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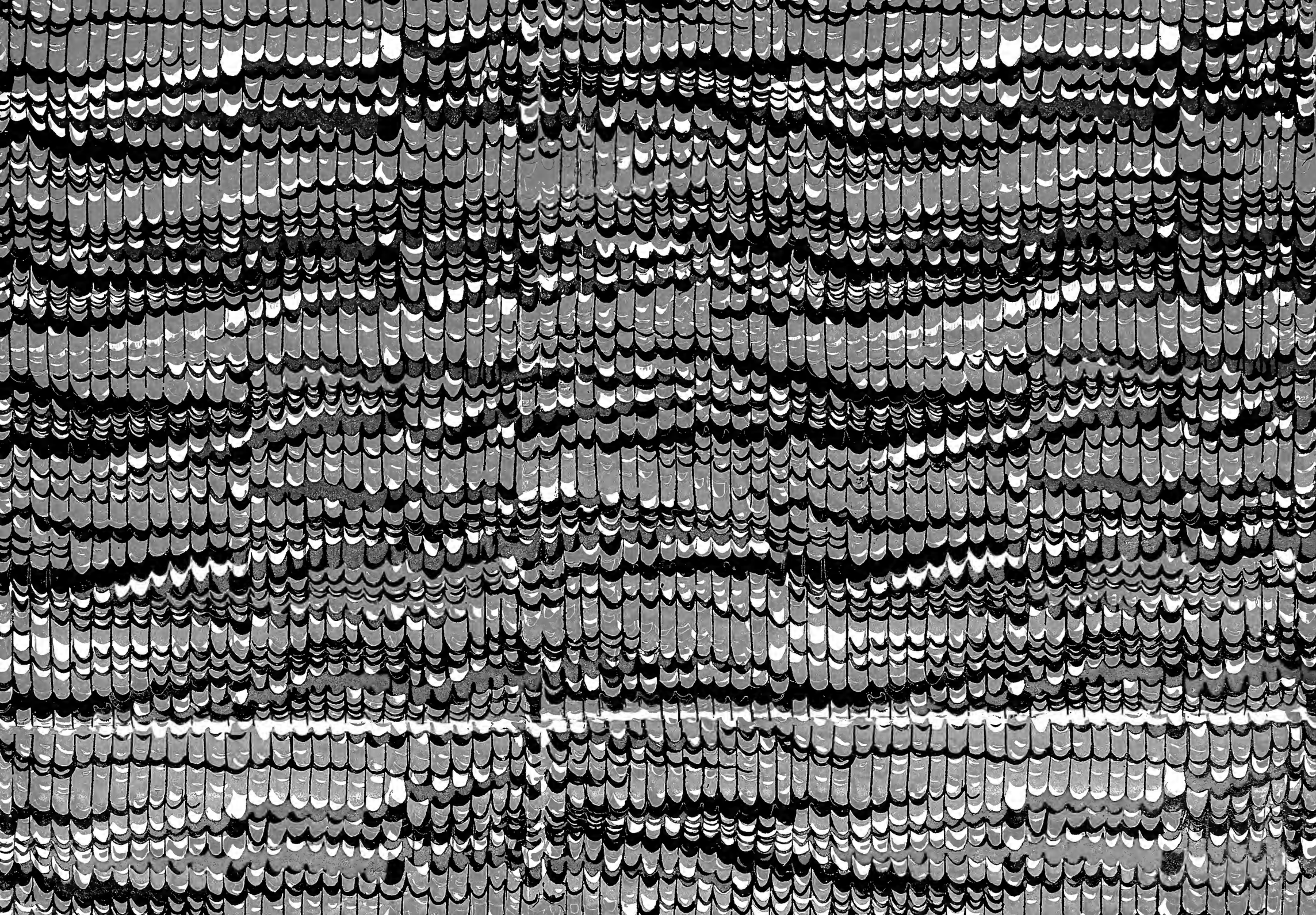

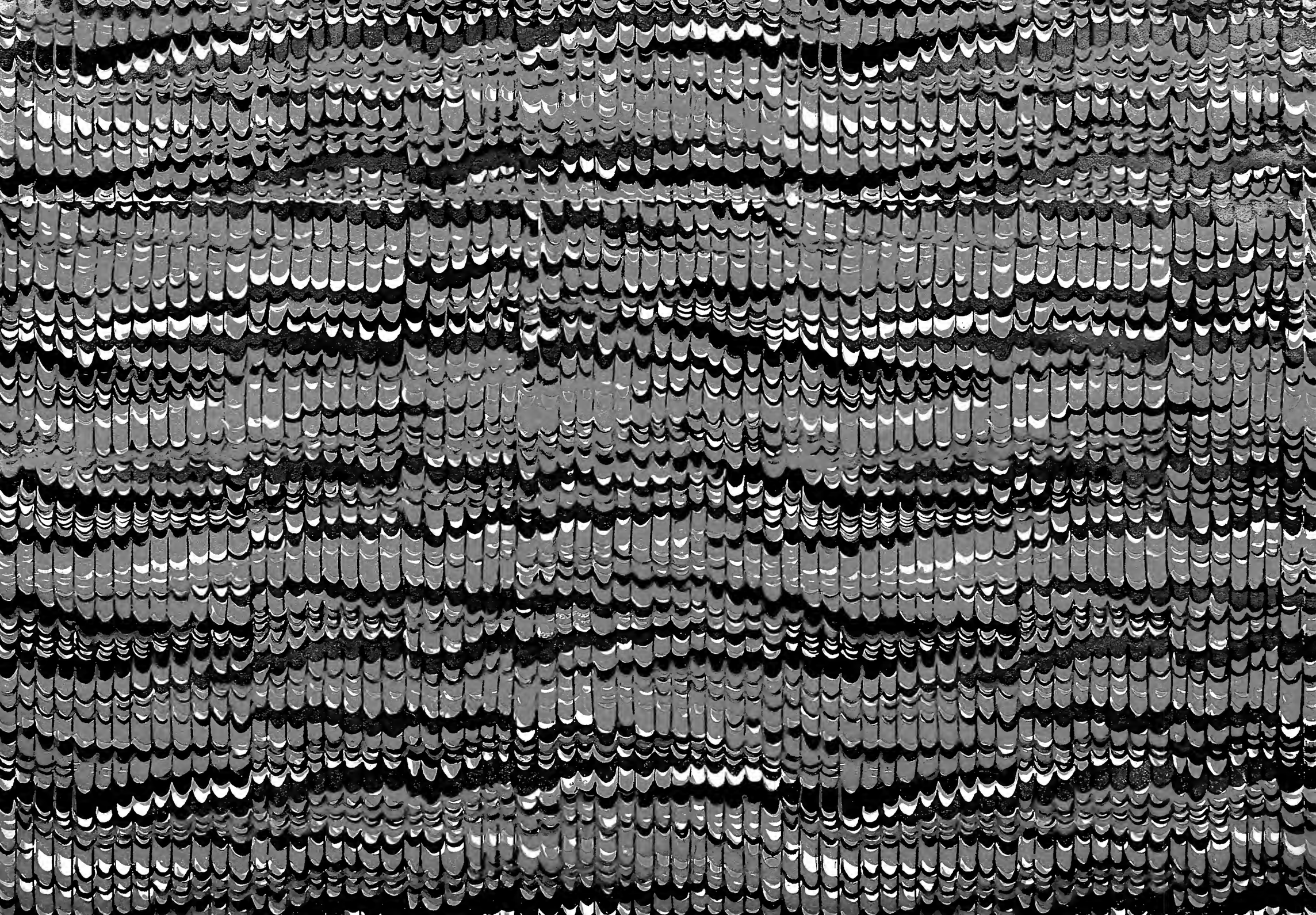

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MEMOIRS

OF THE

CARNEGIE MUSEUM

VOL. IX

W. J. HOLLAND, EDITOR

269701

PITTSBURGH

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PREFATORY NOTE

The Ninth Volume of the Memoirs of the Carnegie Museum, herewith submitted, consists of four Memoirs. The first of these in the order of publication is a paper upon The Fresh-Water Fishes of Northwestern South America by Dr. C. H. Eigenmann, and was issued in October, 1922. The second is an article by Dr. Carl J. Drake, containing descriptions of the types of thirty-two new species and varieties of Neotropical *Tingitidæ*. This paper was also issued in October, 1922. The third article is a paper upon The Skull of *Diplodocus* by W. J. Holland, issued as a separate in November, 1924. The fourth Memoir is a paper by Mr. O. A. Peterson upon the genus *Dolichorhinus*. This paper likewise was issued as a separate in November, 1924. It will be observed that a period of two years elapsed between the publication of Memoir No. 2 and Memoirs Nos. 3 and 4. This fact must be attributed to changes in the method of publication, which were made by the Board of Trustees of the Institute, who decided to install their own printing-press. This decision was accompanied by many and unavoidable delays, such as are incident to the initiation of all new enterprises. The first two numbers appeared with the imprint of the New Era Printing Company, Lancaster, Pennsylvania. The last two were printed by the Carnegie Institute Press.

It is sincerely hoped that the various difficulties and delays attendant upon the installation of the new printing-press of the Institute will be overlooked by subscribers to the publications of the Carnegie Museum and we hope that from this time forward the publications of the Museum may be issued with the same promptness which has for the most part characterized their appearance during the many years which have passed since their publication was commenced.

W. J. Holland, *Editor*

Carnegie Museum
November 10, 1924

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GENERA, SPECIES, AND VARIETIES DESCRIBED AS NEW TO SCIENCE OR REDESCRIBED AND FIGURED IN THIS VOLUME OF THE MEMOIRS OF THE CARNEGIE MUSEUM

MAMMALIA (FOSSILIA)

Perissodactyla

Dolichorhinus longiceps Douglass, redescribed and nearly completely figured; skeleton restored (Uinta beds, Utah) pp. 405–445.
Dolichorhinus hyognathus (Osborn). Notes upon, figs., p. 431.
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REPTILIA (FOSSILIA)

Order Dinosauria

Family diplodocidæ

Diplodocus hayi Holland, sp. nov., p. 397.

PISCES (VIVENTES)

Hexanematichthys henni Eigenmann, sp. nov., p. 30; *Cetopsorhamdia boquillæ* Eigenmann, sp. nov., p. 37; *Astroblepus rosei* Eigenmann, sp. nov., p. 55; *Plecostomus plecostomus panamensis* Eigenmann, subsp. nov., p. 69; **Cheirododus** Eigenmann, gen. nov., genotype *Plecostomus hondæ* Regan, p. 70; **Leporinodus** Eigenmann, gen. nov., genotype *Leporinodus retropinnis* Eigenmann, sp. nov., p. 116; *Leporinus sexdentatus* Eigenmann, nom. nov. for *L. vittatus* Steindachner (not *L. vittatus* C. & V.); *Leporinus y-ophorus* Eigenmann, sp. nov., p. 233; *Leporellus timbore* Eigenmann, nom. nov. for *L. pictus* Lütken (not *Leporinus pictus* Kner); *Hyphessobrycon panamensis daguæ* Eigenmann, var. nov., p. 141; **Phenacobrycon** Eigenmann, gen. nov., genotype *Bryconamericus henni* Eigenmann; *Ræboides caucæ* Eigenmann, sp. nov., p. 162; *Ræboides hildebrandi* Eigenmann,

sp. nov., p. 162; *Rœboides meeki* Eigenmann, sp. nov., p. 163; *Stellifer melanocheir* Eigenmann, sp. nov., p. 193; *Cichlasoma ornatum gephyrum* Eigenmann, subsp. nov., p. 205; *Thalassophryne quadrizonatus* Eigenmann, sp. nov., p. 217; *Chasmocranus rosæ* Eigenmann, sp. nov., p. 220; *Imparfinis microps* Eigenmann and Fisher, sp. nov., p. 221; *Cochliodon plecostomoides* Eigenmann, sp. nov., p. 225; *Chætostomus dorsalis* Eigenmann, sp. nov., p. 226; *Curimatus metæ* Eigenmann, sp. nov., p. 230; *Prochilodus mariæ* Eigenmann, sp. nov., p. 231; *Pyrrhulina lugubris* Eigenmann, sp. nov., p. 231; *Copeina osgoodi* Eigenmann, sp. nov., p. 232; *Mœnkhausia metæ* Eigenmann, sp. nov., p. 234; *Charax metæ* Eigenmann, sp. nov., p. 238; *Æquidens mariæ* Eigenmann, sp. nov., p. 240; *Æquidens metæ* Eigenmann, sp. nov., p. 241.

INSECTA

RHYNCHOTA

HETEROPTERA

Family TINGITIDAE

Phatnoma varians Drake, sp. nov., French Guiana, p. 352; *Monanthia figurata* Drake sp. nov., Brazil, p. 354; *Monanthia balli* Drake, sp. nov., Hayti, p. 355; *Teleonemia chapadiana* Drake, sp. nov., Brazil, p. 356; *Teleonemia hasemani* Drake, sp. nov., Brazil, p. 357; *Teleonemia simulans* Drake, sp. nov., Brazil, p. 358; *Eurypharsa phyllophila* Drake, sp. nov., Brazil, p. 367; *Amblystira morrisoni* Drake, sp. nov., San Domingo, p. 360; *Amblystira nyctalis* Drake, sp. nov., p. 360; *Amblystira silvicola* Drake, sp. nov., S. America, p. 361; *Amblystira marginata* Drake, sp. nov., Canal Zone, p. 362; **Nyctotingis** Drake, gen. nov., genotype *N. osborni* Drake, sp. nov., Brazil, p. 362–3; *Tigava notabilis* Drake, sp. nov., Brazil, p. 364; *Tigava jansoni* Drake, sp. nov., Brazil, p. 364; *Tigava mollicula* Drake, sp. nov., Brazil, p. 365; *Tingis americana* Drake, sp. nov., Brazil, p. 366; **Neotingis** Drake, gen. nov., genotype *N. hollandi* Drake, sp. nov., Brazil, p. 367; *Atheas elongata* Drake, sp. nov., Brazil, p. 367; *Acysta brasiliensis uniseriata* Drake, var. nov., Brazil, p. 368; **Corycera** Drake, gen. nov., genotype *C. comptula* Drake, sp. nov., Brazil, p. 369; *Corycera rugulosa* Drake, sp. nov., Brazil, p. 369; *Leptopharsa illudens* Drake, sp. nov., West Indies, p. 370; *Leptopharsa longula* Drake, sp. nov., Brazil, p. 371; *Leptopharsa manihotæ* Drake, sp. nov., Trinidad, p. 371; *Gelchossa albocosta* Drake, sp. nov., Brazil, p. 372; *Gelchossa magnifica* Drake, sp. nov., Brazil, p. 373; *Leptobyrsa elegantula* Drake, sp. nov., Brazil, p. 373; *Leptobyrsa splendida* Drake, sp. nov., Brazil, p. 374; *Leptobyrsa decora* Drake, sp. nov., Colombia, Ecuador, p. 375; *Leptobyrsa ardua* Drake, sp. nov., Brazil, p. 376; *Dicysta sagillata* Drake, sp. nov., Panama, p. 376.

ERRATA, CORRIGENDA, etc.

P. 80. Seventh line from bottom: for "*Leptancistrus*" substitute the original spelling in the paper quoted: *Leptoancistrus*.

P. 122. After sixth line from bottom add:
15324, I. U. M., two, largest 37 mm., Tambo, Wilson.
15325, I. U. M., one, 31 mm., Quibdo, Wilson.

P. 124. Fourteenth line from bottom, instead of: "and therefore might be referred to *Piabucina*" read: in other words 4.9 per cent. of these *Lebiasinas* revert to *Piabucina*.

P. 135. Sixth line from bottom, add at beginning of line: 13468 I. U. M.

P. 136. Second line from bottom, for "on the Atrato" read: in the Atrato Basin.

P. 178. Line 10 from bottom, for "Stolephorus Lacépède" read: *Anchoviella* Fowler.

P. 178. Ninth line from bottom, for "*Stolephorus lucidus* Jordan and Gilbert" read: *Anchoviella lucidus* (Jordan and Gilbert).

P. 179. Lines one and five, for "*Stolephorus*" read: "*Anchoviella*."

P. 182. Line 23, instead of "*Heterandria*" read: *Pœciliopsis*.

P. 185. Line 15, after "ditches with pools" add: draining into Lake Titicaca.
Line 19, for "*Esocidæ*" read: *Belonidæ*.

P. 186. Line 4, omit "and *querimana*."
Line 13, instead of "*cephalus Linnæus*" read: *rammelsbergi* Tschudi.

P. 187. Line 1, omit.
Line 2, instead of "*querimana*" read: *Mugil*.

P. 188. Line 14 from bottom, delete this line.
Line 13 from bottom, instead of "*Menidia chagresi* Meekand Hildebrand" read: *Thyrina chagresi* (Meek and Hildebrand).

P. 226. Line 18, instead of "*anomalus* Regan" read: *dorsalis* spec. nov.
Lines 19 and 20 omit.

P. 226. Line 7 from bottom, instead of "*dorsalis* sp. nov." read: *anomalus* Regan.
Line 6 from bottom, omit "(*partim*)."

P. 227. Line 12 from bottom, instead of "No. 125" read: 126, p. 96.

P. 232. Line 17, instead of "A series of light spots extends" read: Series of light spots extend.

P. 250. After line 3 add:
1922, The Nature and Origin of the Fishes of the Pacific Slope of Ecuador, Peru and Chili, *Proceedings American Philosophical Society*, LX, 1922, pp. 503–523.

Pl. IV. For "*Naimorhamdia*" read: *Nannorhamdia*.

P. 344. For "*Pomodasys*" read: *Pomadasys;* make same change on Pl. XXXIV.

P. 398. Last line for "anterio" read: antero.

P. 433. For "ragees" read: ranges.

Publications of the Carnegie Museum, Serial No. 112

MEMOIRS

OF THE

CARNEGIE MUSEUM

VOL. IX NO. 1

W. J. HOLLAND, EDITOR

THE FISHES OF WESTERN SOUTH AMERICA, PART I

THE FRESH-WATER FISHES OF NORTHWESTERN SOUTH AMERICA, INCLUDING COLOMBIA, PANAMA, AND THE PACIFIC SLOPES OF ECUADOR AND PERU, TOGETHER WITH AN APPENDIX UPON THE FISHES OF THE RIO META IN COLOMBIA

BY

C. H. EIGENMANN

JAN 10 1923
National Museum

PITTSBURGH

PUBLISHED BY THE AUTHORITY OF THE BOARD OF TRUSTEES OF THE

CARNEGIE INSTITUTE

OCTOBER, 1922

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Nos. 1–59. See preceding lists. (*Mostly out of print.*)

CORRIGENDUM

p. 5, 3rd line from bottom, for "Covitagina" read Cartagena.

MEMOIRS

OF THE

CARNEGIE MUSEUM.

VOL. IX No. 1.

THE FISHES OF WESTERN SOUTH AMERICA, PART I.

THE FRESH-WATER FISHES OF NORTHWESTERN SOUTH AMERICA, INCLUDING COLOMBIA, PANAMA, AND THE PACIFIC SLOPES OF ECUADOR AND PERU, TOGETHER WITH AN APPENDIX UPON THE FISHES OF THE RIO META IN COLOMBIA.*

BY C. H. EIGENMANN.

(PLATES I–XXXVIII.)

INTRODUCTORY.

The present memoir deals with the fresh-water fishes of the area between the Panama Canal and the southern boundary of Peru, between the Pacific Ocean and the continental divide from Crucero Alto in Peru to northern Ecuador, thence along the crest dividing the Amazon, Orinoco, and Maracaibo Basins on the east from the Magdalena Basin to the west. It thus includes the fishes of all of the streams on the Pacific slopes of Peru, Ecuador, Colombia, and southern Panama, as well as of the rivers of Colombia flowing north into the Caribbean Sea and the Chagres River of Panama, which also empties into the Caribbean. The fishes of Chile will be dealt with elsewhere.

I planned an expedition to Colombia as early as 1891. The trip was abandoned, however, and other work engrossed my attention. In 1904 when the United States took over the Panama Canal, I thought the time opportune to arouse interest in a general biological survey of Panama. I wrote first of all to the United States National Museum and received in reply a communication dated April 15,

* Contribution from the Zoölogical Laboratory of Indiana University, No. 172.

1904, and signed by Dr. Richard Rathbun, Assistant Secretary. He said in substance that "the Smithsonian Institution is . . . endeavoring to arrange . . . for a complete natural history investigation, which would, . . . include the fresh-water fishes. . . . The fullest opportunity will be given for collecting in all the important groups."

In *Science*, N.S., XXII, July 7, 1905, pp. 18–20, and in the *Popular Science Monthly*, June, 1906, pp. 515–530, and more fully in "Reports of the Princeton University Expeditions to Patagonia," III, 1910, pp. 275–511, I published estimates of the importance of a biological survey of Panama and the bearing of the distribution of the fishes in this area upon the general problem of the distribution of fishes in South America.

At the meeting of the American Microscopical Society at Sandusky, Ohio, in August, 1905, resolutions were passed on my initiative, urging a biological survey of Panama. The following reasons, as given, were published in the proceedings of the meeting:

"Panama is a point of strategic importance in the study of the distribution of fresh-water organisms in South and Middle America. It is certain that the Pacific slope fresh-water fauna of South and Middle America was derived from the Atlantic slope fauna. The Isthmus of Panama is one of the possible routes of migration. The Panama Canal, when completed, will destroy natural barriers and cause the faunas of the two slopes to mingle to a great extent. It will thus permanently obliterate the natural and primitive conditions, and it is highly desirable that a biological survey of this region be made before the completion of the canal."

At the meeting of the International Zoölogical Congress at Boston in 1907 the Section on Zoögeographical Distribution passed similar resolutions and submitted them to the general session. Mr. Alexander Agassiz, the presiding officer, misunderstanding the resolutions and believing that they called for the duplication of work upon the oceanic faunas already in large part done under his direction, remarked when the resolutions were introduced, that he hoped the Congress would "have nothing to do with such a foolish proposition."

