diaz has been designated as the type.

Habitat: Pacific slope of Central Panama.

90. *Microeleotris mindii* sp. nov.

Type No. 8954, F. M. N. H.; length 55 mm.; Mindi, Canal Zone, Panama.

Head 3.2 to 3.5; depth 4.83 to 6.68; D. VI-I, 9; A. I, 9; scales 30 to 32.

Body anteriorly depressed; caudal peduncle compressed; head low, wider than deep, the width at preopercular margin 1.45 to 1.75 in its length; snout broad, 3.25 to 4 in head; eye superior, 3.7 to 4.65; interorbital very narrow, 8.65 to 12; mouth rather large, oblique; lower jaw strongly projecting; maxillary scarcely reaching opposite middle of eye, 2.17 to 2.6 in head; teeth all small, pointed, in bands in the jaws; gill-membranes narrowly attached to the isthmus, the openings extending forward to nearly under posterior margin of eye; scales large, ctenoid; head, predorsal region, chest and median line of abdomen naked; 7 rows between base of second dorsal and base of anal; origin of first dorsal about midway between tip of snout and base of last ray of second dorsal, the spines weak, reaching second dorsal; origin of second dorsal a little in advance of origin of anal, the rays short; caudal fin without small scales on base, the margin rounded; anal fin similar to second dorsal; ventral fins short, failing to reach vent, inserted under base of pectorals; pectoral fins moderate, reaching past tips of ventrals, 1.13 to 1.5 in head.

Color olivaceous; the back with 4 dark saddle-like blotches; median line of sides with elongate dark blotches; a small caudal spot present. Dorsals and caudal with indistinct dark bars or spots; anal fin with more or less dusky, other fins unmarked.

We have 51 specimens of this species, ranging from 30 to 56 mm. in length. These were taken in a brackish creek at Mindi near the Atlantic coast of the Canal Zone.

This species differs from *M. panamensis* in the somewhat less strongly depressed body, narrower interorbital, fewer scales in the lateral series, one more ray each in the second dorsal and anal, and in the lighter coloration.

A specimen 55 mm. in length has been designated as the type.

55. *Hemieleotris* gen. nov.

Type *Eleotris latifasciatus* Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1912, 68.

Body elongate, compressed; head compressed, not flat above, mostly covered with scales, the upper surface from eyes forward naked; mouth moderate, oblique; lower jaw projecting; no preopercular spine; teeth small, in bands on the jaws, none on vomer; gill-openings extending

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HEMIELEOTRIS LATIFASCIATUS (Meek & Hildebrand).
From a specimen 78 mm. in length.

forward to posterior margin of eye; scales large, ctenoid, present on body and chest; dorsal fins 2, well separated; caudal fin rounded; ventral fins separate. Carniverous.

91. Hemieleotris latifasciatus (Meek & Hildebrand).

Eleotris latifasciatus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1912, 68 (Rio Cardenas, Pacific slope, Panama); Meek, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1914, 131 (Jesus Maria, Costa Rica).

Head 3.4 to 4; depth 3.6 to 4.75; D. VI-I, 9; A. I, 10; scales 35 to 39.

Body compressed; head compressed, notably deeper than broad, not flat above, profile straight or slightly concave over eyes; snout tapering, 3.8 to 4.7 in head; eye rather large, 3.5 to 4.15; interorbital 3.9 to 5.2; mouth moderate, oblique; the lower jaw projecting; maxillary reaching to or slightly past anterior margin of eye, 3.25 to 3.9 in head; teeth small, pointed, in bands in the jaws; gill-rakers feebly developed; gill-membranes attached to the isthmus, the openings extending forward to under posterior margin of eye; scales large, ctenoid, 10 or 11 rows between base of second dorsal and base of anal; origin of first dorsal about midway between tip of snout and base of last ray of second dorsal, the spines weak, the anterior ones somewhat produced, reaching opposite the second or third ray of second dorsal; origin of second dorsal slightly in advance of origin of anal, or about midway between middle of eye and base of caudal; caudal fin with a few small scales at base, its margin rounded; anal fin similar to second dorsal; ventral fins long, reaching vent, inserted under base of pectorals; pectoral fins moderate, reaching tips of ventrals, 1.04 to 1.25 in head.