I therefore sent a communication to the Council through Professor Henry Fairfield Osborn, giving an abstract of the report on which the resolutions were based, accompanied by distributional maps and explaining in detail the purpose of the resolutions. The Council, of which Mr. Agassiz was President, thereupon approved the resolutions, and they were passed unanimously by the general session.

At the meeting of the American Association for the Advancement of Science

in December, 1907, a resolution was adopted urging the President and Congress to make provision for a biological survey of the Panama Canal Zone. The permanent Secretary was instructed to send copies of the resolution to the President, the Vice President, the Speaker of the House, and the Secretary of the Smithsonian Institution. Similar resolutions were passed by the Ohio Academy of Sciences, the Indiana Academy of Sciences, and the American Society of Naturalists.

In *Science* for December 16, 1910 (N.S., Vol. XXXII, pp. 855–856) appeared an article, from which the following extracts have been taken:

"A biological survey of the Panama Canal Zone is about to be undertaken under the direction of the Smithsonian Institution. . . .

"Secretary Walcott considered these appeals [resolutions mentioned above] and under his direction a meeting of representatives of the National Museum, the Bureau of Fisheries, and the Biological Survey, the Bureau of Entomology, and the Bureau of Plant Industry of the Department of Agriculture was held. Their decisions confirmed the desirability of such a survey and in consequence of their opinions he prepared the . . . memorandum which was submitted to President Taft.

"President Taft fully approved the plan for a biological survey and suggested that such arrangements be made with the Secretary of War, the Secretary of Agriculture, and the Secretary of Commerce and Labor as would enable him to have their active coöperation in this important work. The arrangements are now in an advanced state, and field parties will be sent to the isthmus at an early date."

SOURCES OF THE COLLECTIONS AND ACKNOWLEDGMENTS.

With other naturalists sent to investigate various branches of zoölogy, the late Dr. S. E. Meek, from the Field Museum of Natural History of Chicago, and Mr. S. F. Hildebrand, representing the U. S. Bureau of Fisheries, spent the winter of 1910–11 in and about the Panama Canal Zone studying the fishes. Later they spent a second season in Panama, exploring among other places the southern part of the Tuyra Basin. Their report, a splendid volume, has appeared as "The Fishes of the Fresh Waters of Panama" in the publications of the Field Museum of Natural History (Pub. 191, 1916, Zoöl. Series, Vol. 10, No. 15, pp. 1–374, 26 plates). In preparing this report, Mr. Hildebrand availed himself of the collections and laboratories of Indiana University during the winter of 1915–1916. Duplicates of the Meek and Hildebrand Collection are in the Indiana University Museum, and the Carnegie Museum received some of them through an exchange with the U. S. National Museum.

To carry the work southward to the San Juan and Atrato Rivers I arrived at Cartagena, Colombia, on January 3, 1912. I was accompanied by Mr. Arthur Bierhaus, who, however, returned after our first month in the field. The full account of this expedition appears elsewhere in this volume under the caption, "The Colombian Reconnaissance." Manuel Gonzales of Bogotá became my chief assistant from Bogotá to Buenaventura and Cartagena. He later collected for me within a radius of a few days' travel of Bogotá, especially to the eastward of Bogotá in the head-waters of the Rio Meta.

Brother Apolinar Maria, Director of the "Instituto de la Salle" of Bogotá has sent me various collections between 1914 and 1918, especially from the "llanos," or plains, at the eastern base of the Andes, the streams of which form a part of the Orinoco system by way of the Meta River. These collections, together with those of Gonzales mentioned above, are reported upon in Appendix I of this paper.

After my return from Colombia Mr. Carl G. Fisher and Mr. Hugh McK. Landon, both of Indianapolis, provided the means to enable Mr. Charles E. Wilson and Mr. Arthur W. Henn, at the time students in Indiana University, to visit western Colombia in 1913. The Carnegie Museum received the first series of fishes from this expedition and granted my request that an account of this new material, appropriately illustrated, should be incorporated in my report upon the fishes of Colombia.

Mr. Landon and Indiana University later provided the means to enable Mr. Henn to continue his trip to southern Ecuador and along the interandean plateaus of Ecuador. The first series of this expedition is in the collections of Indiana University, the second series is in the Carnegie Museum. An account of this trip occurs elsewhere under the title, "The Landon Expedition to Colombia and Ecuador."

I have had the coöperation of the American Association for the Advancement of Science, the Bache Fund of the National Academy of Sciences, the University of Illinois, and lastly of Mr. Will G. Irwin of Columbus, Indiana, who helped carry the survey as far south as Puerto Montt in Chile during the Irwin Expedition.

Collections from this area have been lent to me by the Field Museum of Natural History, the National Museum, and the Museum of Comparative Zoölogy. I have also had the privilege of examining some of the collections of the Academy of Natural Sciences of Philadelphia and of Leland Stanford, Jr., University. I have examined over ninety-five per cent of the entire recorded fauna. I failed to see, or failed to recognize, slightly less than five per cent of the total fauna.

The drawings were made by Mr. W. S. Atkinson of Stanford University and

Dr. Clarence H. Kennedy, now of Ohio State University. The photographs of the fishes are the joint product of Dr. W. A. Cogshall, Miss Maud Siebenthal, and myself.

Indiana University relieved me of teaching duties to enable me to collect the material and to prepare this memoir.

Physical Features.[1]

The Pacific slope of South America, four thousand miles long and rarely over one hundred miles wide, resembles a veritable shoe-string in shape. Conditions in this area vary from extremely wet to extremely dry, from wet tropical to dry and wet temperate, and from heat to cold, as one goes south from Panama to Cape Horn.

The rainfall in the Canal Zone exceeds two hundred inches per annum. In Buenaventura it is said to be between two hundred and fifty and four hundred inches per year. This condition prevails to the Rio Esmeraldas in Ecuador (Veatch, "Quito to Bogota," p. 163). South of the Rio Esmeraldas the country becomes more and more arid. On the coasts of Peru and of Chile south to Copiapó the rainfall is negligible; it does not average one inch per annum. In Peru all of the water for agriculture is derived from the rivers descending from the mountains, and in a portion of Chile, between the Loa and Copiapó Rivers, even this source fails. In Serena, central Chile, the annual amount has ranged from about two to eight and one-half inches per annum (observations made between 1869 and 1910); and in Santiago between four and thirty-one inches, the latter, an extreme record, in one of the years between 1873 and 1910. In Concepción the rainfall has been between 26.6 and 40 inches during the period from 1876 to 1910; in Valdivia between seventy-three and one hundred and forty-three inches from 1872 to 1910; and at Puerto Montt between seventy-one and one hundred and twenty-eight inches.

The amount of rainfall also varies very greatly with the altitude at any cross-section. Behind the coastal range there are local dry areas, even in the wet regions of Colombia. The upper Dagua river runs through such a "rain shadow" between Caldas and Cisnero, and the upper Cauca runs in the shadow of the western Cordillera and is comparatively arid.

Throughout Peru, Ecuador, and Colombia there are two main chains of the Andes, the Maritime or Western Cordillera, extending from near Covitagina in

[1] This account of the physical features of the country is in large part a reproduction of what appeared in the *Indiana University Studies*, No. 45, pp. 5–11 (1920).

Colombia to Cape Horn, and east of these the older of the two, called Blanca (or *white*) in Peru, Oriental in Ecuador, and Central in Colombia.

Peru.

The physical features of western Peru are very simple. The crests of the Western Cordillera always form the divide between the Titicaca or Atlantic drainage and the Pacific drainage. The crest has an elevation of over 14,000 feet everywhere, except in northern Peru. At Huarmarca, inland from Paita, a dip in the crest has an elevation of only 6,700 feet. Enock ("Peru," 1910, p. 11), says:

"The traveller who enters the interior of Peru from the Pacific Coast must invariably cross the Andes at an altitude of 14,000 feet or more, for the passes of the main Cordillera all reach this elevation. There is one exception in the northerly part of the country towards the frontier of Ecuador, where a low gap exists in the Andes of some 6,700 feet elevation; but this is the only exception in thousands of miles of continuous mountain chain."

In Peru the Pacific slope is drained by a large number of rivers rising in the western Andes. After a comparatively short and very swift course they either empty into the ocean, or are lost in the sands near the coast, or are more or less exhausted in irrigation projects. Only one of the rivers has a north and south trend for any considerable distance. This is the Rio Santa in central Peru, which in its upper course flows between two chains of the Western Cordillera.

All of the rivers have a very great seasonal fluctuation. The Peruvian Bureau of Engineers has made observations extending through a number of years. According to their observations the crest of the flow is usually reached in March and the minimum about August. The minimum is reached earlier in the south than in the north. The period from January to June is usually unfavorable for ichthyological exploration. Their results, as given in Boletin No. 84, Cuerpo de Ingenieros de Minas de Peru, Lima, 1917, are generalized in the following table:

The stretches between successive rivers on the Pacific slope of Peru are in most cases extremely dry deserts, or mountain masses into which the rivers have cut deep gorges. The Vitor River in southern Peru, for instance, rises in an upland meadow (over 14,000 feet), flows through a region of volcanic ash, and has in its middle course a valley (Vitor Valle) about a mile wide, cultivated in vines, figs, small fruits, and grain. It then falls to a lower level near the coast, where there is another valley. Looking from the hills about Yura near Arequipa toward the ocean, the land is a billowy mass of arid, sand-drifted mountains and plains, with nothing green visible anywhere.[2]

[2] At Arequipa there is one species of *Pygidium*. At Tiabaya a species of "peje rey" (*Basilichthys*)

DISCHARGE OF VARIOUS RIVERS OF PERU.

(Cubic meters per second, always at the same date in the months indicated.)

Name of River.	Maximum.	Month.	Minimum.	Month.
	Cub. M.		Cub. M.	
Santa	1,250	Feb.–March	37.0	June–Oct.
Chira	1,250	Jan.–March	5.4	Sept.–Nov.
Tumbez	750	Jan.–April	10.0	Sept.–Nov.
Piura	480	Feb.–March	0.0	Sept.–Feb.
Chicama	320	" "	1.5	June–Nov.
Pativilca	280	" "	10.7	May–Oct.
Jequetepeque	250	March	1.3	June–Nov.
Cañete	240	Feb.–April	13.2	June–Oct.
Lambayeque	220	Jan.–April	1.4	" "
Huaura	190	Feb.–April	9.0	" "
Zaña	170	Mar.–April	0.7	June–Dec.
Moche	170	Feb.–April	0.3	June–Nov.
Pisco	140	Feb.–March	0.8	July–Oct.
Ica	140	" "	0.0	May–June
Rimac	110	" "	5.9	June–Sept.
Chancay	100	Feb.–April	1.0	June–Oct.
Chincha	90	Feb.–March	0.1	June–Nov.
Mala	80	Feb.–March	0.2	" "
La Leche	80	Feb.–May	0.8	" "
Virú	70	Feb.–March	0.0	June–Dec.

The Rimac has a somewhat different course. With its tributaries it rises in small glacial lakes having elevations of from 15,000 to 16,000 feet, and inhabited, in part at least, by *Orestias*. There is then a descent of a few thousand feet with very swift water, which is not suitable for fishes. Within this belt the streams are clear in the morning, but in the afternoon the melting of frozen ground rolls down thin mud, in which nothing can live.[3]

Between Rio Blanco and Lima, distant in a straight line less than fifty miles, the river has a fall of over nine thousand feet. At Chosica it has an annual fluctuation between a minimum of ten cubic meters per second in September and a maximum of one hundred and fifteen cubic meters per second in March.

The Jequetepeque in northern Peru, with a total length of about seventy-five miles and a more gentle slope than the Rimac, has a minimum flow of about five

is added. At Vitor Valle the *Pygidium* could not be found and the "peje rey" shares the river with a giant shrimp. I could not get to the lower course of this river.

[3] Even at Rio Blanco at about 10,000 feet elevation we secured nothing. At Matucana (7,500 feet), we secured a few small specimens of *Pygidium*, *Basilichthys*, *Lebiasina*, and *Bryconamericus*, the four species constituting the entire fauna of the river. At Chosica (1,900 feet) and at Lima we secured the same four species in abundance.

cubic meters per second in September and a maximum of two hundred and twenty in March.[4]

The Piura River at Piura is reduced during the dry season to a few stagnant pools, in which the fishes become crowded together. Some of them starve, but others succeed in living through the dry season.

In southern Peru the interandean region is occupied by Lake Titicaca. In northern Peru, this region is drained by longitudinal rivers, which turn eastward and eventually reach the Atlantic. As stated above, throughout the whole of Peru and northward to the Tumbez River the divide between the Pacific and Atlantic drainage follows the crest of the Western Cordillera.

Ecuador.

In Ecuador the crests of the two main chains of the Cordilleras are but a few miles apart. They are joined here and there by cross-ridges, formed in part of old lava-flows, which divide the area between them into a series of highland parks, having elevations of from six thousand to ten thousand feet. Some of the parks drain into the Pacific, others into the Atlantic. The continental divide thus lies along the crest of the eastern chain from Popayan in southern Colombia to as far as Cotopaxi in northern Ecuador. It then shifts westward to the crest of the Western Cordillera, then again to the Eastern Cordillera, again to the Western, once more to the Eastern, finally shifting to the western crests, where it remains through all of Peru to southern Chile.

It may be questioned whether the northern parks of Ecuador are drained into the Pacific, because the heavy rainfall has enabled the Patia and the tributaries of the Esmeraldas to cut back through the Western Cordillera and thus to annex the interandean streams, or whether the present trend of these interandean rivers is not due to the late formation of the Cordillera of Bogotá, which in southern Colombia and northern Ecuador is piled up against the Cordillera Oriental. In the center and south of Ecuador, others of the interandean parks are tapped by Pacific slope rivers, such as the Tumbez, Rompida, Canar, Chanchan, and Chimbo.

The Rio Patia in southern Colombia rises near Popayan, flows between the Eastern and Western Cordilleras southwestward to about ninety miles north of the Equator, where it breaks through the Western Cordillera and flows northwestward to empty into the Pacific near Tumaco. A large southern tributary, the Guaitara, rises between the two Cordilleras about forty-five miles north of the

[4] In addition to the fishes of the Rimac river, the following species occur here: *Æquidens cœruleopunctatus*, *Pimelodella yuncensis*, *Brycon atricaudatus*, *Philypnus maculatus*, and *Astroblepus rosei*. *Basilichthys semotilus* is not found so far north. The first and third are outriggers of the Guayas fauna.

Equator and flows between them until it joins the Patia, where the latter bends from a southwestern to a northwestern course.

The Rio Mira, with a length of about a hundred miles, flows northwestward, emptying into the Pacific at the northern border of Ecuador.

The Esmeraldas, with a general trend nearly parallel to that of the Mira, drains the parks about Quito and empties into the Pacific approximately sixty miles southwest of the mouth of the Mira at 1° North.

The rivers emptying directly into the Pacific between the Esmeraldas and the Guayas are all small, the largest of them, the Rio de Chone and the Rio de Portoviejo, are less than forty miles long, measured from source to mouth. South of Portoviejo, the country is dry and the rivers are still shorter. In the area between Cuenca and the coast the streams of the Atlantic slope rise within about thirty-five miles of the Pacific coast.

According to Wolf and to Sievers, the Coastal Cordilleras between Esmeraldas and Guayaquil reach a height in places of two thousand three hundred feet. In the north about Esmeraldas and Manabi they are of late Tertiary and Quaternary origin. Southward about Portoviejo they consist of older formations. The youngest land of Ecuador lies between the Coastal Cordilleras and the Western Cordillera. Even as late as Quaternary times, the present Guayas Basin was a gulf reaching from Machala to the base of the Cordilleras. This gulf has been largely filled by sediments, thus forming the present Guayas Basin. The Cretaceous mountains of the Coastal Cordilleras reach a height of two thousand three hundred feet, while the Tertiary portions reach a height of from six hundred to one thousand feet. The rolling land of the Quaternary has an elevation of from sixty to two hundred and fifty feet. Between the Coastal Cordilleras and the Western Cordillera there are a number of characteristically lowland streams with a north and south trend. The southern part of the former gulf is drained through the Vinces, Caracol, Chimbo, and Barranca Alta Rivers into the southward flowing Guayas, which is an extension of the Rio Vinces. Paralleling the Vinces, the Daule drains the area west of it to within about thirty miles of the coast.

Colombia.

In Colombia conditions become complicated. The western Andes of Ecuador are continued through the whole of Colombia to Cartagena.

The eastern Andes, as the Cordillera Central, are also continued through the whole of Colombia to Santa Marta, but are cut in two by a great fault occupied by the valley of the lower Cauca and the lower Magdalena.

It has been questioned whether the Sierra of Santa Marta really belongs to the Eastern Andes. If not, the Central Cordillera ends south of the junction of the Cauca and the Magdalena.

The two chains coalesce near Medellin in central Colombia. South of Popayan the Patia valley between the two old chains of the Cordilleras is drained into the Pacific. North of Popayan it is drained by the Rio Cauca, which starts in a high interandean plateau about Popayan[5] and flows to Cartago, where it begins a turbulent course through the knot of the Western and Central Cordilleras to Caceres, from which place it flows more gently to the Magdalena at a point where in former times it probably emptied into a bay similar to the present Lake Maracaibo.

The complications in Colombia are due to the formation of two younger chains of Cordilleras. One of these is the Cordillera Oriental of Colombia or the Cordillera of Bogotá. These Eastern Andes and the plains of Bogotá have been studied by Hettner ("Die Kordilleren von Bogota," Petermann's Mittheilungen, Ergänzhft. No. 104, 1892). He finds that the Cordillera of Bogotá begins between latitude 1° and 2° North, as a range of low hills joined to the Eastern Cordillera of Ecuador. These hills are cut through by the tributaries of the Amazon flowing from the Eastern Cordillera. They gain in height at 2° and are no longer crossed by streams. The upper Magdalena has cut into these Cordilleras lengthwise, so that it runs between two of the chains as far north as Honda. At Honda the Magdalena cuts through the westernmost chain of the Cordillera of Bogotá and flows in the depression between the Central Cordillera and the Cordillera of Bogotá. Towards the north the Cordillera widens and then divides into several chains separated by plains. The westernmost of these is the Sierra de Perija, which extends to the Sierra Nevada de Santa Marta; the middle chain is replaced on the north by Lake Maracaibo; the eastern and largest chain becomes the Cordillera de Merida, which ends at the depression of Barquisimeto. Beyond this are the Caribbean Mountains, which form the coastal chain of Venezuela.

The Cordillera of Bogotá, aside from a few Quaternary deposits laid down

[5] Veatch ("Quito to Bogota," p. 139) says: "Timbio is in the drainage basin of the Patia River at an elevation of 5,900 feet, while Popayan is on a tributary of the Cauca a few miles to the north at an elevation of 5,600 feet and, as we rode along, we were naturally on the alert to determine exactly when we crossed the inter-oceanic divide, but were unable to do so. The slight rise north of Timbio is very flat-topped, and from anything we could see from the trail the Rio Timbio could quite as well have joined the Cauca as the Patia. The intervening elevation is much less striking than the "Cuchilla de Dolores," which lies between two tributaries of the Patia.

"After a time we saw in a slight depression in the plain the white walls and red roofs and church-towers of Popayan, and not till then did we know that we had crossed the divide."

after the formation of the Andes, consists probably entirely of Cretaceous sedimentary rocks. The youngest strata, the Guaduas layers, may be Tertiary, but this has not been determined paleontologically and is doubtful. A few rocks older than the Cretaceous are the crystalline schists with quarzite and quarzitic conglomerate, seen near Quetame. The southern part of the Cordillera of Bogotá consists of erect or slightly inclined mountainous folds, comparable to the Jura. The westernmost areas consist of the Guaduas layers and are the youngest. During the entire Cretaceous, and perhaps during part of the Tertiary, the region was submerged. The formation of the mountains probably began in the Tertiary.

The fourth of the Cordilleras of Colombia is the Coastal Cordillera. This is the youngest of the great mountain chains of Colombia.

Hettner ("Die Anden des westlichen Columbiens," Petermann's Mittheilungen, 1893, p. 129) has also studied this chain. According to his observations, the Coastal Cordillera begins at the Bay of Buenaventura and extends northward through more than three degrees to the slight depression occupied by the Truando River, which separates it from the mountains of Darien. It reaches a maximum height of eighteen hundred meters, but ordinarily does not exceed one thousand meters. Near the middle there are really two chains, between which the Baudo flows. The western slope is very steep, the distance between the crest and the ocean being in some places only a few hundred feet. According to Karsten the rocks of the Coastal Cordilleras contain, as fossils, species of shells and corals,

FIG. 1. Shores of the Atrato. The tall tree has more than fifty pendent bird-nests upon it.

which still live in the Pacific Ocean at the base of these mountains. It seems that the Coastal Cordilleras are of late Quaternary origin. There are no crystalline rocks.

If Hettner is right about the age of the Coastal Cordilleras, then the streams at present flowing westward from the Western Cordillera such as the Calima, Cucurrupi, Jujiado, Sipi, Tamana, Condoto, and upper San Juan rivers of the Pacific drainage, and the Raspadura, upper Atrato, Certegui, Yurri, and Sucio rivers now of the Atlantic, flowed directly into the Pacific at no very remote period. Along with the formation of the Coastal Cordillera, there was formed the trough between them and the Western Cordillera, which is indicated at present by the Gulf of Uraba on the north and the Bay of Buenaventura on the south.