Color dark green above, paler below. Sides with a well defined, black band, extending from tip of snout through eye to and on base of caudal. Fins unmarked.

This species is represented by 11 specimens, ranging from 27 to 80 mm. in length. This fish was taken in fresh water streams on the Pacific slope from the Rio Chorrera to the Rio Bayano.

The air bladder is thin, adnate to the back; intestine very short; stomach without blind sacs.

Habitat: Pacific slope rivers, from Costa Rica to Panama.

56. Genus *Awaous* Steindachner.

Awaous Steindachner, Verh. Mat. Phys. Naturw., 1860, 289 (after Cuvier & Valenciennes, *les Awaous (ocularis, etc.)*).

Chonophorus Poey, *Memorias*, II, 1861, 274 (type *Chonophorus bucculentus* Poey = *Gobius taiasica* Lichtenstein).

Body elongate, anteriorly subcylindrical, posteriorly compressed; head rather low and broad; eyes placed high; mouth large, horizontal; upper jaw more or less projecting; the lips thickened; shoulder girdle with 2 or more dermal flaps, projecting into gill-cavity and covered by opercle; gill-openings rather small, scarcely produced forward; teeth pointed, in narrow bands in the jaws, none on vomer; scales small, mostly ctenoid; head and chest mostly naked; dorsal fins 2, well separated; caudal fin rounded; ventral fins completely united, forming a disc, free from the body. This genus is represented by 2 species in Panama, which are closely related, but differ somewhat in several characters.

KEY TO THE SPECIES.

- a. Scales very small, 69 to 76 in lateral series; about 20 rows between base of anterior rays of second dorsal and anal; mouth moderate, the maxillary failing to reach vertical from anterior margin of eye, about 2.7 in head in specimens 150 mm. in length; fins low, the spinous dorsal failing to reach origin of second dorsal when deflexed; sides with dark blotches, but without black cross-bars.
taiasica, p. 366.
- aa. Scales somewhat larger, 60 to 67 in lateral series, about 16 rows between base of anterior rays of second dorsal and anal; mouth large, the maxillary reaching vertical from anterior margin of eye, about 2.1 in head in specimens 150 mm. in length; fins high, the spinous dorsal usually reaching to or past origin of second dorsal when deflexed; sides with dark blotches and with narrow, black cross-bars.
transandeanus, p. 368.

92. *Awaous talasica* (Lichtenstein).

Gobius taiasica Lichtenstein, *Berl. Abhandl.*, 1822, 273 (Brazil).

Gobius banana Cuvier & Valenciennes, *Hist. Nat. Poiss.*, XII, 1837, 103 (San Domingo); Günther, *Cat. Fish. Brit. Mus.*, III, 1861, 59.

Gobius martinicus Cuvier & Valenciennes, *Hist. Nat. Poiss.*, XII, 1837, 105 (Martinique).

Chonophorus bucculentus Poey, *Memorias*, II, 1861, 275 (Cuba).

Rhinogobius contractus Poey, *Memorias*, II, 1861, 424 (Cuba).

Rhinogobius bucculentus Poey, *Synopsis*, 1868, 394.

Gobius dolichocephalus Cope, *Trans. Amer. Philo. Soc. Phila.*, 1869, 403 (near Orizaba, Mexico).

Euctenogobius latus O'Shaughnessy, *Ann. & Mag. Nat. Hist.*, Ser. 4, XV, 1875, 146 (Bahia, Brazil).

Chonophorus taiasica (in part) Jordan & Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, 500; Meek, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1914, 131 (East slope of Costa Rica).

Chonophorus mexicanus Jordan & Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, 501 (Eastern slope of Mexico).

Awaous taiasica Jordan, Proc. Cal. Ac. Sci., 2d Ser., V, 1895, 494 (Presidio); (in part) Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2236.

Awaous mexicanus Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2237.

Chonophorus banana (in part) Regan, Biol. Cent. Amer., Pisces, 1905, 11.