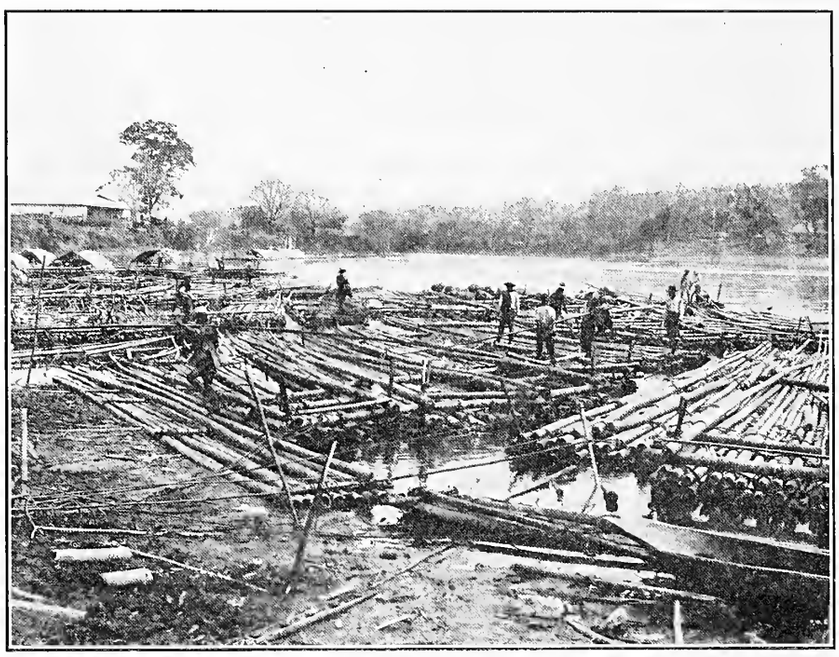

FIG. 2. The Cauca River near Cali (Juancita). Rafts of bamboos.

The rivers Atrato and San Juan must have been later developments: the Atrato gathering the waters of the Raspadura and the streams north of it flowing from the Western Andes and emptying them into the Caribbean; the San Juan gathering the waters of the streams between the upper San Juan and the Rio Calima flowing from the Western Cordillera and emptying them into the Pacific.

It seems then that the oldest of the present rivers of Western Colombia is the Cauca. The Magdalena, which is the largest river, developed with the formation of the newer Cordillera of Bogotá. The youngest rivers are the San Juan

and the Atrato. A lowering of Colombia north of Buenaventura by as little as two hundred feet would convert the valleys of the San Juan and the Atrato into two long bays, or a strait, and cause the Magdalena, the Cauca, and the Cesar Rivers to empty independently into a lake or great bay, like Lake Maracaibo, extending from Santa Marta to slightly above El Banco.

The Colombian Reconnaissance.

Accompanied by Mr. Arthur J. Bierhaus, I reached Cartagena on January 3d, 1912. It had been my intention to ascend the Rio Atrato, descend the Rio San Juan, go eastward over the Quindio Pass to Girardot, descend the Rio Magdalena, and sail home from Cartagena. A side trip to Bogotá was planned. However, when I reached Colombia, there was an unusual drought and the route had to be reversed.

There is no fresh water about Cartagena and at the earliest moment we left for Soplaviento on the Dique. Thence, I went to Calamar on the Magdalena. From Calamar the expedition went up the Magdalena River by steamer to La Dorada, collecting at various stopping places, Barbosa, El Banco, Canaletal, Puerto Wilches, Peñas Blancas, and Puerto Berrio. From La Dorada the route was by rail to the upper part of the Magdalena, collections being made on the way at Honda, especially in Bernal Creek. The upper part of the Magdalena was followed to Girardot, where extensive collections were made. From Girardot the route led first over the western rim of the plain at an elevation of about 8,800 feet to Bogotá on an elevated plain among the eastern Cordilleras. Collections were made on the plain near Puente la Suba, north of Bogotá, and at Madrid near the

Fig. 3. Narrows of the Rio Magdalena below Girardot.

western margin of the plains of Bogotá (about 8,500 ft.). A return was made to Girardot, from which place a pack-train conveyed the expedition via Chicoral to Quatro Esquinas, Ibagué, Toche, across the Quindio Pass of the Central Cordillera (at an elevation of 11,200 feet) to Boquilla, Piedra Moler, and Cartago near the Cauca River. The Cauca being too low for the regular steamers, the pack-train was used through the Cauca valley by way of Paila, Buga La Grande, Buga to Cali, collections being made at Paila and at Cali and in the Cauca near Cali.

By still another pack-train the Western Cordillera was crossed. Near Cali the continental divide is at an elevation of 6,000 feet. After collecting at Caldas (3,722 feet) the valley of the Dagua was descended by rail, collections being made at Cisnero (1,046 feet), at Cordova (120 feet) and in the tidal waters of this river.

From Buenaventura, on the Pacific coast of Colombia, a steamer was taken up the San Juan River to Puerto Negria; thence a dugout and a crew of Indians carried the expedition as far as Istmina. Collections were made at both the latter places and half-way between them. From Istmina, after a ride of two hours up a little stream and across the low continental divide (300 feet), the valley of the Atrato was entered near Tambo. By dugout the settlement of Boca de Raspadura

Fig. 4. Tambo, Atrato basin.

was reached. Thence the Raspadura was followed into the Quito River, which was traversed to Quibdo. Collections were made at Boca de Certegui and near the

town of Quibdo, at the junction of the Quito River with the Atrato. From Quibdo a specially chartered steamer was taken to Rio Sucio, where additional collections were made. From Sucio a steamer carried the expedition back to the starting point at Cartagena.

The reconnaissance outlined above was made possible through the hearty coöperation of Dr. William Lowe Bryan, President of Indiana University. The Trustees of the University granted me leave of absence for the purpose of the trip. President Bryan joined me in giving a note to the Bloomington National Bank for a sum advanced toward expenses. When it was found that the expenses would exceed the original estimate, he borrowed an additional sum and cabled it to me in Colombia. The Bloomington National Bank kindly lent the money without interest.

On my return from Colombia the Carnegie Museum purchased the first series and the duplicates of the collection, after the second series had been set aside for the Museum of Indiana University, and thus covered more than the entire expenses of the trip, with the understanding that it was to be my duty to prepare a report on the expedition.

Everywhere along the line of travel, I met with the most courteous coöperation on the part of citizens of Colombia and on the part of others traveling, or temporarily in residence. Among those who deserve special mention are:

Mr. W. E. H. Diekin, Mr. Thomas Miller, Mr. Harry D. Cutbill, Dr. Felipe Zapata, and Dr. R. A. Salas of the railroads of Colombia, all of whom furnished me with free transportation. Mr. Henri Banneau, a commercial traveler from Paris, who was familiar with all the traveled parts of South America, became enthusiastic over the fishing. Under his guidance the boat-crew on the steamer up the Magdalena secured valuable material. At Honda and about Bogotá he himself entered actively into the work of collecting, and between Calamar and Bogotá he relieved me entirely of the vexatious handling of my baggage. Mr. L. M. Monsanto of New York kindly acted as interpreter during the earlier part of the journey. Brother Apolinar Maria at Bogotá secured guides to the best fishing-places. Mr. Edward H. Mason of Cali helped in various ways both before and after I landed in Colombia. Mr. J. A. Mayolo of Buenaventura and the steamship company he represents granted me special favors; I am further indebted to Mr. Mayolo for letters of introduction and other courtesies.

The complete itinerary follows. Wherever it was possible, if the steamer on the Magdalena stopped for but an hour, collections were made:

January 3d–10th, at Cartagena, in the bay. *11th–13th*, at Soplaviento, in the

Dique. *14th–15th,* at Cartagena (in connection with the Custom House). *16th–18th,* at Calamar, in the Rio Magdalena. *19th–27th,* on S. S. "Neiva" to La Dorada. Collections were made: *20th,* at Barbosa; *21st,* at El Banco; *22d,* at Bodega Central; *23d,* at Peñas Blancas; *24th,* at Puerto Berrio ("elevation 429 feet)"; *27th,* at La Dorada. *28th,* in Bernal Creek at Honda; *29th,* at Rios Perico and Guarinó, six miles below Honda.

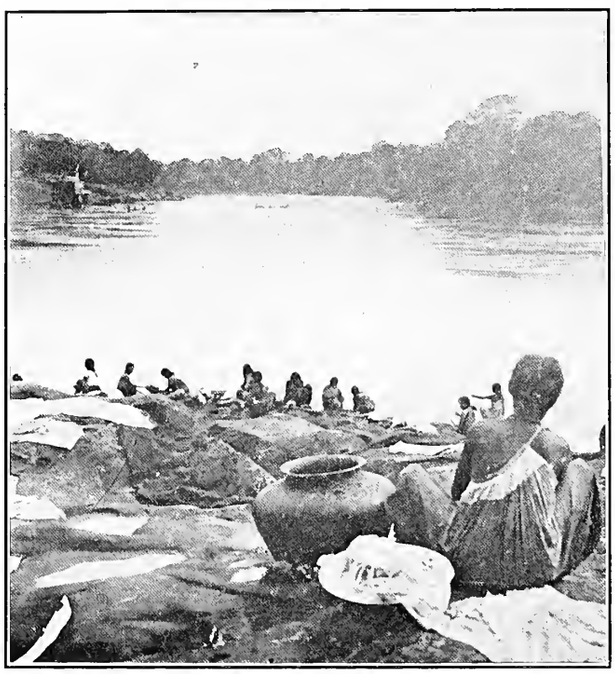

Fig. 5. The Magdalena at Girardot.

February 1st, Girardot, Rio Magdalena. *2d–3d,* Bogotá. *4th,* Puente La Suba north of Bogotá. *5th,* in Zerrezuela river at Madrid. *6th,* at Falls of Tequendama. *8th–11th,* at Girardot on the Rio Magdalena. *12th,* at Chicoral. *13th,* in Rio Gualandai (1,566 feet). *14th–15th,* at Ibagué. *16th–17th,* were spent on road to Toche. *18th–19th,* spent in crossing the Quindio Pass (11,200 feet) to Boquilla, Rio Quindio (5,725 feet). *20th,* at Balsa. *21st,* at Piedra Moler, Rio Viejo. *22d–23d,* at Cartago (3,012 feet). *24th,* at Saragosa. *25th,* at Paila. *26th,* at Buga la Grande. *27th,* at Buga. *28th,* at La Torre, on the Cauca. *29th,* at Cali (3,312 feet).

March 1st–3d, Rio Cauca and Rio Cali. *4th,* Caldas, Rio Dagua (3,722 feet). *5th,* Cisnero, Rio Dagua and Rio Pepita (1,046 feet). *6th,* Cordova, Rio Dagua (120 feet). *7th–12th,* at Buenaventura. *13th,* up the Rio San Juan. *14th-15th,*

Puerto Negria, on Rio San Juan. *16th*, Island, La Cruce, Rio San Juan. *17th*, Depulcito, Rio San Juan. *18th–20th*, Istmina, on Rio San Juan. *21st–22d*, Boca de Raspadura. *23d* Managru, near Boca de Certegui. *25th–27th*, Quibdo. *28th*, down the Rio Atrato. *29th–30th*, Rio Sucio.

April 2d, Cartagena. *6th*, sailed for New York.

The Landon-Fisher Expedition of Indiana University to Colombia.

A second expedition to Colombia was made possible by Mr. Hugh McK. Landon and Mr. Carl G. Fisher, of Indianapolis.

Mr. Arthur W. Henn and Mr. Charles E. Wilson, both undergraduates in Indiana University, left in December, 1912. They landed at Tumaco, near the south-western corner of Colombia. After devoting about a month to the Telembi River, a tributary of the Patia, they separated. Mr. Wilson went to the San Juan River, collecting in the upper San Juan Basin, the Condoto River at Condoto, and in the San Juan River, Istmina, and Tado of the Pacific side, and on the Atlantic side at Tambo, Raspadura, Boco de Raspadura, Managru, Quibdo, in the Atrato between Quibdo and Rio Sucio, and especially in the Truando River emptying into the Atrato near Rio Sucio.

Mr. Wilson writes: "In all places I received the most courteous treatment and kind coöperation from the citizens of Colombia and from others traveling or in temporary residence. Those who deserve special mention are: Mr. J. A. Mayolo of Tumaco, to whom I am indebted for letters of introduction throughout the Choco, for passes on his steamers on the Patia and Telembi Rivers, and for many other courtesies during my stay in Tumaco. Captain Maximilian Llorente and Mr. Andres Knudson of Barbacoas aided the expedition by securing men and canoes for fishing. Mr. Knudson kindly acted as interpreter, and Captain Llorente gave us rooms in his home during the stay in Barbacoas. Mr. Jorge Mercado and Mr. G. Otero Vazquez of Buenaventura relieved me from looking after the transportation of my baggage. Mr. Thomas A. Copeland of Istmina kindly acted as interpreter and cared for me from Buenaventura to Istmina. Others in Istmina, who deserve special mention, are Mr. Antonio Asprilla, who secured men and canoes for collecting; and Mr. Andrés Arizala, who loaned me his servant for the work on the Condoto River. Mr. C. J. Indú and Mr. Frank Ocoassen of Peñalisa furnished men and canoes and aided with the collecting. In Quibdo Mr. Tufik Meluk was of the greatest assistance in securing men and canoes for the expedition. I am also indebted to Mr. Meluk for letters of introduction. In Rio Sucio Mr. Ed. Kromer kindly acted as interpreter and greatly aided the expedition with the

work in the Truando River. In Cartagena the A. & T. Meluk Co. kindly aided the expedition."

The Landon Expedition to Colombia and Ecuador.

Through the continued liberality of Mr. Hugh McK. Landon of Indianapolis Mr. Arthur W. Henn was enabled to remain in South America and spend the time between February 15, 1913, and March, 1914, in collecting fresh-water fishes in Colombia and Ecuador.

The following account by Mr. Henn summarizes his travels: "On February 15, 1913, I left Tumaco for Barbacoas. Three days were spent in securing the necessary pack-animals; then I left for Tuquerres, arriving after five days' travel. Tuquerres (10,090 feet) is on the Andean plateau. After diligent collecting a single species of *Astroblepus* was obtained. On March 4th, accompanied by Mr. Fridolin Hämmerles of Tuquerres as an interpreter and two arrieros or muleteers, I went northward from Tuquerres for the basin of the Upper Patia. Our route was in general that of the geologist, A. Stübel. March 6th was spent in Ancuya (5,000 ft.) where a single species of *Astroblepus* was collected. Crossing the Rio Guaitara, our next stop was Los Llanos de Sandona (5,000 ± ft.), where a collection was made containing three species. Passing northward through Tambo and Peñol, we arrived on March 13, at a place, composed of three huts, known as Guayabillo. This is directly on the brink of the canyon of the Patia. On this and the following day we descended some three thousand feet and collected in the Patia just above the mouth of the Guaitara. The elevation here, as determined by my barometer, was about 1,500 feet; the great swiftness of the river and the huge boulders made collecting difficult, but the collection is assumed to be representative. We returned to Tuquerres by way of Pasto and continued on to Barbacoas. After two days at Barbacoas, I left on the steamer 'Bolivar' for the mouth of the Rio Telembi, from which point I continued up the Patia by canoe. The Rio Magui, the first large tributary of the Patia above the Telembi, was ascended to the negro village of Payan. During the return to Barbacoas we fished in all available places. These localities may be somewhat arbitrarily given as (1) the Rio Magui, between its mouth and the village of Payan; (2) the Rio Patia between the Magui and the Telembi; (3) the Rio Telembi below Barbacoas.

"After returning to Tumaco and waiting more than a week for the steamer, I sailed for Buenaventura, arriving there on April 23, 1913. After waiting in Buenaventura an additional week, I left on the small river-steamer "Buenaventura" for Puerto Negria, the head of navigation on the Rio San Juan. The following

day with two negroes I left, going down-stream in a canoe. Because of flooded conditions fishing was desultory, and most of the fishes secured were obtained by barter with the Indians. Five days were occupied in drifting down the San Juan; the nights were spent in the occasional houses of the Indians. The last large tributary, the Rio Calima, was ascended. Thorough collections of fishes were made in two places: (1) a small creek of the Rio Calima just above the junction of the Calima with the San Juan; and (2) a point probably thirty miles up the Calima, known as Boca del Guineo. Ascending the creek El Guineo to its source, a short portage was made to another creek, known as San Joaquin, where a second canoe was taken to Buenaventura.

"Leaving Buenaventura almost immediately, I arrived in Guayaquil, Ecuador, on May 16, 1913. A few days later, I left with Mr. R. B. Jones, an American residing in Guayaquil, for an hacienda owned by him just south of Naranjito. While here, collections were secured in a small creek known as Estero Verdes, tributary to the Rio Chanchan, which borders the hacienda, and in a clear, deep river, the Rio Barranca Alta, some two hours on horseback south of the hacienda. Later I sailed from Guayaquil for the Province of Manabi, arriving at Bahia de Caraquez, its chief port, on June 21. Going on the short railroad to Chone, I there made collections in the river, and then returned to Calceta, from which point I continued by horse to Portoviejo, where collections were also obtained. These rivers are small, traverse a very dry region, and contain few species of fishes. The return to Guayaquil was made by steamer from Manta.

"I again left Guayaquil on July 17 in a launch for Daule, a small town on the Rio Daule. Delayed a few days by fever at this point, I continued in a launch to the village of Santa Lucia and then proceeded by canoe to another village known as Colimes higher up the river. Extensive collections were made at this point. Then returning to Daule in a large canoe, I embarked in a smaller one, and, after paddling two days along a winding cut-off from the Rio Palenque, I arrived at Vinces, where thorough collecting was done.

"Returning to Guayaquil, I went over the Guayaquil and Quito R. R. to Quito, stopping off for collecting at Huigra (4,000 ft.); Riobamba, Atlantic drainage (9,020 ft.); Latacunga, Atlantic drainage (9,055 ft.) and Quito (9,375 ft.). A short trip for collecting was made to Mindo (4,108 ft.), situated in a region of tremendous rainfall on the western slope of Mt. Pichincha. Somewhat later (October 18, 1913), I went north to El Angel (10,000 ft. ±) in the Province of Carchi, the most northerly province of Ecuador. Here *Astroblepus* was collected. From this point a trip was taken down the valley of the Rio Chota, or Mira, to a small property

two leagues below the hacienda Paramba, known as "Maria Luisa," belonging to Señor Cesar Mena of Angel. Unfavorable conditions made this trip almost a failure, nevertheless a good collection of *Astroblepus* was obtained on the return from a place opposite the settlement, Guallupi (5,000 ft. ±) farther up the Rio Chota.

"Being forced to return to Quito by revolutionary developments in the province of Carchi, I remained there until February 9, 1914, when I again went back to El Angel to secure the collections, continued on over the Colombian frontier, twice changing mules, and returned over the road to Barbacoas. Traveling as rapidly as possible, though long delayed by waiting for steamers at Barbacoas and Tumaco, and by the quarantine at Panama, I did not reach New York until the very last of March, 1914.

"Throughout the course of the trip I met with numerous courtesies from residents of the countries traversed. Chief among these persons may be mentioned Sr. José A. Mayolo of Tumaco, Colombia. Mr. Mayolo provided free transportation on the 'Linea Costanera Fluvial de Vapores' for myself and my extensive outfit and collections on several trips between Tumaco and Barbacoas; in the Choco he gave me recommendations to the authorities, his friends, and business associates; assisted in employing laborers; and performed other innumerable services. His favors coming, as they did, when I knew but little of the language and customs of the country, were well-nigh indispensable. For the 'Sierra,' similar services were performed for me by Mr. John W. Bidlake, an American resident of Tuquerres. In Guayaquil Mr. R. B. Jones showed me a number of courtesies and Mr. H. W. Henderson of the Guayaquil and Quito Railway Company kindly provided free transportation to Quito. Sr. Alberto Santos of Bahia did me several favors. I was a guest at several haciendas; among which may be mentioned those of Sr. Cesar P. Garzon of Mindo, of Sr. José Tamaya, and of Sr. Cesar Mena of Carchi. The Panama Railroad Steamship Line courteously provided free transportation of freight from Panama to New York and reduced fare for myself.

"The expenses of this Expedition were largely provided by Mr. Hugh McK. Landon of Indianapolis. He not only provided funds for the trip as originally planned, but later gave an additional sum, which allowed considerable modification and extension of the plans and enabled the expedition to remain in the field nearly four times as long as had been originally intended."

The Irwin Expedition.

The Irwin Expedition of Indiana University, of 1918–19, carried the survey of the rivers of the Pacific slope from northern Peru to southern Chile. It also descended on the Atlantic side into the Huallaga Basin to two thousand feet, the Chanchamayo to two thousand feet, the Urubamba to three thousand feet, and surveyed the Titicaca Basin. The main account of the Irwin Expedition will appear with the reports on these regions. The portion of the Irwin Expedition, which comes within the present territory, deals with the Chira, Piura, Rimac, and Chili Rivers, enumerating these rivers in order from north to south, but not in the order in which they were examined.

All four of these rivers belong to the dry Peruvian coast. The Chira River rises in southern Ecuador in the southernmost of the interandean parks of Ecuador and empties into the ocean north of Paita. I collected at Sullana early in January, 1919. The river had been swollen by recent rains in the mountains and collecting was difficult. The water was muddy and fishes were scarce and scattered. A species of *Curimatus* was obtained here; and this is the southernmost record for the genus on the Pacific slope. The rest of the fauna was the same as that farther south at Pacasmayo.

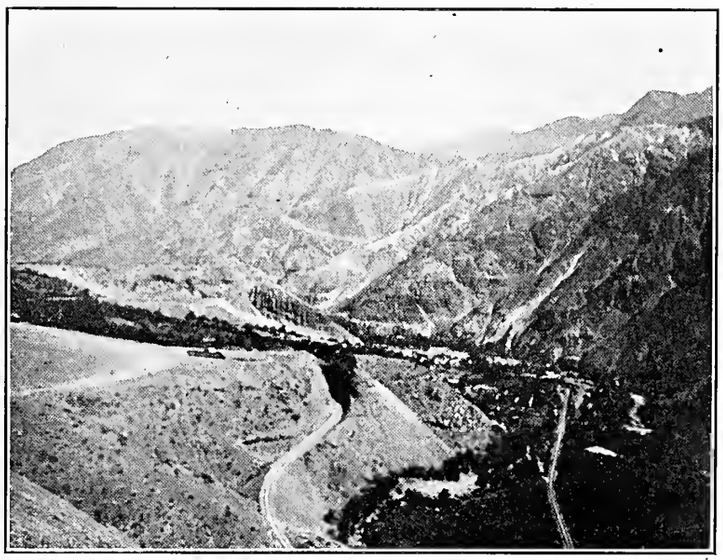

Fig. 6. Upper Rimac Valley.

Conditions at Piura on the Piura River, only a few miles south from Sullana, were the reverse of those at Sullana. I reached Piura at the end of the dry season. On asking where the river was, I was told that it had not yet come down. The

river-bed was damp in places and shallow excavations provided water for gardens and dwellers along its shores. There were a few pools in natural depressions about the pier and alongside of some rocks. These were covered with green slime and were crowded with starving fishes. A single species each of *Pimelodella, Pygidium, Brycon, Bryconamericus, Lebiasina,* and *Æquidens* formed the entire fauna. Both Sullana and Piura are reached by rail from Paita. The Piura River reaches the ocean south of Paita. The next stop farther south was at Pacasmayo. Conditions here are similar to those at Paita. The town clusters about a little rivulet, which always carries water and is affected by the tide. Behind the town there is a considerable lagoon. The Rio Jequetepeque rises in the Andes west of Cajamarca and empties into the ocean north of Pacasmayo. Collections were made at Llallan (elevation 2,437 ft.), at Cultambo, and in the outlet of the lagoon just above and below the locks controlling its level. Llallan is at the junction of two clear, swift streams. At Cultambo I collected near the railroad bridge. The water was clear with alternating swift stretches or even miniature rapids and quiet pools. The fauna was the same as that at Piura with the addition of an *Astroblepus,* which could not be expected to occur in the portion of the Piura I examined. *Astroblepus* is probably found nearer the mountains in the Piura River. A *Liza* is abundant in the lagoon, but we were not fortunate enough to get one. Pacasmayo was the southernmost locality for *Æquidens, Pimelodella,* and *Brycon.*

We should have made collections in the Santa River, the largest and most constant river of Peru. However, several matters prevented its examination; the regular steamers do not stop at Chimbote at its mouth and the time needed for its exploration was therefore uncertain. The Rimac River south of the Santa contained everything we secured at Pacasmayo except *Astroblepus, Brycon, Æquidens,* and *Pimelodella.* Somewhere between Pacasmayo and Callao they disappear. *Astroblepus* is known to occur in the Santa Basin, which is the southernmost locality on the Pacific Slope. One question thus left unanswered is whether *Brycon, Æquidens,* and *Pimelodella* extend as far south as the Santa, or not. It will probably be found that they do. A second question is whether the "Peje rey," *Basilichthys semotilus,* is found in the Santa? It is found in the Rimac, and has not been taken in the Jequetepeque. Again *a priori* considerations would answer this question in the affirmative. A question exceeding the other two in interest, because its answer is more problematical, is whether the Santa, being the largest and most permanent of the Peruvian rivers, harbors a more abundant representation of the ancient fauna of the Pacific slope of Peru? The answers to these questions must be left for the future.

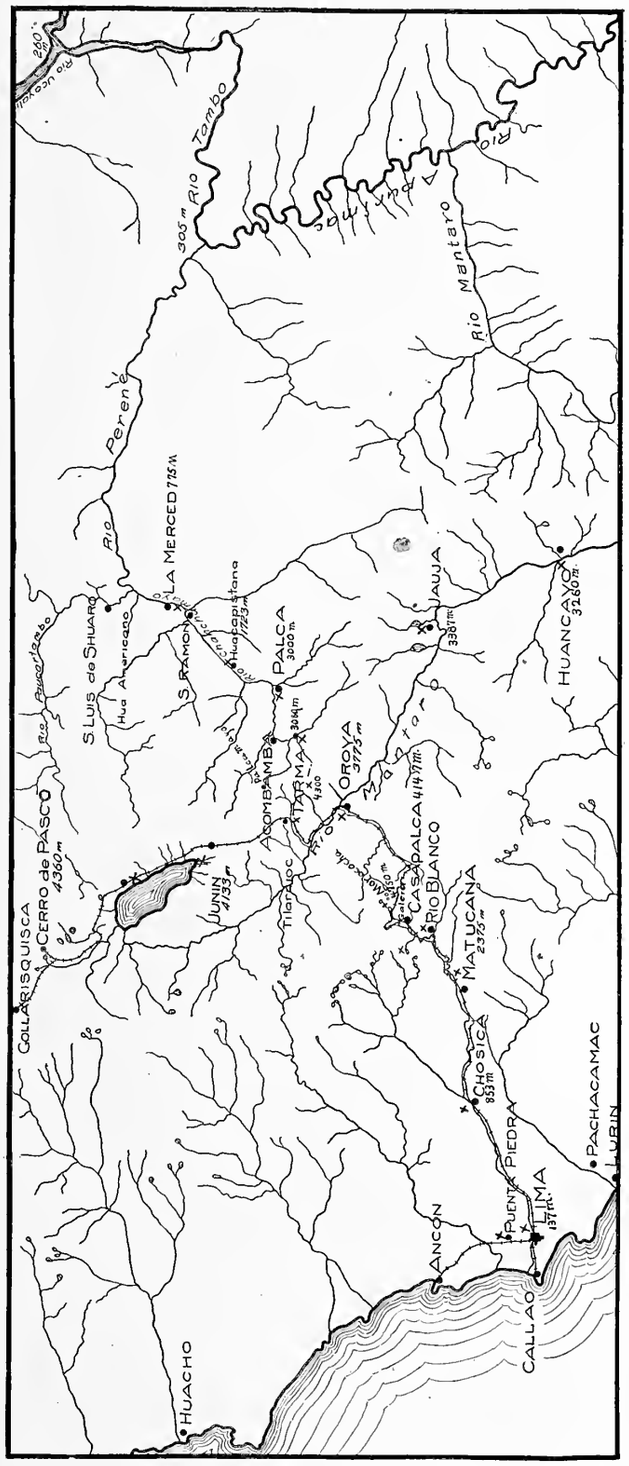

Fig. 7. Map of Central Peru from Callao to Rio Ucayale. Places where collections were made are marked ×.

The Rimac River, emptying just north of Callao, has been examined at various times. During the Irwin Expedition collections were made at Puenta Piedra in a shallow lagoon north of the river on the railroad toward Ancon. The water was about "knee-deep" and full of fishes, principally *Bryconamericus peruanus* and *Lebiasina bimaculata*. Many of these were badly infected with *Saprolegnia* and a peculiar wavy shortening and up and down distortion of the caudal portion of the spine. Collections were made in little side-branches and rivulets emptying into the Rimac at Lima. Four species, *Lebiasina bimaculata*, *Bryconamericus peruanus*, *Pygidium punctulatum*, and *Basilichthys semotilus* formed the total fauna at Lima, Chosica, and Matucana. At Chosica (elevation 2,800 ft.) the river is canalized and very swift. A pool below the dam of the electric-light plant in the city yielded the usual fauna with "Cube," a native poison. *Basilichthys* was abundant in the pool. Chosica lies at the foot of the gorge of the Rimac. Matucana lies in a little widening of the gorge at about 7,800 ft. elevation. The usual fauna was secured during a stay of several days, devoted largely to becoming acclimated to the elevation. At Rio Blanco at an elevation of ten thousand feet we secured nothing. Undoubtedly the fauna of the Rimac, especially in its upper parts, has become affected by the enormous masses of waste daily dumped into it by the smelter at Casapalca.

We made two excursions out from Casapalca to examine the lakelets up to 15,250 feet, but, although we seined and poisoned, we saw no fishes. Our guide was more fortunate on subsequent excursions, and he secured enough specimens for us from one of the lakelets to verify Garman's report of the occurrence of *Orestias* in the lakes at the headwaters of the Rimac. We were put under the greatest obligations to Mr. Roper, manager of the Casapalca Works. We were his guests in the company house at Casapalca; he provided us with a guide and beasts; and finally secured for us the fishes we were not fortunate or skilled enough to catch ourselves.

The southernmost river of Peru in which collections were made is the Rio Vitor with its tributary, the Chili, which flows through Arequipa. Both of these rivers rise in upland meadows near the crest of the divide between Lake Titicaca and the Pacific. The rivers were examined at Yura, Vitor Valle, Arequipa, and Tiabaya. At Yura our attempts at diverting a branch of the river and in poisoning yielded nothing.

At Arequipa we poisoned a very unpromising branch at the large wagon-bridge. It yielded *Pygidium quechuorum* in such numbers that a passerby remarked that it exceeded the miraculous draft of St. Peter. Other attempts at Tiabaya, a few miles below Arequipa, yielded the same species of *Pygidium* and *Basilichthys semotilus*.

We went by train to Vitor and took horses to Vitor Valle about twelve miles distant. The trail leads for several miles over the most arid desert imaginable. The valley is irrigated and strongly contrasts with the arid walls and plains above. We were given numerous assistants by the Alcalde and the Gobernador and did our best, but secured no fishes, except the "peje rey," *Basilichthys semotilus*. We were told that there is a fall several miles below, which prevents the lowland fishes from penetrating further.

Attempts to get fishes from the Rio Tambo proved abortive, and the question whether the fishes of the Tambo belong to the Peruvian or the Chilean fauna must be decided later.§

The Irwin Expedition was largely made possible through the generosity of Mr. William G. Irwin of Columbus, Indiana. It had also the coöperation of the National Academy of Sciences through the Bache Fund, and that of the American Association for the Advancement of Science. The University of Illinois made Dr. Wm. Ray Allen, a "Travelling Fellow" and thus provided for his entire expenses.

§ In 1921 Mr. N.E. Pearson of the Mulford Expedition examined the Rio Tambo for me at Chucarapi. He only found *Mugil rammelsbergi* and *Basilichthys semotilus*. The boundary between the Guayas fauna and that of Chile is therefore near the Rio Rimac.

He devoted himself largely to the upper Huallaga, Lake Titicaca, and the highlands between La Raya and Chile.

The heartiest co-operation was received from the Peruvian Company, which granted free transportation over all of the railways it manages, and from the Peruvian Government, which provided steamer transportation between the ports of Peru and granted numerous other favors.

SYSTEMATIC ACCOUNT OF THE FRESHWATER FISHES.

Subclass SELACHII.

Order BATOIDEI.

Suborder *SARCURA*

Family I. PRISTIDÆ.

Pristis Latham

1. **Pristis pectinatus** Latham.

Pristis pectinatus Latham, Trans. Linn. Soc. Lond., 1794, II, p. 278. Pl. 26, fig. 2 (rostrum).

A rostrum or saw of what was presumed to be this species was seen nailed to a house on the shores of the Quito River of the Atrato Basin.

2. **Pristis perrotteti** Valenciennes.

Pristis perrotteti Steindachner, Denkschr. Akad. Wiss. Wien, 1879, XLI, 169 (Mamoni).

Several small saws, which had been taken from young individuals, were seen in houses half-way between Puerto Negria and Istmina on the San Juan River. As no complete specimens were obtained, I am not certain of the identification of the species.

Family II. DASYATIDÆ.

Subfamily Potamotrygoninæ.

Potamotrygon Garman.

3. **Potamotrygon magdalenæ** (Dumeril.)

Tæniura magdalenæ Dumeril, Elasm., 1865, p. 625; Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 72, plate 15 (Magdalena); *ibid.* XLII, 1880, p. 90 (Cauca near Caceres).

Potamotrygon magdalenæ Steindachner, Denkschr. Akad. Wiss., Wien, LXXII, 1902, p. 60 (Magdalena, at Bodega Central); Garman, Mem. Mus. Comp. Zoöl., XXXVI, 1913, p. 421.

7515 *a*, C. M., one female, Rio Sucio. Eigenmann.
7516 *a-e*, C. M.; 13899 I. U. M., including two pregnant females, Rio Truando. Wilson.
7523 *a-b*, C. M., two, 162 and 370 mm., Puerto Wilches. Eigenmann.
13901, I. U. M., two, largest 315 mm., Cienaga, at Puerto del Rio. Gonzales.
13900, I. U. M., two, 185 and 196 mm., one pregnant female, Apulo. Gonzales.
Habitat: Magdalena and Atrato Rivers.

Subclass TELEOSTOMI.

Order NEMATOGNATHI.

Family III. ASPREDINIDÆ.

A family of Nematognathi, the members of which are found in streams with muddy bottoms and along the coast from the Orinoco River to the São Francisco. The family was not known to occur west of the Andes, until the specimens reported in the present paper were secured.

Sub-family BUNOCEPHALINÆ.

4. **Bunocephalus colombianus** Eigenmann. (Plate I, fig. 2.)

Bunocephalus colombianus EIGENMANN, Indiana University Studies, No. 16, Sept. (Dec. 23), 1912, p. 10.
4828 *a*, C. M., *type*, 89 mm., Boca de Raspadura. Eigenmann.
12687, I. U. M., *paratype*, 103 mm., Quibdo. Eigenmann.
5485, C. M.; 12966, I. U. M., two, larger 135 mm., Raspadura. Wilson.
5483 *a*, C. M., one, 136 mm., Managru. Wilson.
7067 *a-c*, C. M.; 13767, I. U. M., nine, 33–77 mm., Truando. Wilson.
5484 *a*, C. M.; 13176, I. U. M., three, 43–51 mm., creek near Pembana, Rio Telembi. Jan. 17, 1913. Henn and Wilson.

Habitat: West of the Andes in Colombia; the Atrato Basin of the Atlantic drainage; and the Patia Basin of the Pacific drainage. This is the only species of the genus found on the Pacific slope. It may occur in the Magdalena.

Head to gill-opening 5.5; depth 6.5–7.5; D. 5; A. 8 or 9; snout 1.5 in interorbital, distance of dorsal from snout, $2\frac{1}{6}$–$2\frac{1}{3}$ in the length; maxillary barbels extending beyond base of pectorals; coracoid process 1.5–1.6 in the space between its tips; pectoral spine strong, curved, several small hooks along its anterior margin and about ten strong hooks along its posterior margin, its filiform prolongation reaching the ventrals; caudal margin rounded; tail subcylindrical; tail and body to the dorsal covered with numerous warts arranged in longitudinal series, much smaller

warts on belly and before dorsal; a strong occipital crest diverging forward to the eyes; width at base of pectorals 1.5–1.4 in distance from snout to dorsal.

Tips of all fin-rays light; upper caudal ray barred; ventrals and anal mottled anteriorly. General color black with faint mottlings.

Xyliphius Eigenmann.

Xyliphius Eigenmann, Indiana University Studies, No. 16, Sept. (Dec. 23, 1912), p. 10. Type, *Xyliphius magdalenæ* Eigenmann.

A genus of *Bunocephalinæ*. Mouth inferior; lower lip with a series of antrorse fringe-like papillæ, which screen the mouth. Not greatly expanded at the shoulder, the width at the pectoral spine equal to its distance from the snout. Eyes minute; anterior nares not quite marginal.

5. **Xyliphius magdalenæ** Eigenmann. (Plate I, figs. 1, 1 *a*, and 1 *b*.)

Xyliphius magdalenæ Eigenmann, Indiana University Studies, No. 16, Sept. (Dec. 23), 1912, p. 10.

4829 *a*, C. M., *type*, 32 mm., Girardot. Eigenmann.

Head to gill-opening 5 in the length; depth 7; D. 5; A. 7. Head about as wide as long; eyes minute, about half the diameter of the posterior nares; maxillary barbel not quite reaching pectoral; about twenty labial papillæ. Length of coracoid processes two in the coracoid space. Distance from snout to dorsal 2.33 in the length; ventrals just reaching anal; pectoral spine short, as long as its distance from the barbel, four strong hooks on its posterior margin, the spine prolonged in a soft tip reaching nearly to middle of ventrals. Caudal obliquely truncate. Head without distinct ridges; skin slightly warty, except on belly.

Light brown; tips of all the fins light.

This species is known only from the type.

Family IV. SILURIDÆ.[6]

Distribution: Atlantic slope; Pacific slope south to Pacasmayo.

Key to the Genera of Siluridæ.

a. Gill-membranes free from the isthmus, nares approximated..(*Ariinæ*) **Hexanematichthys** Bleeker.

aa. Gill-membranes free from the isthmus. Nares remote.

b. Palate without teeth, or with a very minute patch of teeth.

c. Head wider than long; mouth wide, terminal, the jaws equal; eye small, much in advance of the center of the head, without free orbital margin; pectoral spine short, very strong, with strong teeth on its posterior face; adipose fin short; barbels short.

[6] The account of the *Siluridæ* was prepared in collaboration with Homer G. Fisher, who died of influenza in 1918.

d. Premaxillary band of teeth with a sharp-angled prolongation on its outer posterior angle; part of the species gigantic.....**Pseudopimelodus** Bleeker.

dd. Premaxillary band of teeth rounded laterally, without a backward projecting angle; species minute.....**Microglanis** Eigenmann.

cc. Head longer than wide, the eye in the center of the head, or very nearly so.

e. First dorsal and first pectoral rays not spinous; pectorals broad, with ten to fourteen rays; ventrals large.

f. Mental barbels in two pairs, the outer pair much farther back than the inner pair; snout broad; eye large, with a free margin; occipital process narrow, reaching half way to dorsal, free behind; a large frontal fontanel, occipital fontanel small or obliterated. Premaxillary band of teeth rounded at the ends.

Perugia Eigenmann and Norris.

ff. Mental barbels nearly in a straight line, the outer ones but little farther back than the inner ones; snout narrow, pointed; eye without a free orbital margin, its center a little in advance of the center of the head; occipital process very short; a large parietal and a smaller frontal fontanel; adipose about equal to the anal.

Cetopsorhamdia Eigenmann and Fisher.

ee. First dorsal and first pectoral rays spinous.

g. Occipital process not reaching to the dorsal plate, skull smooth, covered with skin; dorsal and anal rounded; adipose fin moderate or long; pectoral spine with short hooks.

h. A frontal fontanel, no occipital fontanel; eye with a free orbital margin.

Rhamdia Bleeker.

hh. A large frontal and a large occipital fontanel; eye with a free margin only above.....**Nannorhamdia** Regan.

gg. Occipital process forming with the dorsal plate a complete bridge between the head and the dorsal; eye with a free orbital margin.

i. Occipital process narrow throughout; a large occipital fontanel, head covered with skin; adipose fin longer than the anal; dorsal and anal rounded; pectoral spine shorter than the rays.

Pimelodella Eigenmann and Eigenmann.

ii. Occipital process wide at base tapering to the tip; no occipital fontanel; head granular above; adipose medium, or as short as the anal; anal emarginate; dorsal truncate, the spine almost equal to the first ray, which reaches beyond the tips of the rest; pectoral spine equal to, or but little shorter than, the first ray.....**Pimelodus** Lacépède.

bb. Large patches of teeth on vomer and palate; head depressed, longer than broad; eye with a free margin, equidistant from tip of snout and origin of opercle; occipital process reaching to the dorsal plate, the two of about the same length; barbels of moderate length; first dorsal and pectoral rays spinous, long, slender, the latter with moderate teeth on its posterior margin; adipose fin very short, shorter than the anal; caudal forked; mouth but little, if any, narrower than the head.

j. Snout but little produced beyond the lower jaw; the premaxillary band of teeth shallowest at the symphysis; head less depressed than in *Sorubim*, the eyes dorso-lateral; interocular equal to half the width of the head; base of anal equals caudal peduncle; occipital process keeled, tapering from base to the pointed tip; dorsal rounded.

Pseudoplatystoma Bleeker.

jj. Snout greatly produced beyond the lower jaw; the premaxillary band of teeth very deep, deepest at symphysis, covering the entire projecting part of the upper jaw; head greatly depressed; the eye in the edge of the head; interocular equal, or almost equal, to the width of the head; base of anal longer than caudal peduncle; occipital process of nearly equal width throughout, with a median groove; dorsal lanceolate.....**Sorubim** Spix.

aaa. Gill-membranes united with the isthmus; dorsal entirely in front of the ventrals.

k. Sides with a series of spine-bearing bony plates; barbels simple; eye in middle of the head; jaws with narrow bands of teeth; caudal forked.....**Doris** Lacépède.

kk. Sides naked.

l. Mental barbels in two pairs; adipose fin much shorter than the anal fin; anal long, nineteen to forty rays, rounded; caudal obliquely emarginate; lower jaw slightly longer than upper; no prominent bony orbit; pectoral and dorsal spines strong.....**Trachycorystes** Bleeker.

ll. No mental barbels; snout greatly depressed; mouth very wide, terminal, the upper jaw longer; maxillary barbel very short; eye lateral, without free margin; dorsal spine over the middle of the base of the pectoral; adipose fin very short; anal very long; dorsal and pectoral spines weak; no humeral process; caudal forked.....**Ageneiosus** Lacépède.

Subfamily Ariinæ.

The species of the subfamily *Ariinæ* are abundant along the sandy and muddy shores of tropical America, where many of them enter rivers. For the most part, they are omitted here. Boulenger enumerates *Selenaspis dowi* (Gill), *Hexanematichthys guatemalensis* Günther, *Tachysurus multiradiatus* (Günther), *Netuma planiceps* Steindachner, and *Felichthys pinnimaculatus* Steindachner, from the Rivers Sabana, Lara, Cianti, and Tuyra, Darien. Steindachner records *T. multiradiatus* from the Mamoni.