Head 3.4 to 3.9; depth 4.75 to 5.55; D. VI-I, 10; A. I, 10; scales 69 to 76.

Body anteriorly subcylindrical, posteriorly compressed; head rather large, wider than deep; snout long, 2.04 to 2.6 in head; eye small, 5.25 to 7.5; interorbital 6.25 to 9.7; mouth large, horizontal; upper jaw projecting, the lip thickened; maxillary not quite reaching anterior margin of eye, 2.5 to 3 in head; teeth small, pointed, in a narrow band in each jaw; gill-openings rather small, the membranes broadly attached to isthmus; scales small, ctenoid, except the reduced scales on predorsal region and abdomen; about 20 rows of scales between anterior rays of second dorsal and anal; head and chest mostly naked; origin of first dorsal notably nearer snout than base of last ray of second dorsal, the spines short and weak, rarely reaching second dorsal; origin of second dorsal about midway between posterior margin of eye and base of caudal, the rays rather short; caudal fin scaly at base, the margin rounded; anal fin similar to second dorsal; ventral fins not much longer than snout; pectoral fins rather short, 1.3 to 1.73 in head.

Color yellowish green; back and sides spotted and mottled with dark brown; a series of dark blotches along side; sides of head usually with a few dark stripes. Dorsals, caudal and sometimes the pectorals with dark spots on the rays forming cross-bars; pectorals with a short black bar at base of upper rays, running downward and backward; anal and ventrals unmarked.

Of this species we have 48 specimens, ranging from 50 to 215 mm. in length. These were taken at various places in the Chagres Basin, but always in fresh water, most usually in the lower courses of the streams, but a few of them are from the Upper Chagres.

We have compared specimens from Guatemala and Costa Rica with our Panama material and find that the differences between the Pacific and Atlantic slope forms as set forth in the above key also are true for

these specimens. It is probable that all the Atlantic slope specimens from Mexico to Brazil belong to this species.

Habitat: Atlantic slope rivers, from Mexico south to Brazil, and the West Indies.

93. *Awaous transandeanus* (Günther).

Gobius transandeanus Günther, Cat. Fish. Brit. Mus., III, 1861, 62 (Western Ecuador).

Chonophorus taiasica (in part) Jordan & Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, 500.

Awaous taiasica (in part) Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2236.

Awaous nelsoni Evermann, Proc. Biol. Soc. Wash., XII, 1898, 3 (Sinaloa, Mexico); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2235.

Gobius güntneri Regan, Ann. & Mag. Nat. Hist., Ser. 7, XII, 1903, 629 (Western Ecuador).

Chonophorus transandeanus Regan, Biol. Cent. Amer., Pisces, 1905, 12; Meek, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1914, 131 (West slope of Costa Rica).

Head 3 to 3.8; depth 5.1 to 5.9; D. VI-I, 10; A. I, 10; scales 60 to 67.

Body anteriorly subcylindrical, posteriorly compressed; head large; wider than deep; snout long, 2.1 to 2.5 in head; eye small, 5 to 6.9; inter-orbital 6.5 to 10; mouth large, horizontal; upper jaw projecting, the lips much thickened; maxillary reaching vertical from anterior margin of eye, 2 to 3.1 in head; teeth small, pointed, in a narrow band in each jaw; scales rather larger than in *A. taiasica*, about 16 rows between anterior rays of second dorsal and anal; head and chest mostly naked; origin of first dorsal slightly nearer tip of snout than base of last ray of second dorsal, the spines of moderate length, usually reaching to or more often past origin of second dorsal; origin of second dorsal a little in advance of anal, about midway between anterior margin of eye and base of caudal, the rays rather long; caudal fin scaly at base, its margin rounded; anal fin similar to second dorsal; ventral fins somewhat longer than snout; pectoral fins of moderate length, 1.38 to 1.8 in head.

Color yellowish green; back and sides with dark markings; a series of dark blotches along median line of side, at each blotch there is a narrow, black cross-bar; sides of head with dark bars. Dorsals, caudal and usually also the pectorals with dark spots on the rays, forming cross-bars; pectoral with a short black bar at base of upper rays, running backward and downward; anal and ventrals unmarked.

This species is represented by over 100 specimens, ranging from 33 to 200 mm. in length. Common in all the streams of the Pacific slope of Panama from the Rio Chame eastward to the Rio Tuyra, ranging from the head of tide to the upper courses of the streams.

This species differs slightly from the preceding in several respects. The principal differences are mentioned in the key. We have compared our specimens with specimens from the Pacific slope of Costa Rica and of Colombia and find them all to be identical. It is probable that all the Pacific slope specimens from Mexico to Ecuador belong to this species.

Habitat: West slope rivers from Mexico south to Western Ecuador.

57. Genus *Sicydium* Cuvier & Valenciennes.

Sicydium Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 167 (type *Gobius plumieri* Bloch).

Cotylopus Guichenot, in Maillard, Notes sur l'Isle de la Réunion, II, 1864, Addendum 9 (type *Cotylopus acutipinnis* Guichenot).

Sicya Jordan & Evermann, Report U. S. Fish Comm., 1896, 456 (type *Sicydium gymnogaster* Grant).

Body elongate, anteriorly subcylindrical, posteriorly compressed; head low, broad; eyes lateral, placed high; snout very blunt; mouth horizontal; upper jaw in advance of the lower; the lips thick; teeth in upper jaw in a single series, numerous, slender, curved inward, tricuspid, bicuspid, or simple; lower jaw with 2 series, the outer series nearly horizontal and partly or completely hidden in the gums, the second series pointed and nearly vertical, none on vomer; gill-opening vertical, not extended forward; body nearly or entirely covered with small ctenoid scales; dorsal fins 2, well separated; caudal fin rounded; ventral fins united, more or less attached to abdomen, forming a sucking disc. But one species of this genus was taken by us. *S. pittieri* Regan, recorded from Panama, was not seen.

94. *Sicydium salvini* Grant.

Sicydium salvini Grant, Proc. Zool. Soc. London, 1884, 159, Pl. XII, fig. 2 (Panama); Regan, Biol. Cent. Amer., Pisces, 1905, 10 (Panama; Western Ecuador).

Sicyopterus salvini Jordan & Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, 485.

Cotylopus salvini Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2208.

Oreogobius rosenbergii Boulenger, Ann. & Mag. Nat. Hist., Ser. 7, IV, 1899, 126 (Western Ecuador).

Head 4.17 to 4.85; depth 4.85 to 5.75; D. VI-I, 10; A. I, 10; scales 70 to 86.

Body elongate, anteriorly subcylindrical, posteriorly compressed; head short, quadrate, as wide as deep; snout very short and blunt, anterior profile nearly vertical, its length 2.2 to 2.96 in head; eye small, lateral, placed high, 4.7 to 5.75; interorbital 3 to 4.3; mouth large, horizontal, inferior; the upper jaw notably in advance of the lower, the lip thickened; maxillary reaching to or past posterior margin of eye, 1.7 to 2.2 in head; teeth in upper jaw in a single series, very slender, recurved, somewhat compressed and grooved at apices, tricuspid in young, with nearly smooth cutting edge in adult; lower jaw with 2 series of teeth, the outer series nearly horizontal, directed forward, more or less exposed in young, but completely hidden in the gums in adult; second series composed of comparatively few, rather strong, vertical or slightly recurved, pointed teeth; gill-openings vertical, not extending forward; scales small mostly ctenoid, extending forward nearly to interorbital region; abdomen completely covered with scales; those on predorsal region and abdomen very small and partly embedded; origin of first dorsal about midway between posterior margin of eye and origin of second dorsal, the spines produced in adult males, sometimes reaching past middle of base of second dorsal; origin of second dorsal midway between posterior margin of eye and base of caudal or slightly nearer the latter, notably higher in adult males than in females; caudal fin scaly at base, the margin rounded; anal fin similar to second dorsal, but scarcely as high; ventral fins forming almost a perfect circular disc; pectoral fins broad at base, rounded, 1.05 to 1.4 in head.