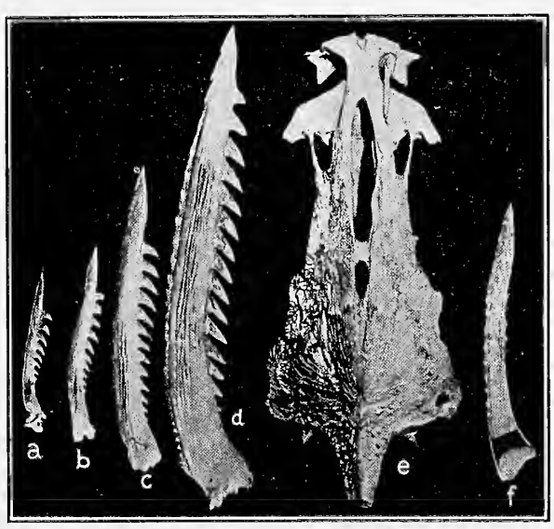

Fig. 8. Pectoral spines of *Hexanematichthys simonsi* (Starks). *a*, Specimen 50 mm. long to base of caudal; *b*, 63 mm. long to base of caudal; *c*, 105 mm. long to base of caudal; *d*, No. 13225, I. U. M., 188 mm. long to base of caudal; *e*, macerated skull of *Hexanematichthys henni* Eigenmann, showing fontanels; *f*, pectoral spine of *H. henni*, 112 mm. long to base of caudal.

HEXANEMATICHTHYS Bleeker.

6. **Hexanematichthys simonsi** (Starks).

Galeichthys simonsi STARKS, Proc. U. S. Nat. Mus., XXX, 1906, p. 765, figs. 1 and 2 (Callao, Peru); WILSON, Ann. Carnegie Mus., X, 1916, p. 58 (Mouth of Rio Dagua; Tumaco; Rio Rosario).

13218, 13223, 13224, and 13225, I. U. M.; 5586, 5663, 5664, 5665, and 6721, C. M., Mouth of Rio Dagua; Buenaventura; Tumaco; and Rio Rosario, Colombia. 65–230 mm.

A. usually 19 or 20, more rarely 18 or 21; pectoral spine with long hooks; vomerine teeth in two separate patches, patches of palatine teeth larger, in contact with the vomerine patches; an anterior and usually a posterior fontanel, the latter variable and sometimes obliterated.

7. **Hexanematichthys henni** sp. nov.

15045, I. U. M., three, *type* and *paratypes*, 145–157 mm., Colimes, Rio Daule, Ecuador. Henn.

Head 3.66–3.7; depth 5.5–6; D. I, 7; A. 20; eye 1.5 in the snout, 4.5 in the head, 1.25 in the interorbital; width of head equal to the eye and postorbital portion; depth at base of occipital process equal to head behind the anterior margin of the pupil; the width of the head at the angle of the mouth equal to the postorbital portion of the head; profile nearly straight from the dorsal plate to the anterior border of the eye, then rapidly decurved; head flat below, mouth inferior, the upper jaw considerably projecting; depth of premaxillary band of teeth about five in their length; no vomerine teeth, the palatine patches linear, scarcely evident

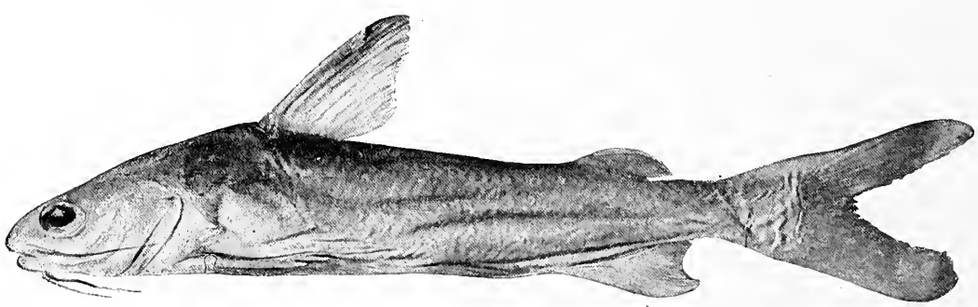

FIG. 9. *Hexanematichthys henni* Eigenmann. Type. No. 15045, I. U. M., 145 mm. Colimes.

in these specimens. Fontanel extending for half the diameter of the eye behind the posterior border of the latter, a bridge over it at the posterior margin of the eye, continued as a narrow groove to a transverse groove in front of the base of the occipital process; granules and ridges of the skull extending forward to near

the anterior margin of the eye; width of occipital process at its base equal to its length; dorsal plate V-shaped; maxillary barbel not reaching to the axil of the pectoral spine, the mental barbels extend to about the edge of the gill-membrane, the postmental beyond the edge of the membrane; gill-membrane narrowly free at the middle; pectoral spine equal to dorsal spine, equal to snout and eye, its anterior and posterior hooks of about the same size, very small; base of adipose fin a little longer than that of the dorsal, about 2.33 in its distance from the dorsal; caudal deeply forked, its lobes equal to the head behind the nares; base of anal not quite equal to snout and eye, its middle ray (counting rudiments) highest, extending considerably beyond the tip of the last ray.

Dark ashen above, white beneath; anal, ventrals, and pectorals largely dark.

It is possible that these specimens are the young of *H. labiatus*, the only known specimen of which is three times as large as our largest.

8. **Hexanematichthys labiatus** (Boulenger).

Arius labiatus Boulenger, Boll. Mus. Zoöl. Anat. Comp., Torino, XIII, 1898, No. 329 (Rio Peripa).

Habitat: Guayas Basin.

Said to be allied to *Hexanematichthys rugispinis.*

Head 5 in the total length; depth 5; D. I, 7; A. 17; eye 9 in the head, 4 in interocular; width of head 1.4 in its length; depth of premaxillary band of teeth half the length of the eye, 4 in its length; palatine (vomerine ?) teeth conical, in two small oblique groups, much smaller than the eye, and separated by a space about equal to .75 of the length of the premaxillary band; occiput and occipital process granulate, the latter a little longer than wide, with an obtuse keel; fontanel narrow, indistinct, followed by a groove, which does not reach the occipital process; upper lip projecting; maxillary barbel .6 the length of the head, not reaching edge of opercle, outer barbel 1.5 times as long as the inner, equal to half the length of the head; dorsal spine with very indistinct teeth, a little less than half the length of the head; base of adipose equal to base of rayed dorsal, twice as far removed from the dorsal as from the caudal; pectoral spine .4 the length of the head, much shorter than the soft rays; ventrals reaching the anal; depth of caudal peduncle 2.5 in its length; no axillary pore; dark gray above, silvery below; all the fins dark.

This description of Boulenger is based on a specimen 470 mm. long from the Rio Peripa, an upper tributary of the Daule, the only known specimen.

9. **Hexanematichthys assimilis** (Günther).

Arius assimilis Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 38 (Cienega at mouth of Magdalena, Ciudad Caiman).

Subfamily Pimelodinæ.

Pseudopimelodus Bleeker.

This genus is represented in the area under consideration by two species, *Pseudopimelodus zungaro* (Humboldt) and *Pseudopimelodus transmontanus* Regan. Both species were taken; *P. zungaro* at various places on the Magdalena and Atrato Rivers, *P. transmontanus* in the San Juan Basin by Spurrell, as recorded by Regan, and in the Patia of the Pacific slope by Henn and Wilson.

Key to the Colombian Species of Pseudopimelodus.

a. No teeth on outer margin of pectoral spine, those on the inner margin long and recurved; the spine blunt at its end. Maxillary barbels reaching beyond opercular flap. Ventrals white; adipose one-half as long as head, depth of caudal peduncle 2.7–3 in head; D. I, 6 or 7; A. 9–10. **zungaro** (Humboldt).

aa. Teeth on outer margin of pectoral spine as long as those on inner margin, the spine sharp at its end. Maxillary barbels not reaching beyond gill-opening; ventrals black; depth of caudal peduncle 1.8–2.2 in head; D. I, 6; A. 10..... **transmontanus** Regan.

10. **Pseudopimelodus zungaro** (Humboldt).

Pseudopimelodus bufonius Steindachner, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 59, plate II, figs. 1 and 1 *b* (Cauca near Caceres).

Pseudopimelodus zungaro Eigenmann and Eigenmann, Occasional Papers Cal. Acad. Sci., I, 1890, p. 112.

Habitat: Amazon, San Francisco, La Plata, Magdalena and Atrato Basins.

The following specimens were collected by Eigenmann:

12804, I. U. M.; 5010 *a–b*, C. M., three, Quibdo, Rio Atrato.

13498, I. U. M.; 6671 *a–b*, C. M., three, 175–215 mm. (to base of caudal), Soplaviento, El Dique.

12777, I. U. M.; 6672 *a–b*, C. M., three, 223–490 mm., Honda, R. Magdalena.

6673 *a*, C. M., one, 211 mm., Puerto Berrio, R. Magdalena.

13499, I. U. M., one, 155 mm., El Banco, R. Magdalena.

There is no question that the specimens recorded here belong to the species figured by Steindachner as *P. bufonius*. Steindachner compared specimens of from 160 to 550 mm. in length from the Cauca, Irisanga, and Cuyabá (*bufonius*), from the Rio das Velhas (*charus*), and from the La Plata (*mangurus*). Humboldt figured the type of *Pimelodus zungaro*, a specimen three feet four inches long from the upper Amazon, and reported that it reaches a length of from six to seven feet. However, the large specimens reported may belong to another species. The name "zungaro" is applied to various large silurids in the Peruvian Amazon.

11. **Pseudopimelodus transmontanus** Regan. (Plate II, figs. 1 and 2.)

Pseudopimelodus transmontanus REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 467 (Rios Condoto, Tamana, and San Juan, Colombia; Rio Durango, N. W. Ecuador).

5331, C. M.; 13007, I. U. M., 73–123 mm., Creeks near San Lorenzo, Rio Telembi, Patia Basin, Jan. 14, 1913. Henn and Wilson.

Habitat: Pacific slope from the Rio San Juan, south to northwestern Ecuador.

Width of head very little less than its length, its length 3.25–3.5; depth 4.5–5.5; D. 1.6; A. 9 or 10. Premaxillary band of teeth about equal to the length of the eye, with a distinct backward projecting angle; inner row of teeth more depressible and larger than the rest. Maxillary barbel reaching to the base of pectoral spine, or to base of last ray; outer mental barbel about to gill-opening; eye 4–5 in interocular, 3 in snout, 9–10 in head; frontal fontanel minute; occipital process but little longer than the eye, not reaching the dorsal plate, which is about twice as long as the eye. Dorsal spine about 2.5 in the head, without teeth; the second to fifth rays of about the same height, a little more than half the length of the head; adipose fin short, the length of its base nearly equal to the length of the base of the dorsal. Caudal rounded, with a slight emargination; anal rounded, reaching caudal, its base equal to that of the adipose and nearly opposite it; ventrals rounded, entirely behind the dorsal; pectoral spine strong, nearly half the length of the head, its posterior hooks nearly equal to the width of the spine; humeral spine reaching only to the second of the outer hooks of the pectoral spine.

A light band extending from the base of the pectoral across the humeral spine, opercle, and nape; a small light spot in front of each of the dorsals, one each above and below at the end of the caudal peduncle, one just behind the anal; light spots or marblings above the middle of the ventrals and above the posterior anal rays; sides and upper parts otherwise dark; traces of more intense dark bands between the adipose dorsal and anal and across the base of caudal; dorsal, anal, ventrals, and pectorals black, with very narrow white edges, caudal translucent, except for a submarginal marbled band.

MICROGLANIS Eigenmann.

A genus of minute catfishes with a very wide distribution.

12. **Microglanis variegatus** Eigenmann and Henn. (Plate II, figs. 3 and 4.)

Microglanis variegatus EIGENMANN and HENN, Indiana University Studies, No. 19, 1914, p. 14.

13106, I. U. M., *type*, 45 mm., *paratypes* 36–45 mm.; 5418 *a*, C. M., Forest pool near Vinces, Ecuador. Henn.

Head 3.5; depth 5; D. I, 6; A. 10 or 11; width of head a little greater than its length; eye three in interocular, 5.5–7 in the head; head covered with thin skin; frontal fontanel extending to posterior margin of eye; occipital fontanel minute; mouth terminal, the lower jaw slightly the longer; width of mouth about equal to half the greatest width of the head; premaxillary bands of teeth very narrow, without backward projecting angles, the length of the bands about half the width of the mouth; maxillary barbels extending to tip, or a little beyond tip, of humeral spine; posterior mental barbel but little shorter than the maxillary barbel; the anterior mental barbel to, or a little beyond, the gill-opening; gill-membranes narrowly joined to the isthmus; occipital process articulating with the dorsal plate, which it meets about half-way; origin of dorsal nearly equidistant from snout and adipose, the spine strong, shorter than the rays, three times in the head; adipose fin reaching to caudal, its length not equal to its distance from the dorsal, its posterior margin free, its length about five times in the length; caudal slightly emarginate, about five times in the length, its fulcra prominent; base of anal about equal to base of adipose, its tip reaching caudal; ventrals not reaching anal; their origin on, or behind, the vertical from the last dorsal ray; pectoral spine stout, one-half to two-thirds as long as head, with about eight to thirteen strong hooks behind, less prominent spines in front; humeral spine reaching to near middle, or last third, of the pectoral spine.

Adult variegated; fins like the body, traces of a darker band through the dorsal; belly white. Young marbled or less finely variegated. A lighter area through basal half of caudal.

Perugia Eigenmann and Norris.[7]

Perugia Eigenmann and Norris, Rev. Mus. Paul., IV, 1900, p. 355.

Type, *Pirinampus agassizi* Steindachner.

Nares remote; gill-membranes free from the isthmus; first dorsal ray and first pectoral ray not pungent; P. 14; dorsal and anal truncate, or slightly emarginate, the first rays of dorsal and pectoral longest; mouth broad, terminal; the jaws subequal; teeth in the jaws strong, none on the palate, the band in the upper jaw without a backward projecting angle; mental barbels in two pairs; head much longer than broad, orbit with a free margin, eye large, nearly in the middle of the head; occipital fontanel lacking, or represented by a minute pore; occipital process

[7] Driver (Proc. Amer. Philos. Soc., LVIII, 1919, pp. 448–456) has shown that this genus together with *Luciopimelodus* and *Megalonema* form a distinct subfamily. It is presented here out of order among the genera of the *Pimelodinæ*.

narrow, reaching about half-way to the dorsal to a floating interneural attached to the interneural supporting the first dorsal ray.

13. **Perugia xanthus** (Eigenmann). (Plate III, fig. 3.)

Megalonema xanthum EIGENMANN, Indiana University Studies, No. 16, Sept. (Dec. 23), 1912, p. 16.

Perugia xanthus DRIVER, Proc. Amer. Philos. Soc., LVIII, 1919, pp. 453, 456.

Habitat: Magdalena Basin near Girardot.

4822, C. M., *type*, 202 mm.; 4823 *a–j*, C. M.; 12681 *a–j*, I. U. M., *paratypes*, many, Girardot. Eigenmann.

12682, I. U. M., *paratypes*, many specimens, Apulo. Gonzales.

Head 3.75; depth 5.33; D. 7; A. 3, 9; eye 5 in head, 1.25 in interocular, slightly nearer margin of opercle than tip of snout.

Elongate; profile steep and nearly straight. Head covered with thin skin; occipital process narrow, not extending half-way to dorsal, an interneural intervening between it and the dorsal; top of head with some reticulating canals; depth at base of occipital crest slightly more than snout and eye; head a little wider than deep; eye with a free, oval, orbital rim; snout projecting, equal to orbital diameter, or two-thirds of that. Teeth in very narrow bands, the upper band narrowed at middle, almost separated into two patches, without retrorse angles; teeth of upper jaw movable, slightly larger than those of lower jaw which are a little firmer.

Fourteen gill-rakers on the lower arch. Branchiostegal membrane free from the isthmus, overlapping mesially; maxillary barbel extending nearly to end of adipose (to caudal in some smaller examples), the mental barbels are disposed as two pairs, the outer extending past middle of ventrals (to base of last anal ray in some younger), the anterior pair past middle of pectorals (to ventrals in some younger specimens).

First dorsal ray very high, greater than head and humeral process, the fin thence rapidly becomes lower, the last ray about four times in the height of the first; adipose beginning at or before tip of last dorsal ray, reaching its maximum height above tips of ventrals, its base 2.5–2.6 in the length, its height nearly equal to two orbital diameters; caudal deeply forked, upper lobe the longer, 3.5 in the length; anal short, emarginate, tip of first branched ray extending past tip of last ray, equal to snout and eye. Ventrals very large, the outer rays very heavy, longer than head; pectorals broad, falcate, reaching ventrals in the young but not in the old.

Plumbeous, yellow in life.

Cetopsorhamdia Eigenmann and Fisher.

Cetopsorhamdia Eigenmann and Fisher, Ann. Carnegie Mus., X, 1916, p. 83.

Type, *Cetopsorhamdia nasus* Eigenmann and Fisher.

A genus of *Pimelodinæ* related to *Chasmocranus* and *Nannorhamdia*.

Orbit without a free margin; head subconical, the snout projecting in *C. nasus*, Rhamdia-like in *C. boquillæ*, no teeth on vomer or palatines; premaxillary band of teeth narrow and without a backward projecting process; first dorsal and first pectoral rays not spinous; anal moderate; lower caudal lobe the longer; origin of ventrals under the dorsal; adipose fin longer than high; skull covered with skin, not granular; occipital process vestigial.

Key to the Species of Cetopsorhamdia.

a. Adipose 6.3 in the length; occipital fontanel much smaller than the frontal; mouth very narrow, the snout subconical; a light band about the width of the eye across the back between the gill-openings..... **nasus** Eigenmann and Fisher.

aa. Adipose 3.25–3.5 in the length; occipital fontanel equal to the frontal; width of mouth equal to the length of the snout; uniformly chocolate-colored..... **boquillæ** Eigenmann.

14. **Cetopsorhamdia nasus** Eigenmann and Fisher. (Plate IV, fig. 1.)

Cetopsorhamdia nasus Eigenmann and Fisher, Ann. Carnegie Mus., X, 1916, p. 83 (Honda).

Habitat: Magdalena Basin.

7124 *a*, C. M., *type*, 72 mm., Honda. Eigenmann.

Head 4.3; depth 6.25; adipose 6.3; snout in head 2.5, eye in snout 3; eye in interorbital 2. Depth of body at beginning of dorsal equal to its width. D. 7; A. 10; P. 12; ventrals 7.

Body rather slender, compressed toward the caudal. Head short, subconical, snout somewhat depressed. Eye small, without a free orbital margin. Mouth narrow, its width at rictus a little greater than snout less the diameter of the eye. Jaws unequal, the upper jaw projecting; premaxillary band of teeth narrow, of equal depth throughout, and without backward projecting angle. Vomer and palatine without teeth. Frontal fontanel small and round, far removed from the long narrow occipital fontanel, which is widest in front.

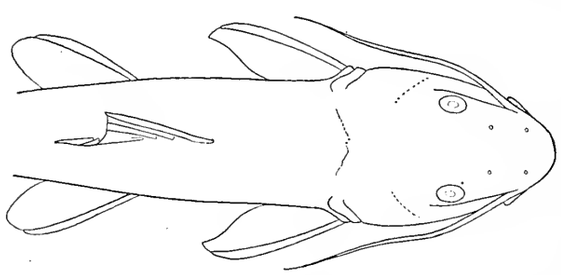

Fig. 10. *Cetopsorhamdia nasus* Eigenmann and Fisher. Type, 72 mm. No. 7124 *a*, C. M. Honda.

Maxillary barbels reach a little beyond beginning of pectorals, postmentals to gill-opening; the mentals are a little over half the length of the postmentals. Dorsal concave, the first ray not pungent. Adipose fin moderate, its height 3 in its length. Caudal deeply forked, the lower lobe the longer, longer than the head.

Anal broken, length of base less than length of adipose. Pectorals short, not reaching to ventrals, which do not reach origin of anal.

Everywhere covered with small dark purplish chromatophores, which are much more abundant dorsally. A dark band at base of caudal and a light band about the width of the eye extending between the upper margins of the gill-openings across the base of the occipital.

15. **Cetopsorhamdia boquillæ** sp. nov. (Plate I, fig. 3.)

3923, C. M., *type*, 81 mm.; 3924 *a–e*, C. M.; 15004, I. U. M., *paratypes*, eleven, the largest 60 mm. to base of caudal. Boquilla. Eigenmann.

Head 5; depth 6.5; adipose 3.25–3.5; snout 2.66–2.75 in the head; eye 2 in the snout, 5 in the head; D. 7; A. 10–12; P. 9–10; ventrals 6.

In shape of head and body this species resembles species belonging to the genus *Rhamdia*. The eye is without a free margin; the mouth at the rictus equals the length of the snout; jaws subequal. Premaxillary band of teeth of about the same depth throughout, without a backward projecting angle, its width equal to the length of the snout; vomer and palatines without teeth; frontal fontanel and occipital fontanel of about the same length and shorter than the roofed space between them.

The maxillary barbels reach to the middle of the pectorals, or to the middle of the dorsal; mentals to the gill-openings; and postmentals nearly to the pectorals. Adipose highest behind, becoming a low membrane in front; caudal (frayed in all specimens) deeply forked, the lower lobe probably somewhat the longer; anal rounded, the middle ray highest, about two-thirds the length of the head; pectorals not reaching to ventrals; ventrals not reaching to anal. Chocolate-brown in coloration.

As shown by one of the specimens, 60 mm. long, and containing ripe eggs, this is a small species. All of the specimens were caught in a little brook crossing the road at Boquilla. They were caught one morning after the pack-train had left, and could not be properly preserved.

Rhamdia Bleeker.

Key to the Species of Rhamdia.

a. A dark lateral band. Maxillary barbels extending beyond middle of adipose. Pectoral spine short, 2 in head, top of head flat. . . . . **wagneri** (Günther).

aa. No dark lateral band.

b. Maxillary barbels extending beyond middle of adipose; eye small, 7 in head.

sebæ (Cuvier and Valenciennes).

bb. Maxillary barbels short, not reaching adipose in most cases. Distance of adipose from dorsal equal to one-fourth of its length; eye 6 in head, well in anterior part of head.

cinerascens (Günther).

16. **Rhamdia wagneri** (Günther).

Pimelodus cinerascens (*non* Günther) Kner and Steindachner, Abhandl. Bayer. Akad. Wiss., München, 1865, p. 49 (Panama).

Pimelodus wagneri Günther, Trans. Zoöl. Soc. London, 1868, p. 474 (Pacific and Atlantic rivers of Panama).

Rhamdia wagneri Eigenmann and Eigenmann, Occasional Papers Cal. Acad. Sci., I, 1890, p. 133; Regan, Biologia Centrali-Americana, 1908, p. 131 (Costa Rica, Panama, Western Ecuador); Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 467 (San Juan); Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1916, p. 240 (all streams of Panama).

Rhamdia bransfordi Gill, Proc. Acad. Nat. Sci. Phila., 1876, p. 337 (Panama).

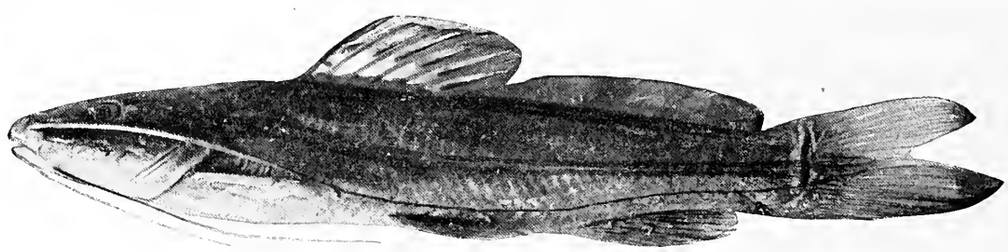

Fig. 11. *Rhamdia wagneri* (Günther). No. 13558, I. U. M. 137 mm. Truando.

6728 *a–f*, C. M.; 13558, I. U. M., 110–153 mm., Truando R., Atrato Basin. Wilson.

6729 *a*, C. M.; 13559, I. U. M., 110 mm., Raspadura, Atrato Basin. Wilson.

6736 *a–c*, C. M.; 13566, I. U. M., 190–260 mm., Rio Sucio, Atrato Basin. Eigenmann.

13565, I. U. M., 210 mm., Quibdo, Atrato Basin. Wilson.

6735 *a*, C. M.; 13562, I. U. M., Rio Calima, San Juan Basin. Henn.

13565, I. U. M., 340 mm., Condoto, San Juan Basin. Wilson.

6730–6732, C. M.; 13560, I. U. M., 70–230 mm., Rio Dagua respectively at Cisnero, Caldas, and Cordova. Eigenmann.

6734 *a*, C. M.; 13561, I. U. M., 78–210 mm., Rio Telembi at Barbacoas. Henn and Wilson.

51967, University of Michigan Museum, marsh at Fundación. Colombia. A. S. Pearse.

Habitat: Panama to the Rio Patia on the Pacific slope; Chagres, Atrato, and (?) Magdalena Basins.

17. **Rhamdia sebæ** (Cuvier and Valenciennes).

Pimelodus (*Rhamdia*) *sebæ* STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 32 (Magdalena near Barranquilla); *ibid.*, XLII, 1880, p. 59 (Cauca near Caceres).

Rhamdia sebæ EIGENMANN and EIGENMANN, Occasional Papers Cal. Acad. Sci., I, 1890, p. 123.

6737, C. M., 304 mm., Soplaviento. Eigenmann.

Habitat: Widely distributed east of the Andes, and in the Magdalena Basin. (See Appendix, No. 6, for a number of records from east of the Andes.)

18. **Rhamdia cinerascens** (Günther).

Pimelodus cinerascens GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 130 (Guayaquil, and Esmeraldas); STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 96 (Rivers near Guayaquil).

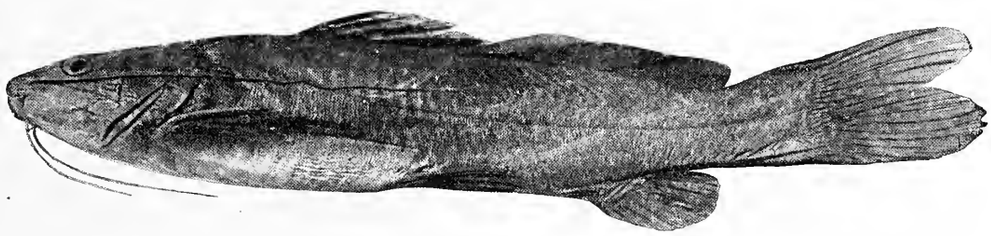

FIG. 12. *Rhamdia cinerascens* (Günther). No. 13569, I. U. M., 215 mm. Vinces, Ecuador.

6738 *a–g*, C. M.; 13568, I. U. M., 141–218 mm., Guayaquil. Henn.
6739 *a–e*, C. M.; 13569, I. U. M., 130–190 mm., Vinces. Henn.
6740 *a–c*, C. M.; 13571, I. U. M., 144–253 mm., Rio Chanchan. Henn.
13570, I. U. M., 141–268 mm., Colimes, Rio Daule. Henn.

Habitat: Guayas Basin of Ecuador.

NANNORHAMDIA Regan.

Nannorhamdia REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 467.

Type, *Nannorhamdia spurrelli* Regan.

Closely allied to *Chasmocranus*, from which it differs only in the slightly free upper margin of the eye and the absence of a backward projecting angle to the premaxillary band of teeth, which is much narrower than in *Chasmocranus*. From *Rhamdella*, which it greatly resembles, it differs in the absence of strong dorsal and pectoral spines.

KEY TO THE SPECIES OF NANNORHAMDIA.

a. None of the rays filamentous; caudal lobes of equal length; the maxillary barbel extending to the end of the pectoral; A. 9; eye small, 6 in the head, 1.6 in the interorbital. . . . . **spurrelli** Regan.

aa. First dorsal and pectoral rays prolonged beyond rest of fin, this prolongation being more pronounced in females than in males. Upper caudal lobe much longer than lower; maxillary barbels reaching to the end of the ventrals. A. 10 or 11; eye 5 in the head, .9 in the interorbital.

nemacheir Eigenmann and Fisher.

19. **Nannorhamdia spurrelli** Regan.

Nannorhamdia spurrelli REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 467.

7123 *a*, C. M., 75 mm., Istmina, San Juan Basin. Eigenmann.

This specimen is typical. There are faint dark areas across the nape, as in many of the related species.

Habitat: San Juan Basin.

20. **Nannorhamdia nemacheir** Eigenmann and Fisher. (Plate IV, fig. 4.)

Nannorhamdia nemacheir EIGENMANN and FISHER, Ann. Carnegie Mus., X, 1916, p. 83 (Girardot).

7125 *a*, C. M., *type*, 105 mm.; 7126 *a*, C. M.; 13547 *a–b*, I. U. M., *paratypes*, Girardot, Magdalena Basin. Eigenmann.

7127 *a–c*, C. M.; 13548, I. U. M., 64–81 mm. (to base of caudal), Cauca at Cali. Eigenmann.

7130 *a–h*, C. M.; 13550, I. U. M., 33–59 mm., Cali. Eigenmann.

7128 *a–d*, C. M., 48–59 mm., Certegui, Atrato Basin. Wilson.

7129 *a–b*, C. M.; 13549 I. U. M., 54–63 mm., Rio Telembi, Patia Basin. Henn and Wilson.

Habitat: Magdalena, Cauca, Atrato and Patia Basins.

D. 7; A. 10 or 11; head 5; depth 7; width 7.3; snout 2.4–3 in head; snout .8 in interorbital; adipose 4 in the length.

Body slender, compressed toward the caudal; depth at first dorsal ray equal to the width. Head short, its width equal to its length, less the diameter of the eye; its depth at base of occipital a little greater than the post-orbital part of the head.

Eye with a free orbital margin above, placed more dorsally than laterally, 1.8 in the snout, 5 in the head, 1.4–1.8 in the interorbital. Head covered with thin skin. Fontanels long and narrow, entirely separating the frontals, a narrow bridge behind the eyes. Jaws subequal, premaxillary band of teeth moderate, without backward projecting angle; the vomer and palatines without teeth. The band of teeth slightly wider at the rictus than in the middle. Maxillary barbels reaching

to end of ventrals; postmentals to end of pectorals or less; mentals to origin of pectorals, or slightly more.

Pectorals and dorsal spines variable, being almost soft in the type and in those from the Cauca, and slightly stronger in those from other localities. First dorsal and pectoral ray prolonged one-third the length of the fin in females, but less prolonged in males. Caudal deeply forked, the upper lobe much the longer, in many cases twice the length of the head. Dorsal emarginate, the length of the bases of the dorsal and anal about equal. Depth of the caudal peduncle equal to the snout. Pectorals not reaching the ventrals and the ventrals not reaching the anal. The pectorals without the prolonged ray are about equal to the length of the ventrals. Origin of ventrals under fourth dorsal ray. Color brownish above, lighter below. A narrow, dark, lateral band, indistinct in some specimens. A dark band across the nape, other cross shades at the origin, at the latter half, and behind the tips of the short rays of the dorsal. Fins hyaline.

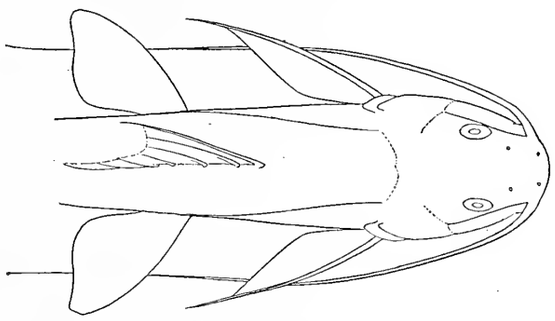

FIG. 13. *Nannorhamdia nemacheir* Eigenmann and Fisher. Type, 105 mm. No. 7125 *a*, C. M. Girardot.

PIMELODELLA Eigenmann and Eigenmann.

Pimelodella EIGENMANN and EIGENMANN, Proc. Cal. Acad. Sci. (2), I, 1888, p. 131; Occasional Papers Cal. Acad. Sci., I, 1890, pp. 99 and 147.

For an account of the species of this genus with keys for their identification, see Eigenmann, Memoirs Carnegie Museum, VII, 1917, pp. 251–255, plates XXXIII and XXXIV. The present account is limited to a list of the species from the area under consideration.

KEY TO THE COLOMBIAN AND ECUADORIAN SPECIES OF PIMELODELLA.

a. Upper caudal lobe about equal to head in the length; pectoral spine with thorns for more than two-thirds of its length.

b. Basal four-fifths of pectoral spine with very strong hooks on the posterior face, the hooks of the distal half longer than the width of the spine at its base. Dorsal spine with a few teeth on its posterior face. Adipose fin 4.25–5.5 in the length, pectoral spine very little longer than snout and eye; maxillary barbel reaching to somewhere about the ventrals. Head 4.25; depth 5; D. I, 6; A. 11–12. . . . . **grisea** Regan.

bb. Basal three-fourths or four-fifths of the pectoral spine with hooks along the posterior face, the hooks less than the width of the spine; posterior face of dorsal spine rough; adipose fin 3.25–

3.5 in the length; peetoral spine about equal to snout and eye. Maxillary barbels reaching somewhere about middle of adipose, shorter in the young. Head 4.8; depth 5.5; D. I, 6; A. 12; a sharply defined lateral band.....**modesta** (Günther).

bbb. Basal two-thirds of the peetoral spine with eight (6–7 *fide* Steindachner) hooks; posterior face of dorsal spine smooth; adipose fin 2.66 in the length; peetoral spine very little less than snout and eye; maxillary barbel reaching the last third of the ventrals; head 4.33; depth 5; D. I, 6; A. 12; no sharply defined lateral band.....**yuncensis** Steindachner.

aa. Upper caudal lobe much longer than the lower, much longer than head.

c. Distal one-third or one-fourth of peetoral spine without hooks, the hooks strong.

d. Adipose fin 3–3.5 in the length; peetoral spine equal to length of snout and eye; maxillary barbels reaching beyond the base of anal. Head 4.5–4.8; depth 5–6; D. I, 6; A. 11–12. **chagresi** (Steindachner).

dd. Adipose fin 2.66–2.75 in the length, peetoral spine a little longer than snout and eye; maxillary barbel reaching beyond origin of anal. Head 4.75; depth 5.5; D. I, 6; A. 11. **elongata** (Günther).

cc. Distal half of inner face of peetoral spine without hook; adipose fin 3.25–3.5 in the length; peetoral spine equal to head less half or whole of operele; maxillary barbels reaching beyond tip of ventrals in small, or of anal, in large specimens. Head 4–4.66; depth 5; D. I, 6; A. 11–12.....**eutænia** Regan.

21. **Pimelodella grisea** Regan.

Pimelodella griseus Regan, Ann. & Mag. Nat. Hist. (7), XII, 1903, p. 625 (Northwestern Ecuador); Regan, *ibid.* (8), XII, 1913, p. 467 (Rio San Juan); Eigenmann, Mem. Carnegie Mus., VII, 1917, p. 252, Plate XXXIII, fig. 2.

Habitat: San Juan River, southward to northwestern Ecuador; not taken in the Patia.

22. **Pimelodella modesta** (Günther).

Pimelodus modestus Günther, Proc. Zoöl. Soc. London, 1860, p. 239, Plate X, fig. C (Esmeraldas).

Habitat: Patia Basin, southward to the Chone and Portoviejo Rivers in Ecuador.

23. **Pimelodella yuncensis** Steindachner.

Pimelodella yuncensis Steindachner, Denkschr. Akad. Wiss. Wien, LXXII, 1912, p. 47 (Pacasmayo).

Rhamdia gilli Starks, Proc. U. S. Nat. Mus., XXX, 1906, p. 769, plate LXV, fig. 1 (Rio Eten, Peru).

Specimens Collected by Eigenmann.

7694 *a–c*, C. M.; 15162, I. U. M., many, Cultambo.

7695 *a–c*, C. M.; 15163, I. U. M., twenty-six, 60–85 mm., Pacasmayo.

7696 *a–b*, C. M.; 15164, I. U. M., seventeen, 55–87 mm., Rio Jequetepeque at Llallan.

7693 *a–e*, C. M.; 15165, I. U. M., many, largest 105 mm., Piura.
15166, I. U. M., three, 81–109 mm., Sullana.

Habitat: Northwestern Peru, between Paita and Pacasmayo.

The specimens from Pacasmayo agree very well with the figure of *Rhamdia gilli* given by Starks. In the specimens examined, the dorsal is I, 5 in two; I, 7 in two; and I, 6 in the rest; A. 11–13, usually 12; the maxillary barbels extend to near the tip of the ventrals in the largest specimen from Sullana and to a little beyond the middle of the pectorals in some of the smallest; the pectoral spine equals the snout and eye in all but the specimens from Llallan, in which it equals the snout and half of the eye; the number of hooks varies with age, reaching ten in the largest specimen from Llallan, and thirteen in the largest from Piura and Sullana; the dorsal spine is always slightly shorter than the pectoral spine; the adipose is from 3 to 3.8 in the length; the upper caudal lobe is a little longer than the head.

The specimens from Piura and Sullana have the width of the head equal to the snout and the eye or half of the eye; the eye is 3.5–4.3 in the head; the interorbital 4.2–4.5.

In the other specimens the width of the head is considerably more than the snout and eye; the eye 4–4.3 in the head; the interorbital 3.5–4.

The color varies much with the nature of the environment, being very dark in those specimens coming from a shaded brook near Pacasmayo, and sand-colored in those from Sullana. The lateral line in all specimens is darker than the body.

24. **Pimelodella chagresi** (Steindachner).

Pimelodus (*Pseudorhamdia*) *chagresi* Steindachner, Sitzb. Akad. Wiss. Wien, LXXIV, Ichthyol. Beitr., IV, 1876, p. 34 (Rio Chagres).

Pimelodella chagresi Eigenmann, Mem. Carnegie Mus., VII, 1916, p. 253, plate XXXIII, fig. 3.

Habitat: Both slopes of Panama, Rio Atrato and Rio Magdalena. Doubtfully Rio Meta Basin.

25. **Pimelodella elongata** (Günther).

Pimelodus elongatus Günther, Proc. Zoöl. Soc. London, 1860, p. 238, plate X, fig. B (Esmeraldas).

Habitat: Guayas and Esmeraldas Basins of Western Ecuador.

26. **Pimelodella eutænia** Regan.

Pimelodella eutænia Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 466 (Rio

San Juan); EIGENMANN, Mem. Carnegie Mus., VII, 1916, p. 254, plate XXXIV, fig. 7.

Habitat: San Juan to Patia Basins.

PIMELODUS Lacépède.

Steindachner records three species of this genus from the Magdalena Basin, *P. clarias*, *P. maculatus*, and *P. grosskopfi*. We have examined a large number of specimens from the Magdalena Basin and find only two species, *P. grosskopfi* and *P. clarias*. These species differ from each other in the following characters:

KEY TO THE SPECIES OF PIMELODUS.

a. Adipose fin long, 3.5–4 in length; barbels reaching caudal; occipital process narrow, its width at base 3–3.5 in its length, width of mouth greater than length of snout. Color creamy white below, shading into a light brown above; back and sides with numerous small spots of a much darker brown. **grosskopfi** Steindachner.

aa. Adipose fin short, 5.7–6.2 in the length; barbels reaching middle of adipose and occasionally reaching base of caudal. Occipital process wide, its width at base 1.6–2.1 in its length. Width of mouth less than length of snout. Color silvery white below, also silvery above, but the silvery appearance is much obscured by light brown pigment..... **clarias** Bloch.

27. **Pimelodus grosskopfi** Steindachner.

Pimelodus grosskopfi STEINDACHNER, Sitzb. Akad. Wiss. Wien, LXXX, 1879, Ichthyol. Beitr, VIII, p. 68 (Cauca); Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 57, plate I, figs. 1 and 1 *a* (Cauca near Caceres).

Habitat: Magdalena Basin, from the Coast to Girardot and Cali.

SPECIMENS EXAMINED.

Catalog Numbers.	Length in mm.	Locality.	Collector.
6641 *a–f*, C. M.; 13476, I. U. M.	51–184	Soplaviento	Eigenmann
6642 *a*, C. M.	327	El Banco	"
6647 *a–d*, C. M.	50–305	Puerto Wilches	"
6645 *a–c*, C. M.; 13477, I. U. M.	250–330	Puerto Berrio	"
6644 *a–c*, C. M.	43– 65	Peñas Blancas	"
13478, I. U. M.	51	Bernal Creek	"
6646 *a*, C. M.	319	Honda	"
6648 *a–f*, C. M.; 12479, I. U. M.	30–160	Apulo	Gonzales
6649 *a–f*, C. M.; 13480, I. U. M.	60–109	Cartago	Eigenmann
6650 *a–f*, C. M.; 13481, I. U. M.	58–159	Cauca at Cali	"

28. **Pimelodus clarias** (Bloch).

Pimelodus clarias STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 31 (Magdalena River).

Habitat: Atrato and Magdalena Basins from near the coast at least to Girardot.

SPECIMENS EXAMINED.

Catalog Numbers.	Length in mm.	Locality.	Collector.
6651 *a–f*, C. M.; 13482, I. U. M.	120–220	Soplaviento	Eigenmann
6653 *a–f*, C. M.; 13484, I. U. M.	88–160	Calamar	"
6654 *a–f*, C. M.; 13485, I. U. M.	34–50	Puerto Wilches	"
6652 *a–p*, C. M.; 13483, I. U. M.	48–152	Peñas Blancas	"
6655 *a–d*, C. M.	201–210	Below Buenavista	"
6656 *a–f*, C. M.; 13486, I. U. M.	80–160	Apulo	Gonzales
6657 *a–e*, C. M.; 13487, I. U. M.	44–221	Honda	Eigenmann
6658 *a–e*, C. M.; 13488, I. U. M.	134–219	Girardot	"
6661 *a–c*, C. M.; 13490, I. U. M.	204–264	Rio Sucio	"
6659 *a*, C. M.	232	Truando	Wilson
6660 *a–c*, C. M.; 13489, I. U. M.	110–154	Quibdo	Eigenmann
6662 *a–d*, C. M.; 13491, I. U. M.	136–169	Boca de Certegui	"

29. **Pimelodus clarias punctatus** (Meek and Hildebrand).

Megalonema punctatum MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1913, p. 77 (Marrigante).

Megalonema robustum MEEK and HILDEBRAND, *loc. cit.*, p. 78 (Marrigante).

Pimelodus clarias punctatus MEEK and HILDEBRAND, *ibid.*, Zoöl. Ser., X, 1916, p. 241.

Habitat: Rio Tuyra Basin in Panama.

This is considered a variety of *Pimelodus clarias* with dark spots present in all, except the adults.

PSEUDOPLATYSTOMA Bleeker.

This genus, found in the La Plata and São Francisco Basins and northward, is represented in Colombia by one species, *P. fasciatum*.

If my interpretation of the origin of the Magdalena fauna is correct, the vertical markings of this species antedate the formation of the Cordillera of Bogotá.

30. **Pseudoplatystoma fasciatum** (Linnæus). (Plate III, fig. 4.)

"Bagre tigre."

The Colombian references to this species are:

Platystoma fasciatum STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 31 (Magdalena near Barranquilla); *ibid.*, XLII, 1880, p. 57 (Cauca near Caceres).

Pseudoplatystoma fasciatum EIGENMANN and EIGENMANN, Occasional Papers Cal. Acad. Sci., I, 1890, p. 208.

Habitat: Amazon, Orinoco, and Magdalena Basins.

5015 *a*, C. M.; 12835 I. U. M., largest 600 mm.; Soplaviento. Eigenmann.

5078 *a*, C. M., 430 mm., Calamar. Eigenmann.

13551, I. U. M., 359 mm., Puerto Berrio. Eigenmann.
15047, I. U. M., head, 210 mm., Apulo. Gonzales.