Color dark green. Young with a dark lateral band, which later breaks up into more or less confluent spots; sides also with dark cross-bars, which are very indistinct in our largest specimens; back in young with dark reticulations; scales usually with roundish spots which are largest and most distinct on caudal peduncle. Dorsal fins spotted or not; anal fin with a dark stripe near its margin.

We have 8 specimens of this species, ranging from 55 to 100 mm. in length. One of these was taken at Paraiso, on the Pacific slope, in a small tributary of the Rio Grande, and the others are from various places in the Chagres Basin. We are unable to separate the Pacific slope specimen from those of the Rio Chagres. Our specimens were all taken in upland streams where the species inhabits the rocky rapids. By means of its ventral sucking disc, it is able to cling closely to the rocks and is extremely difficult to capture. It is therefore quite certainly not as rare as the small number captures would indicate.

Habitat: Both slopes of Panama and Western Ecuador.

GLOSSARY OF TECHNICAL TERMS.

- Abdomen.** The belly; the cavity containing the digestive and reproductive organs.
- Adipose fin.** A peculiar, fleshy fin without rays but occasionally with a spine, occurring on the back behind the dorsal fin of most cat fishes, characins, etc.
- Air-bladder.** A sac filled with air, lying beneath the backbone and in or behind the abdominal cavity; also known as swim-bladder.
- Anal.** Pertaining to the anus or vent.
- Anal fin.** The fin on the median line behind the vent.
- Antrorse.** Turned forward.
- Anus.** The external opening of the intestine; the vent.
- Articulate.** Jointed; said of soft fin rays.
- Azygous.** Occurring singly; not paired.
- Barbels.** An elongate fleshy projection, usually about the head; also called whiskers, present in most cat fishes.
- Bicuspid.** Having two points.
- Branchiæ.** The gills.
- Branchiostegals.** Slender bones forming the support for the branchiostegal membranes lying under the head and below the opercular bones.
- Canines.** Long conical teeth.
- Carinate.** Keeled; having a single ridge along median line.
- Caudal.** Pertaining to the tail.
- Caudal fin.** The fin on the tail.
- Caudal peduncle.** The region between the anal and caudal fins.
- Cirri.** Fringes.
- Cœcum.** An appendage of the form of a blind sac connected with the posterior end of the stomach, or pylorus.
- Compressed.** Flattened from side to side.
- Ctenoid.** Rough-edged; said of scales when the posterior margin is spinous or pectinate.
- Cycloid.** Smooth-edged; said of scales when the posterior margin is not rough; scales showing concentric lines or striations.
- Deciduous.** Falling away or out.
- Decurved.** Curved downward.
- Dentary.** The principal or anterior bone of the lower jaw or mandible.
- Depressed.** Flattened vertically.

- Distal. Remote from the point of attachment.
 Dorsal. Pertaining to the back.
 Dorsal fin. The fin on the median line of back.
 Emarginate. Slightly notched at the end.
 Falcate. Scythe-shaped; long, narrow and curved.
 Fauna. The animals inhabiting any one region, taken collectively.
 Filament. Any slender or thread-like structure.
 Filiform. Thread form.
 Fontanel. An opening between the bones of the skull.
 Foramen. A hole or opening.
 Frontal bone. Anterior bone on top of head, usually paired.
 Fusiform. Spindle shaped; tapering toward both ends.
 Gape. Opening of the mouth.
 Gill-arches. The bony arches to which the gills are attached.
 Gill-openings. Openings reaching to or from the gills.
 Gill-rakers. A series of bony projections placed along the inner edge of the gill arch.
 Gills. Organs for breathing the air contained in water.
 Hæmal spine. The lowermost projection of a caudal vertebra.
 Incisors. Cutting teeth, usually in front of jaws.
 Interorbital. Space between the orbits or eyes.
 Isthmus. The region between the lower part of the gill-openings.
 Keeled. Having a ridge along the median line.
 Lamellæ. A thin plate, layer or process.
 Larva. The immature form.
 Lateral. Referring to the side.
 Lateral line. A series of mucus pores along the side of the fish and containing sense organs.
 Mandible. The lower jaw.
 Marbled. Variegated; clouded.
 Maxillaries. The outermost bones of the upper jaw, joined to the premaxillaries in front, and usually extending farther back than the latter.
 Nape. The back of the neck.
 Nares. Nostrils.
 Nasal. Pertaining to the nostrils.
 Nuchal. Referring to the nape.
 Obsolete. Poorly developed; scarcely evident.
 Obtuse. Blunt.
 Occipital. Relating to the occiput.
 Occiput. The back of the head.
 Ocellated. Having an ocellus or ocelli.