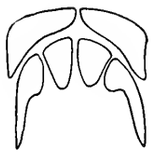

FIG. 14. Teeth of upper jaw and palate of *P. fasciatum* (L.).

This species reaches a large size and is an important food-fish. Camps are established in the dry season on the sand-bars in the Magdalena, where this fish is caught with seines in considerable numbers. The fish are dried and used for food by the natives, among whom the dried fish is an element of commerce. They are found inland at least as far as Girardot. They follow the "Boca-Chicas" (*Prochilodus*) to the banks of the rivers and are in their turn pursued by the Caiman.

SORUBIM Spix.

This genus with its single species is of wide distribution, being found in the Amazon Basin from Pará to the Huallaga; in the Rio Guaporé, the Rio Branco, and from the La Plata Basin at Santa Fé and Asunción to the Orinoco and the Magdalena Basins.

31. **Sorubim lima** (Bloch and Schneider).

"Bagre blanco."

The Colombian references to this species are:

Sorubim lima STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 31 (Rio Magdalena near Barranquilla); *ibid.*, XLII, 1880, p. 57 (Cauca near Caceres).

Habitat: La Plata, Amazon, Orinoco, and Magdalena Basins.

5024 *a–c*, C. M.; 12805, I. U. M., 320–390 mm., Soplaviento. Eigenmann.
5025, C. M.; 12806, I. U. M., Calamar. Eigenmann.
6678 *a–b*, C. M.; 13552, I. U. M., 300–315 mm., Puerto Berrio. Eigenmann.
5019 *a*, C. M., 430 mm., Honda. Eigenmann.

This species is very abundant in the lower Magdalena Basin, but is of less importance as a food-fish than *Pseudoplatystoma fasciatum*.

DORAS Lacépède.

32. **Doras crocodili** Humboldt.

"Mata-Caiman."

Doras crocodili HUMBOLDT and VALENCIENNES, Recherches sur les Poissons Fluv., Rec. d'Observ. Zoöl., II, 1821, p. 181 (Magdalena).

Doras longispinis STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878,

p. 39, plate IV, fig. 2, and plate V, fig. 1 (Magdalena near Barranquilla); *ibid.*, XLII, 1880, p. 63 (Cauca near Caceres).

Habitat: Magdalena Basin, where it is abundant.

6727 *a*, C. M.; 13557, I. U. M., 115–210 mm., Soplaviento. Eigenmann.

6725 *a*, C. M.; 13555, I. U. M., 154–209 mm., El Banco. Eigenmann.

6724 *a*, C. M., 158 mm., Puerto Wilches. Eigenmann.

6726 *a–b*, C. M.; 13556, I. U. M., 141–194 mm., Puerto Berrio. Eigenmann.

Steindachner, on account of the unsatisfactory description of Humboldt, which under ordinary circumstances would be unidentifiable, described the *Doras* of the Magdalena as a new species. However, as far as known, but one species of *Doras* occurs in the Magdalena, and Humboldt's name for this species may therefore stand.

It is still known as "Mata-Caiman." When swallowed by a Caiman, it erects and locks its formidable spines and inflicts severe, if not fatal, wounds upon the unlucky crocodile.

Humboldt (Recueil d'Observ. Zoöl., p. 182) says of this species: "Ce poisson se trouve fréquemment dans les parties chaudes de la Nouvelle-Grenade, traversée par la grande Rivière de la Madeleine. Nous l'avons peché entre Pinto et Mompox, par les 9° et 9½° latitude. Les indigènes assurent qu'il est l'ennemi naturel des Crocodiles, qu'il entre tout exprès dans leur gueule et qu'il les blesse dangereusement en écartant les nageoires pectorales qui sont plus tranchantes que les meilleurs instrumens de chirurgie. Cette circonstance a fait donner à ce poisson le nom bizarre de Mata-Cayman, c'est à dire *pexe que mata el Cayman* (qui tue le Crocodile). S'il est vrai que l'on rencontre des Crocodiles expirans dont l'œsophage est déchiré, il faut supposer que les Mata-Caymans, qui nagent par bandes, ont enfoncé leurs rayons dentelés dans les membranes de l'œsophage du Crocodile, moins pour se défendre, que parce qu'ils ont été agités par la peur, au moment où le Saurien les a avalés.

"Le Doras du Magdalena a une force musculaire extraordinaire. L'individu que j'ai dessiné me blessa douloureusement, et je l'ai vu s'avancer par sauts sur une plage aride, à plus de 200 pieds de distance, en s'appuyant sur les rayons osseux de ses nageoires pectorales. Un autre individu, que les Indiens pêchèrent à la ligne près du confluent du Rio Cauca, grimpa sur un monticule de sable de 20 pieds de haut. Ces faits, que j'ai observés moi-même, rappellent le Tamaota du Bresil (*Cataphractus callichthys*, Bloch, Tom. VI, p. 70) qui, selon Marcgrav, se traîne par terre d'une rivière a une autre. C'est à tort que plusieurs naturalistes ont traité cette assertion comme très-hasardée."

Trachycorystes Bleeker.

Key to the Colombian and Panamanian Species.

a. Anal longer than head, pectoral spine with strong teeth on both outer and inner margins. Anal rays 29–33. Color creamy white below the lateral line, exeept a few seattered ehromatophores in the peetoral region, and some dark pigment on sides of head; brownish above.

insignis Steindaehner.

aa. Anal shorter than head; pectoral spine with teeth on its inner margin only.

b. Anal rays 21–25; eaudal less deeply eoneave than in *T. amblops*, the lower lobe round, somewhat shorter than head; distanee from tip of snout to origin of dorsal equal to, or less than, half the distanee from origin of dorsal to tip of adipose; color ereamy below the lateral line, brownish above, with numerous very blaek longitudinal fleeks and streaks seattered promiseuously over the baek and sides of the body.....**fisheri** Eigenmann.

bb. Anal shorter than head; peetoral spine with teeth on its inner margin only. A. 17–20; eaudal deeply eoncave, both lobes pointed and equal to, or longer than, head; distanee from tip of snout to origin of dorsal more than half the distanee from origin of dorsal to tip of adipose.

amblops (Meek and Hildebrand).

33. **Trachycorystes insignis** (Steindachner).

Auchenipterus insignis Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 35, plate III, figs. 2 and 2 *a* (Magdalena near Barranquilla); *ibid.*, XLII, 1880, p. 62 (Cauca near Caceres).

Auchenipterus magdalenæ Steindachner, *ibid.*, XXXIX, 1878, p. 36, plate IV, figs. 1 and 1 *a* (Magdalena).

Habitat: Lower Magdalena Basin.

6664 *a–f*, C. M.; 13493, I. U. M., 148–210 mm., El Banco. Eigenmann.

6665 *a–b*, C. M., 159–164 mm., Puerto Berrio. Eigenmann.

6666 *a–f*, C. M.; 13494, I. U. M., 74–171 mm., Soplaviento. Eigenmann.

Steindachner describes and figures two new species of this genus from the Magdalena Basin, *T. insignis* and *T. magdalenæ*. Of the former he does not state the number or the sex of the specimens on which he based his description; of the latter species he states that only females were examined. We have examined a large number of specimens of this genus from the Magdalena Basin and find one species, the male of which agrees in every particular with Dr. Steindachner's description and plate of *insignis;* while the female agrees in every particular with his description and plate of *magdalenæ*. This places *Trachycorystes magdalenæ* in the synonomy of *Trachycorystes insignis*.

34. **Trachycorystes fisheri** Eigenmann. (Plate V, figs. 1 and 2.)

Trachycorystes fisheri Eigenmann, Ann. Carnegie Mus., X, 1916, p. 82 (Recording the specimens listed below).

6667 *a*, C. M., *type*, male, 250 mm.; 6668 *a–e*, C. M.; 13495, I. U. M., *paratypes*, 151–226 mm. (to base of caudal), Rio Sucio. Eigenmann.
6670 *a–f*, C. M.; 13497, I. U. M., 44–89 mm., Truando. Wilson.
6669 *a*, C. M.; 13496, I. U. M., 44–89 mm., Quibdo. Wilson.

Habitat: Atrato Basin.

D. I, 5; A. 21–25 (type 24); head 4–4.5, width of head 4–4.5; depth 3.3–4 in the length; snout 2.7–3.2 in head; eye 1.5–2 in snout. Adipose short, three in head. Dorsal spine equal to length of head, which is equal to length of pectoral spine. Maxillary bone extending beyond gill-opening in adult male, to anterior border of eye in female. Dorsal spine curved forward in male, with its entire anterior surface covered with short, heavy, irregularly placed spines; in the female straight and almost smooth. Humeral process short and pointing slightly upwards, reaching only one-third the distance to end of pectoral spine. Pectoral spine with strong recurved teeth on its inner margin, its outer margin almost smooth. Head flat, granular, as broad as long. Profile of head slightly convex to above the eye, thence strongly concave to articulation of dorsal spine in the male, much less so in the female.

Color creamy white below, brownish above. Back and sides covered with very black, irregular, longitudinal flecks and streaks, which are much more abundant dorsally. Middle of caudal with a dark bar in most specimens.

Named for Mr. Carl G. Fisher of Indianapolis, who helped make possible Mr. Wilson's trip to the Atrato, where this species abounds.

35. **Trachycorystes amblops** Meek and Hildebrand.

Felichthys amblops Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1913, p. 77 (Marrigante, Panama); *loc. cit.*, X, 1916, p. 243, plate IX.

Habitat: Tuyra Basin of Panama.

This species is evidently closely allied to *fisheri*, if it is not identical with it. The apparent differences between the two species are indicated in the key.

Ageneiosus Lacépède.

Steindachner (Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 33, plate III, figs. 1 and 1 *a*; *ibid.*, XLII, 1880, p. 61, plate VI, figs. 1 and 1 *a*) redescribes *Ageneiosus dentatus* Kner as *A. pardalis* of Lütken. He also describes *Ageneiosus caucanus* Steindachner. These are the two species known from the area under consideration and the differences between them are shown by the following key:

a. Maxillary barbels reaching rictus; width of maxillary band of teeth equal to width of eye; ventrals not reaching beyond beginning of anal; D. I, 6; A. 38–41[8]. . . . . **caucanus** Steindachner.

aa. Maxillary barbels not reaching beyond rictus; width of intermaxillary band of teeth one half width of eye; ventrals reaching beyond the beginning of anal; D. I, 6; A. 44 or more. . . . . **dentatus** Kner.

36. **Ageneiosus caucanus** Steindachner.

Ageneiosus caucanus Steindachner, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 61, plate VI, figs. 1 and 1 *a* (Cauca); Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1916, p. 245 (Tuyra).

Specimens Collected by Eigenmann, unless Otherwise Stated.

6675 *a*, C. M., 281 mm., female, Soplaviento.

6674 *a*, C. M., 420 mm., female, Calamar.

6677 *a*, C. M., 310 mm., Puerto Berrio.

13500, I. U. M., 379 mm., male, Truando. Wilson.

6676 *a–b*, C. M.; 13501, I. U. M., 320–350 mm., Quibdo. Eigenmann.

Habitat: Tuyra, Atrato, and Lower Magdalena Basins.

37. **Ageneiosus dentatus** Kner.

Ageneiosus dentatus Kner, Sitzb. Akad. Wiss. Wien, XXVI, 1857, p. 441 (Surinam); Günther, Cat. Fishes Brit. Mus., V, 1864, p. 192 (Pará); Ribeiro, Fauna Brasil, IV, A, 1912, p. 405.

Ageneiosus pardalis Lütken, Vidensk. Meddel. Naturhist. Förening. Kjöbenhavn, 1874, p. 190 (Caracas); Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 33, plate III, figs. 1 and 1 *a* (Cienega near mouth of Magdalena); *ibid.*, XLII, 1880, p. 62 (Cauca near Caceres).

Habitat: Amazon, Orinoco, and Magdalena Basins.

No specimens of this species were taken.

Family V. ASTROBLEPIDÆ.

A monograph of this family is in preparation. Large collections have been brought together and other collections are in immediate prospect. I therefore limit myself here to a list of the species.

The members of this family occur in torrential mountain streams up to an elevation of nearly 13,400 feet. In favorable locations, such as Istmina, stragglers may extend downward to as low as three hundred feet above sea-level. The northernmost locality recorded is the Rio Tuyra, the easternmost Merida, and the

[8] In the specimens examined one (a large female from the Rio Calima) has thirty-eight anal rays, three have thirty-nine anal rays; one has forty anal rays; and two have forty-one anal rays.

southernmost locality on the Pacific side is the Rio Santa. On the Atlantic side they are known to occur at Urcos near the divide between the Urubamba River and Lake Titicaca at an elevation of about 10,200 feet. They were very abundant in the Urubamba at 7,000 feet elevation and were taken also at 3,000 feet, the lowest point reached on this river during the Irwin Expedition.

ASTROBLEPUS Humboldt.

Cyclopium SWAINSON; *Arges* CUVIER and VALENCIENNES; *Brontes* CUVIER and VALENCIENNES; *Stygogenes* GÜNTHER.

The mountain cat-fishes, hitherto known chiefly under the names of *Cyclopium* and *Arges*, are considered here under the above generic name. *Astroblepus* was described by Humboldt as lacking ventrals, and has not been recognized since the publication of the original description, based on the "pescado negro" of Popayan.

Posada, a Colombian naturalist (*Cf.* his *Estudios Cientificos*, 1909), made a special effort to secure such a fish lacking ventrals, but did not find any, although many specimens were examined.

Likewise in our collections, numbering hundreds of individuals, no specimens lacking the ventrals are to be found. It seems, therefore, that the lack of ventrals in the figure of Humboldt is due to a mistake of the artist. Humboldt's name must stand as the earliest designation of these fishes.

38. **Astroblepus homodon** (Regan). (Plate VI, fig. 1.)

Arges homodon REGAN, Trans. Zoöl. Soc. London, XVII, 1914, p. 309 (Villeta, Colombia).

Habitat: Abundant along the road between Honda and Facatativa.

My specimens are from Villeta, Rio Guaduas, and Quebrada Guadual, Chimbi, Sarjento, and Quebrada Alban.

39. **Astroblepus guentheri** (Boulenger).

Stygogenes guentheri BOULENGER, Ann. & Mag. Nat. Hist. (5), XIX, 1887, p. 348 (Colombia).

Arges guentheri REGAN, Trans. Zoöl. Soc. London, XVII, 1904, p. 310, plate XXI, fig. 2.

Habitat: Colombia.

40. **Astroblepus chapmani** (Eigenmann). (Plate VI, fig. 2.)

Cyclopium chapmani EIGENMANN, Indiana University Studies, No. 16, 1912, p. 13 (Boquilla).

Habitat: Central Andes of Colombia.

41. **Astroblepus retropinnis** (Regan).

Arges retropinna REGAN, Proc. Zoöl. Soc. London, 1907 (May 1908), p. 800, plate XLVIII, fig. 2 (Jimenez, western Colombia).

Habitat: Rio Dagua.

42. **Astroblepus trifasciatus** (Eigenmann). (Plate VI, figs. 4, 5, and 6.)

Cyclopium trifasciatum EIGENMANN, Indiana University Studies, No. 16, 1912, p. 14 (Rio Dagua).

Habitat: Rio Dagua.

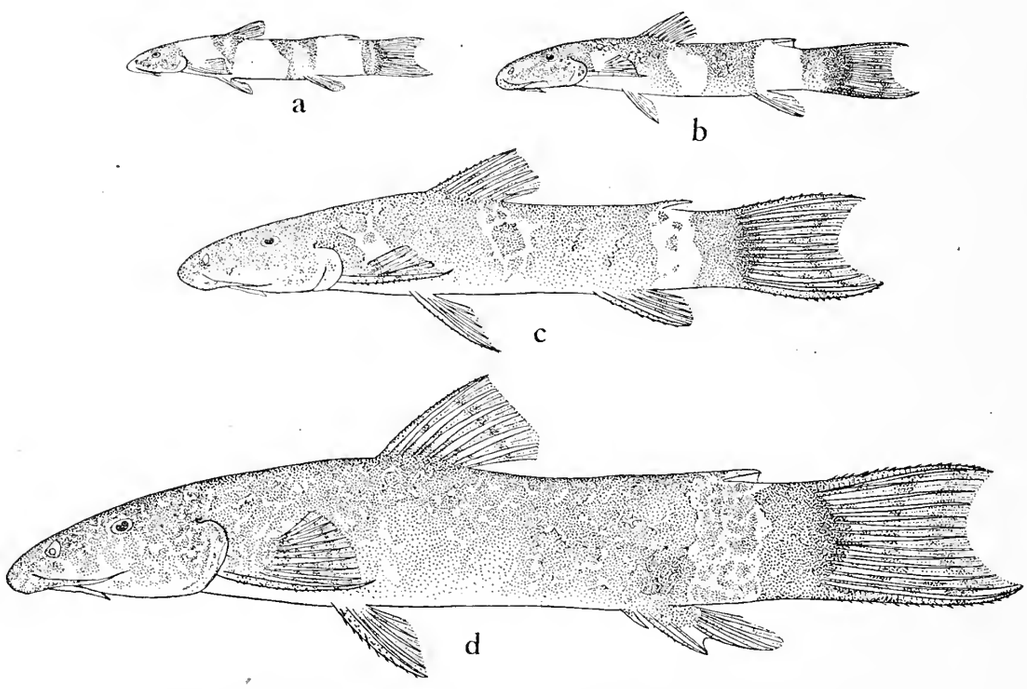

FIG. 15. *Astroblepus trifasciatus* Eigenmann. *a*, *b*, *c*, respectively 24, 40, and 56 mm. long. No. 4869 *d*, C. M. *d*, Type, No. 4868, C. M., 85 mm. Caldas.

43. **Astroblepus cyclopus** (Humboldt). (Plate VII, fig. 1.)

Pimelodus cyclopum HUMBOLDT, Rec. d'Obs. Zoöl., I, 1805, p. 21, plate VI.

Cyclopium chimborazoi FOWLER, Proc. Acad. Nat. Sci. Phila., 1915, p. 241, fig. 11.

Habitat: High Andes of Ecuador.

Our specimens are from Mindo and Hacienda Lachis (4,000 ft.), Province of Carchi, Ecuador.

44. **Astroblepus unifasciatus** (Eigenmann). (Plate VII, fig. 2.)

Cyclopium unifasciatum EIGENMANN, Indiana University Studies, No. 16, 1912, p. 15 (Caldas).

Habitat: Rio Dagua; brooks of the Eastern Andes east of Honda.

Our specimens are from Caldas, Quebrada Guadual, Sarjento, Labaja, Rio Guaduas, Quebrada Agua Larga, Quebrada del Guamal, Quebrada de Chimbe, Rio de Ducho.

45. **Astroblepus cyclopus santanderensis** Eigenmann.

Astroblepus cyclopus santanderensis EIGENMANN, Proc. Amer. Philos. Soc., LVI, 1917, p. 675 (Many brooks draining into the Rio Suarez at an elevation of 1,000–2,000 M.).

Habitat: Province of Santander, Colombia.

46. **Astroblepus cyclopus cirratus** (Regan). (Plate VII, fig. 3.)

Arges cirratus REGAN, Proc. Zoöl. Soc. London, 1912, p. 670.

Cyclopium ventrale EIGENMANN, Indiana University Studies, No. 16, 1912, p. 15.

Habitat: Rios Dagua and San Juan.

47. **Astroblepus frenatus** Eigenmann.

Astroblepus frenatus EIGENMANN, Proc. Amer. Philos. Soc., LVI, 1917, p. 676 (Quebrada de San Joaquin, Santander).

Habitat: Santander, Colombia.

48. **Astroblepus grixalvii** Humboldt.

Astroblepus grixalvii HUMBOLDT, Rec. d'Obs. Zoöl., I, 1805, p. 19, plate VII (Popayan).

Brontes prenadilla CUVIER and VALENCIENNES, Hist. Nat. Poiss., XV, 1840, p. 343, plate 445 (Cotopaxi).

?Arges brachycephalus GÜNTHER, Proc. Zoöl. Soc. London, 1859, p. 92 (Andes of Western Peru).

Arges whymperi BOULENGER, Proc. Zoöl. Soc. London, 1890, p. 451, plate XLI, fig. 2 (Milligalli, Ecuador).

Arges eigenmanni REGAN, Trans. Zoöl. Soc. London, XVII, 1904, p. 312, plate XXI, fig. 3 (Cayambe and Machachi, Ecuador).

Arges vaillanti REGAN, Trans. Zoöl. Soc. London, XVII, 1904, p. 312 (Huamani, Ecuador, 10,700 feet).

Arges regani PELLEGRIN, Bull. Mus. Hist. Nat. Paris, XV, 1909, p. 518 (Rio Cariyacu, 3,100 M., tributary of Rio del Angel, Ecuador).

Habitat: Andes of Ecuador, Central and Eastern Andes of Colombia. Our specimens came from Toche, Choachi, Tuquerres, Latacunga, Quito, Rio del Angel, Riobamba, and Carneceria.

49. **Astroblepus micrescens** Eigenmann. (Plate VII, fig. 4.)

Astroblepus grixalvii micrescens EIGENMANN, Proc. Amer. Philos. Soc., LVI, 1917, p. 677 (numerous Quebradas of the Provinces of Santander and Norte, Colombia).

Habitat: Both slopes of the Eastern Andes of Colombia.

50. **Astroblepus fissidens** (Regan).

Arges fissidens REGAN, Trans. Zoöl. Soc. London, 1904, p. 316 (Andes of Ecuador).

Habitat: Andes of Ecuador.

51. **Astroblepus chotæ** (Regan). (Plate VII, fig. 5.)

Arges chotæ REGAN, Trans. Zoöl. Soc. London, XVII, 1904, p. 313, plate XXI, fig. 5 (Chota Valley, Northern Ecuador).

Arges marmoratus REGAN, *loc. cit.*, p. 314, plate XXI, fig. 6 (St. Augustine, Colombia).

Habitat: Western slope of Ecuador; Central Andes and both slopes of Eastern Andes of Colombia; ? Peru.