- Ocellus. An eye-like spot; a dark spot with a lighter border.
- Opercle. The thin flat bone on sides of head covering the gills; also called gill-covers.
- Orbit. Eye socket.
- Osseous. Bony.
- Oviparous. Reproducing by means of eggs laid and hatched outside of the body.
- Ovum (plural ovi). Egg.
- Palate. The roof of the mouth.
- Palatines. Bones of the roof of the mouth, one on each side of the vomer, often provided with teeth.
- Papilla. A small fleshy projection.
- Papillose. Covered with papillæ.
- Parietal. Bone of the side of the head.
- Pectinate. Having teeth like a comb.
- Pectoral. Pertaining to the breast.
- Pectoral fins. The anterior or uppermost paired fins, corresponding to the anterior limbs of the higher vertebrates.
- Peritoneum. The membrane lining the abdominal cavity.
- Pharyngeal bones. Bones behind the gills and at the beginning of the œsophagus, usually provided with teeth.
- Plicate. Folded; showing folds or wrinkles.
- Plumbeous. Lead colored; dull bluish gray.
- Postorbital. Behind the eye.
- Premaxillaries. The bones, one on each side, forming the front of the upper jaw, usually bearing most of the upper teeth.
- Preopercle. A thin bone lying just in front of the opercle.
- Preorbital. The bone lying just in front of the eyes.
- Protractile. Capable of being drawn forward.
- Pseudobranchiæ. Small gills developed on the inner side of the opercle.
- Punctate. Dotted with fine points.
- Ray. One of the bony or cartilaginous supports of a fin. Rays are either spiny or soft, the latter are either simple or branched.
- Recurved. Turned backward or toward the point of origin.
- Reticulate. Marked with a net work of lines.
- Retrorse. Turned backward.
- Rudimentary. Undeveloped.
- Rugose. Rough, wrinkled.
- Scute. An external horny or bony plate.
- Serrate. Notched like the edge of a saw.
- Setiform. Having the form of a bristle.
- Snout. That portion of the head which projects beyond the eyes.

Spinous. Stiff or composed of spines.

Striate. Striped or streaked.

Suborbital. The bone immediately below the eye.

Supraoccipital. The bone at posterior part of skull.

Suture. The line of union of two bones, as in the skull.

Symphysis. The tip of chin; point of juncture of the two bones of lower jaw.

Synonym. A different word having the same meaning; a technical name given to a fish already described is said to be a synonym.

Synonymy. A list of technical names applied to a certain genus or species.

Tail. In ichthyology the part posterior to the anal fin.

Temporal. Referring to the region of the temples.

Terete. Cylindrical or tapering.

Thoracic. Pertaining to the thorax; said of the ventral fins when attached beneath the pectorals.

Trenchent. Compressed to a sharp edge.

Truncate. With a square or straight margin.

Tubercle. A small projection, like a pimple.

Type. The particular specimen upon which the original description of the species was based or the species upon which was based the genus to which it belongs.

Type locality. The particular place or locality at which the type was collected.

Vent. The posterior opening of the alimentary canal.

Ventral. Relating to the abdomen.

Ventral fins. The paired fins behind, in front of or below the pectoral fins, corresponding to the hind limbs in the higher vertebrates.

Ventral plates. The plates lying on the belly.

Vertical fins. The fins on the median line of the body; the dorsal, caudal and anal fins.

Villiform. Slender, minute teeth crowded into compact patches or bands.

Viviparous. Bringing forth living young.

Vomer. A bone in the center of the roof of the mouth, just behind the premaxillaries, often bearing teeth.

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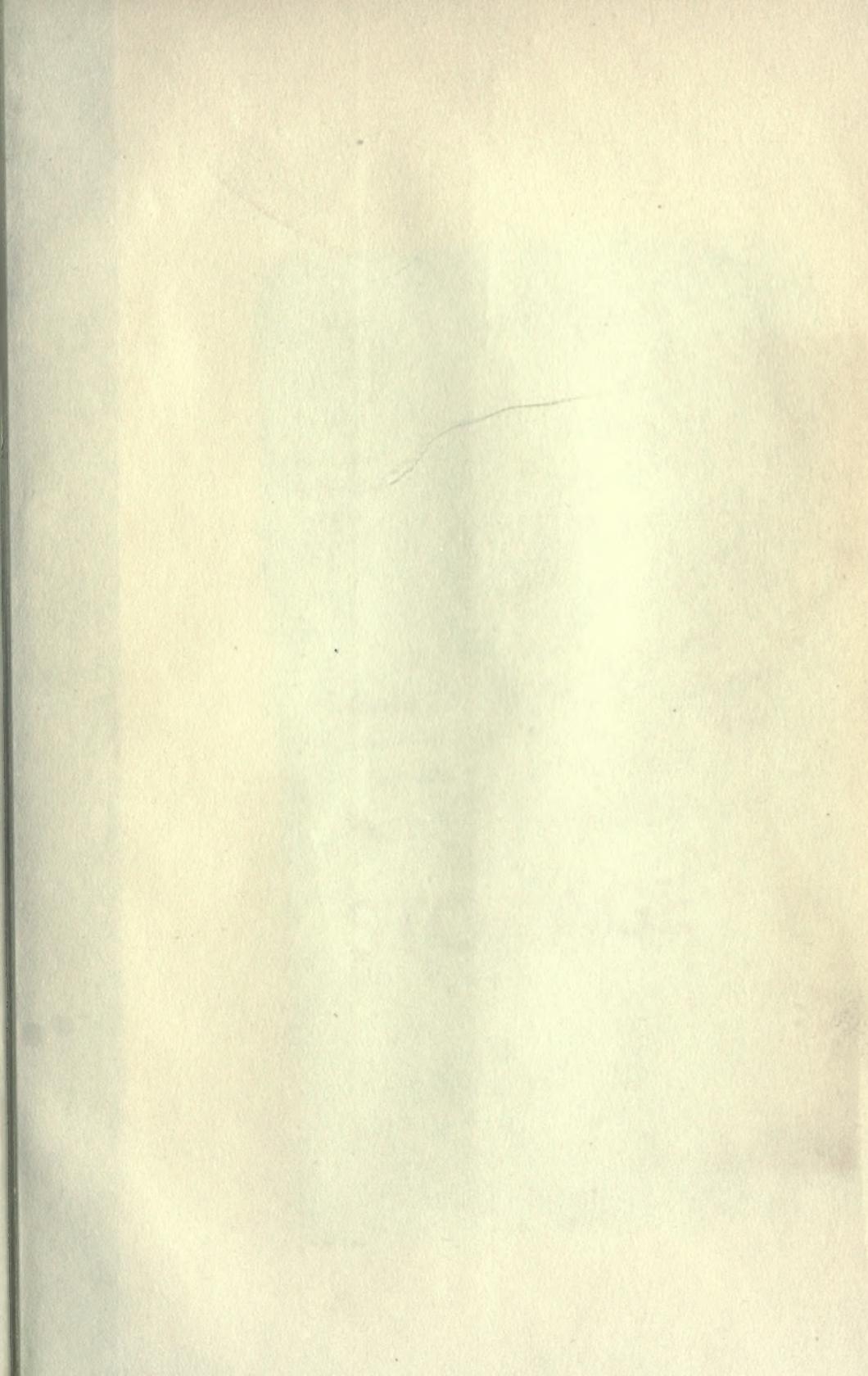
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