We have a large number of specimens from between Huigra and Chota, Ecuador; from Tuquerres to Boquilla and Santander in Colombia; and from the plains east of Bogotá.

52. **Astroblepus longifilis** (Steindachner).

Arges longifilis STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLVI, 1882, p. 19, plate V, fig. 3 (Rio Huambo, Rio Totora, Northern Peru).

Arges heterodon REGAN, Proc. Zoöl. Soc. London, 1907 (May 1908), p. 799, plate XLIX, fig. 2 (Jiminez, Western Colombia).

Cyclopium pirrense MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1916, p. 265, plate XVI (Rio Cana, Panama).

Habitat: Peru to the Tuyra in Panama; to Mogotes, Province of Santander, Colombia; and the Eastern slope east of Bogotá to Villavicencio.

53. **Astroblepus heterodon** (Regan).

Arges heterodon REGAN, Proc. Zoöl. Soc. London, 1907 (May 1908), p. 799, plate XLIX, fig. 2 (Jiminez near Cisnero, Rio Dagua, Western Colombia).

This species is known from a single specimen 110 mm. long, collected by Mr. Mervin G. Palmer.

54. **Astroblepus simonsi** (Regan).

Arges simonsi REGAN, Trans. Zoöl. Soc. London, XVII, 1904, p. 317 (Huaras, 10,700 feet).

Habitat: Santa Basin of Central Peru.

55. **Astroblepus rosei** sp. nov.

7668 *a*, C. M.; 15152, I. U. M., eleven, 62–94 mm., Rio Jequetepeque, Llallan, Peru, Jan. 18, 1919, Eigenmann. *Type* in I. U. Museum.

Head 3.66–3.75; D. I, 6; A. I, 6. Adipose fin a well developed membrane extending from the tip of the last dorsal ray to the caudal, without the trace of a spine; teeth in the upper jaw pointed, or narrow incisors on the sides, the two median teeth on each side forked, the two branches subequal; nasal flap prolonged into a distinct barbel; interocular equals the distance between the nostril and the eye, 3.33 in the head; maxillary barbel reaching to near edge of gill-membrane; distance between snout and dorsal 2.4–2.6 in the length; dorsal spine but little prolonged, 1.66–2 in its distance from the snout; distance from anal to caudal about 6 in the length; outer ventral rays but little prolonged, reaching to or beyond the anus, its base nearer the snout than the base of the dorsal spine; pectoral filament about equal to the length of the head, reaching to the middle of the ventrals.

Well defined spots most conspicuous below the dorsal, least numerous on caudal peduncle; pectoral and dorsal spines with spots; caudal dusky at base with numerous spots distally; anal and ventrals pale.

Allied to *A. simonsi*, differing in the teeth and the length of the ventrals. Named in honor of Dr. J. N. Rose of the U. S. National Museum, student of the flora of South America.

Family VI. CETOPSIDÆ.

A family of Nematognaths found in the lowlands on both sides of the Andes.

KEY TO THE GENERA OCCURRING WEST OF THE ANDES.

a. Palatine teeth in two separate patches of several series each..... **Cetopsogiton** Eigenmann.

aa. Palatine teeth in one continuous series or in places in two series. Teeth all conical, in from one to three series in the jaws..... **Hemicetopsis** Agassiz.

CETOPSOGITON Eigenmann.

Cetopsogiton EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 398.

Paracetopsis EIGENMANN and BEAN, Proc. U. S. Nat. Mus., XXXI, 1907, p. 665, (Preoccupied).

A genus of one species characterized by the teeth.

56. **Cetopsogiton occidentalis** (Steindachner).

"Ciego."

Cetopsis occidentalis STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 99, plate VIII, figs. 2 and 2 *a* (Guayaquil).

13006, I. U. M., several, Guayaquil Market. Henn.

Habitat: Rivers about Guayaquil.

HEMICETOPSIS Agassiz.

KEY TO THE SPECIES OF HEMICETOPSIS.

a. Base of anal less than distance between snout and first dorsal ray; first dorsal ray frequently prolonged in a filament; A. 26; snout pointed, projecting, the mouth inferior; premaxillary with about three series of conical teeth. . . . . **othonops** Eigenmann.

aa. Base of anal equals distance between snout and base of last dorsal ray; first dorsal ray not prolonged in a filament; A. 30; snout broad, not prolonged, the mouth subterminal; premaxillary with two series of teeth. . . . . **amphiloxa** Eigenmann.

57. **Hemicetopsis othonops** Eigenmann. (Plate III, fig. 1.)

Hemicetopsis othonops EIGENMANN, Indiana University Studies, No. 16, Sept. (Dec. 23) 1912, p. 17.

Habitat: Magdalena Basin.

4830, C. M., *type*, 120 mm., Girardot. Eigenmann.

4831 *a–j*, C. M.; 12684, I. U. M., twenty-seven *paratypes*, Girardot. Eigenmann.

12685, I. U. M., thirty-eight *paratypes*, Apulo. Gonzales.

4832 *a–b*, C. M.; 12686, I. U. M., three, Cauca near Cali. Eigenmann.

Allied to *H. plumbeus*.

Head 4.5; depth 4–5.5; D. 7; A. 26; V. 6 or 7; eye 6.5.

Subcylindrical, compressed backward; mouth subterminal, the snout projecting; premaxillary with about three series of conical teeth; mandible with two or three irregular series of similar teeth in front, a single regular series on sides; palate with a single series of about twenty-four teeth, somewhat heavier than those of the jaws, conical. Gill-opening large, two-fifths of it above the upper ray of pectoral; distance between the posterior nares about 1.5 in the distance between the anterior nares. Pectoral pore large; lateral line simple, straight. Distance of dorsal from tip of snout a little more than 3 in the length; first dorsal ray distinctly higher than second, prolonged in a filament, the last ray less than half as high as second. Caudal forked, less than one-fourth of the length; anal rays gradually decreasing backward; inner ventral ray adnate for most of its length; filament of first pectoral ray exactly, or not quite, reaching the ventrals.

Plumbeous above, silvery on the sides and below.

The stomach of a specimen 93 mm. long contained a characinid fish 40 mm. long.

58. **Hemicetopsis amphiloxa** Eigenmann. (Plate III, fig. 2.)

Hemicetopsis amphiloxus EIGENMANN, Indiana University Studies, No. 19, Jan. 1914, p. 14.

Habitat: Patia, San Juan, and Atrato Basins.

5332 *a*, C. M., *type*, 88 mm., Rio Telembi, Patia Basin. Henn and Wilson.

13040, I. U. M., *paratype*, 97 mm., Rio San Juan at mouth of Rio Munguido. Henn.

13009, I. U. M., *paratype*, 53 mm., Quibdo, Atrato Basin. Wilson.

Head 4.5–4.66; depth 4.33–5; D. 7; A. 30; V. 6 or 7.

Snout broader and more blunt than in *H. othonops*. Eye 2.5 in interorbital, 7 in head. Premaxillary with two irregular series of teeth, vomer with a single series; mandible with a single series on the sides, two or three near the symphysis; first dorsal ray not prolonged in a filament; inner ventral ray adnate for half or more of its length, the longest ray reaching the anus; pectoral ray not prolonged. Distance between base of last anal ray and base of middle caudal ray equals depth of caudal peduncle; base of anal 2.5–3 in the length; origin of anal midway between eye or tip of snout and base of middle caudal rays; origin of ventrals equidistant from snout and fourth, fifth, or second third of anal.

Profusely covered with chromatophores above; dorsal dusky.

Family VII. PYGIDIIDÆ.

The species of this family have recently been treated monographically by me in the Memoirs of the Carnegie Museum, VII, No. 5, 1918, pp. 259–398, plates XXXVI–LVI. For detailed references, figures, and a key to the species from the area under consideration, the reader is referred to that paper. I limit the present account to a list of the species and the localities at which they were taken, and give a key.

Colombia forms the northern end of the area of distribution of the family. Only one species, which came from near Merida, has been recorded from Venezuela, although no doubt others exist both in the mountains south of Caracas and in the lowlands. One species of this genus *P. piuræ* Eigenmann, locally called "*Bagre*," "*Bagrecito*, and "*Life*" has been found useful in the control of the yellow-fever mosquito.

Pygidium Meyen.

Key to the Species of Pygidium from the Area under Consideration.

a. Teeth incisors, apparently conic in the very young.

b. Last dorsal ray over the last anal ray; distance between last anal ray and base of middle caudal ray about 2.28 in its distance from the snout; distance between last anal ray and base of middle caudal rays five and one-half in the length; obscure spots about as large as the eye evenly distributed over back and sides, no lateral band. . . . . **laticeps** (Kner).

bb. Last dorsal ray over the anal.

c. Sides with a lateral band or nearly confluent series of spots.

d. Maxillary barbel extending beyond base of last pectoral ray; origin of ventrals equidistant between caudal and some part of the opercular spines; distance between anal and caudal four and one-half to four and three-fourths in the length; distance between origin of dorsal and base of caudal about two in its distance from the snout; a narrow lateral band, a variable number of small spots. . . . . **stellatum** Eigenmann.

dd. Maxillary barbel extending little beyond origin of the pectoral or shorter; a dark band or a series of spots below and another above the median band.

e. Origin of ventrals equidistant from caudal and middle of pectoral; distance between anal and caudal five in the length; distance between origin of dorsal and caudal a little more than two in its distance from the snout.

chapmani Eigenmann.

ee. Origin of ventrals nearer head than caudal; distance between anal and caudal five to five and one-half in the length; distance between origin of dorsal and caudal one and four-fifths to two in its distance from the snout. . . . . **tænium** (Kner).

cc. Sides with numerous spots, those along the middle line not forming a band; origin of ventrals equidistant from caudal and base or middle of the pectorals; distance between the anal and caudal four and three-tenths to five in the length; distance between origin of the dorsal and the caudal one and three-fourths to one and four-fifths in its distance from the snout. . . . . **caliense** Eigenmann.

ccc. Sides plain; maxillary barbel extending beyond the axil; origin of ventrals equidistant from caudal and pre-operele; distance between anal and caudal five and one-half in the length; distance between origin of dorsal and caudal two in its distance from the snout; origin of anal a little in advance of the middle of the dorsal. See also *kneri*.

latidens Eigenmann.

aa. Teeth sharp-pointed, conical or recurved conical.*

f. Origin of ventrals nearer to caudal than to tip of pectoral filament, the distance between the ventrals and caudal two in the distance from the snout; distance between origin of dorsal and caudal two and two-fifths in its distance from the snout. Sides densely covered with small spots with only vermiculating light lines between them. (Appendix I, No. 24.)

metæ Eigenmann.

ff. Origin of ventrals nearer to tip of pectoral filament than to caudal, usually much further forward.

g. Sides plain.

h. Origin of dorsal nearly over origin of the ventrals, nearer the eye than the tip of the caudal; distance between origin of dorsal and caudal 1.5 or less in its distance from the snout, head 4.5–5.33 in the length. . . . . **stramineum** Eigenmann.

* Not examined in *unicolor*, *kneri*, and *retropinne*.

hh. Origin of dorsal above or a little in advance of the vent, its distance from the caudal 1.8 in its distance from the snout; head six times in the length; caudal subtruncate; barbels as long as head..... **unicolor** Regan.

hhh. As under *h*, caudal emarginate, barbels reaching considerably beyond origin of pectoral. (Appendix I, No. 25)..... **kneri** (Steindachner).

hhhh. Origin of dorsal distinctly behind the origin of the ventrals, much nearer the tip of the caudal than the eye..... **striatum** Meek & Hildebrand.

gg. Sides irregularly spotted, more rarely a lateral band, the spots along the middle of the sides rarely in a distinct series; caudal rounded.

i. Maxillary barbels very slender, reaching to the middle of the pectoral rays; eye entirely in the anterior half of the head; origin of dorsal equidistant from tip of caudal and opercle; sides and back with moderate-sized dark spots. (*Extralimital.*)
meridæ Regan.

ii. Maxillary barbels not reaching to the middle of the pectoral.

j. Origin of dorsal, on an average, slightly nearer to the caudal than to the eye; dorsal inclusive of the rudimentary rays most frequently 12.5; head a little longer than wide; distance between dorsal and caudal 1.5–1.7 in its distance from the snout; sides and back with numerous large spots, rarely in rows, the spots largest in the larger specimens..... **bogotense** Eigenmann.

jj. Origin of dorsal nearly equidistant from tip of caudal and snout; D. 11.5 or 12.5; head as wide as long; distance between dorsal and caudal 1.4–1.5 in its distance from the snout; sides and back in the largest with numerous irregularly arranged spots about the size of the eye, the spots larger and less numerous in the young. Sometimes nearly plain, sometimes with a lateral stripe.
nigromaculatum (Boulenger).

jjj. Origin of dorsal nearer tip of caudal; sides with large dark blotches.
poeyanum Cope.

k. Pectoral ray not prolonged. Origin of dorsal nearer tip of caudal than tip of snout; head as wide as long; sides variously spotted or marbled, sometimes with a lateral stripe..... **quechuorum** Steindachner.

kk. Pectoral ray prolonged. Caudal emarginate. Sides profusely spotted.

l. Dorsal entirely in front of the anal.

m. Spots much smaller than the eye, largest on caudal peduncle.
punctulatum (Cuv. & Val.).

mm. Spots uniformly larger..... **punctulatum piuræ** n. subsp.

ll. Dorsal in part over the anal..... **dispar** Tschudi.

ggg. Sides with distinct longitudinal bands or rows of spots; caudal emarginate, truncate, or truncate-rounded.

n. Caudal emarginate; origin of dorsal equidistant from tip of caudal and opercle or pre-opercle, its distance from the caudal 1.5–1.8 in its distance from the snout; head five in the length; sides and back with numerous dark spots, those along the middle of the sides forming a distinct row, sometimes confluent along the anterior half of the body..... **banneaui** Eigenmann.

nn. Caudal truncate or rounded.

o. Dorsal, anal, and caudal truncate; origin of dorsal equidistant from tip of caudal and pre-operele, its distance from the base of the middle caudal rays 1.6 in its

distance from the snout; sides with a faint broad band, oversown like the back with spots about the size of the eye.....**spilosoma** Regan.

oo. Dorsal and anal rounded.

p. Lateral band above the middle; maxillary barbels extending to the axil.

q. Caudal truncate-rounded; origin of dorsal equidistant from tip of caudal and eye or nasal barbel, its distance from the caudal about 1.4 in its distance from the snout; the lateral band or row of spots above the middle, from the upper part of the gill-opening to above the middle of the caudal. (Appendix I, No. 26.).....**dorsostriatum** Eigenmann.

qq. Barbels very short, about reaching the eye; origin of dorsal equidistant from tip of caudal and opercle; a faint lateral band; sides reticulated; first pectoral ray not prolonged.....**venulosum** Steindachner.

pp. Lateral band, if present, in the middle of the sides.

r. Origin of dorsal equidistant from tip of caudal and nasal barbel, its distance from the base of the middle caudal rays about 1.4 in its distance from the snout; a lateral band increasing in width to the caudal; middorsal area dark, a dark stripe between the lateral stripe and the dorsal stripe in front of the dorsal...**latistriatum** Eigenmann.

rr. Origin of dorsal equidistant from tip of caudal and a point between the middle of the pectoral and the pre-opercle, its distance from the middle caudal rays 1.8–2 in its distance from the snout.

s. Maxillary barbel reaching a little beyond the axil or shorter; color very variable, plain, or with one to three lateral stripes; origin of the dorsal typically equidistant from tip of caudal and middle of pectoral rays.....**striatum** Meek & Hildebrand.

ss. Maxillary barbel reaching to near the end of the lower pectoral ray, longer than the head; origin of dorsal equidistant from tip of caudal and opercular spines.....**regani** Eigenmann.

rrr. Distance between origin of dorsal and caudal 2.2–2.4 in its distance from the snout; head as broad as long; eye in the middle of the head; distance between base of last anal ray and the caudal 5.4 in the length. An indistinct darker stripe along the middle of the side and traces of some darker spots.....**retropinne** (Regan).

59. **Pygidium laticeps** (Kner).

Pygidium laticeps EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 307, fig. 12 (Below Paramba; Mindo).

Habitat: Western Andes of Ecuador.

60. **Pygidium stellatum** Eigenmann.

Pygidium stellatum EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 308, plate XLVII, fig. 1 (Sarjento; Guamal; Guadual; Rio Guaduas; Quebrada Cristalina near Puerto Berrio).

Habitat: Between Honda and Facatativa; near Puerto Berrio, Magdalena Basin.

61. **Pygidium chapmani** Eigenmann.

Pygidium chapmani EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 309, plate XLVII, figs. 2, 3; text-figure 13 (Boquilla; Rio Dagua at Caldas).

62. **Pygidium tænium** (Kner).

Pygidium tænium EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 310, fig. 14 (Los Llanos de Sandona, Southern Colombia).

Habitat: High Andes of Southern Colombia and Northern Ecuador.

63. **Pygidium caliense** Eigenmann.

Pygidium caliense EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 311, fig. 15 (Cali).

Habitat: Upper Cauca Basin.

64. **Pygidium latidens** Eigenmann.

Pygidium latidens EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 312, plate XLVII, fig. 21 (Rio Calima).

Habitat: San Juan Basin.

65. **Pygidium stramineum** Eigenmann.

Pygidium stramineum EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 313, plate XLIX, fig. 1 (Quebradas del Mango, del Maradat, La Densino, Deocamante, de Suaita, de la Honda).

Habitat: Andes of the Province of Santander, Colombia.

66. **Pygidium unicolor** Regan.

Pygidium unicolor EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 314 (Condoto).

Habitat: San Juan Basin.

67. **Pygidium bogotense** Eigenmann.

Pygidium bogotense EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 315, plate XLIX, figs. 3, 4 (Puente de Suba and Madrid on the plains of Bogotá; San Lorenzo and Cincinnati, Santa Marta; Rio Piedras, Quebrada da Charala, Santander).

Habitat: Andes from Bogotá to Santa Marta.

68. **Pygidium nigromaculatum** (Boulenger).

Pygidium nigromaculatum EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 317, plate XLIX, fig. 5 (San Lorenzo, Santa Marta; Quebrada de la Raya, Capitanejo, Cobarachior, Santander).

Habitat: Andes of Santander and Santa Marta.

69. **Pygidium poeyanum** (Cope).

Pygidium poeyanum EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 302.

This species was first recorded by Cope in a paper entitled "On some Batrachia and Nematognathi brought from the Upper Amazon by Prof. Orton," Proc. Acad. Nat. Sci. Phila., 1874, pp. 120–137. Among the records of specimens from the Upper Amazon occurs the mention of a specimen of *Trichomycterus rivulatus* from Arequipa, which Cope later named *poeyanum*. Until additional specimens are obtained it is to be doubted whether the specimen mentioned came from the Pacific slope at Arequipa. The species *P. rivulatum* is very abundant directly across the divide in the Titicaca Basin and also in the Urubamba Basin. Cope lists *Cyclorhamphus œmaricus* sp. nov. from Lake Titicaca in the same paper, so that it is not impossible that the specimen under consideration came from the Titicaca Basin.

70. **Pygidium quechuorum** Steindachner.

Pygidium quechuorum EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 305, fig. 11 (Arequipa).

Habitat: Rio Chili, at least in the upper valley between Arequipa and Tiabaya. The Rio Chili empties into the Rio Vitor. It was not found in the Rio Vitor at Yura nor the lower "Vitor Valle."

7679 *a–c*, C. M.; 15230, I. U. M., many, largest 140 mm., Arequipa. Oct. 24, 1918. Eigenmann.

7680 *a–c*, C. M.; 15231, I. U. M., many, largest 115 mm., Tiabaya. Oct. 25, 1918. Eigenmann.

D. 11 to 13. A. 10 or 11; nasal barbel extends to posterior margin of eye, the maxillary barbel not nearly to gill-opening; teeth conical, in bands.

Head as wide as long; origin of dorsal behind base of ventrals; middle of sides in the young with a black stripe, which breaks up into a series of spots with growth, and tends to disappear in the old. Color in adult uniformly yellowish or variously marbled, to blackish.

Above the bridge, which crosses the Rio Chili in Arequipa, there was at the time of my visit a small branch running from the main stream to a little pool below the bridge. There were no fishes in evidence, but a little poison "cube" brought them from their hiding places in such numbers that a devout passerby exclaimed: "It exceeds the miraculous draft of St. Peter."

71. **Pygidium punctulatum** (Cuvier and Valenciennes).

Pygidium punctulatum EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 300, plate XLV, fig. 4 (Rio Rimac)

?Pygidium dispar (*non* Tschudi) EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 299.

15226, I. U. M., six, largest 188 mm., Rimac at Lima, Aug. 18, 1918, Allen.

7677 *a–c*, C. M.; 15227, I. U. M., twenty-six, largest 130 mm., Laguno near Puente Piedra, near Lima, Jan. 26, 1919. Eigenmann.

7678 *a–c*, C. M.; 15228, I. U. M., many, largest 155 mm., Chosica, Oct. 10, 1918. Eigenmann.

15229, I. U. M., one, 55 mm., Matucana, Aug. 10, 1918. Eigenmann.

Habitat: Rimac Basin of Peru.

A dusky lateral band in the young; body, sides, and back profusely covered with spots much smaller than the eye, largest on caudal peduncle, smallest on nape and head; sometimes uniform, or with larger spots.

The specimens from Puente Piedra are mostly females containing nearly ripe eggs.

This is the species of the Rimac. All the specimens enumerated above have the origin of the dorsal behind the origin of the ventrals, while in *dispar* it is represented as over, or in front of, the origin of the ventrals.

72. **Pygidium punctulatum piuræ** subsp. nov.

?Pygidium dispar (*non* Tschudi) STARKS, Proc. U. S. Nat. Mus., XXX, 1906, p. 770 (Eten, Northern Peru).

SPECIMENS COLLECTED BY EIGENMANN.

15224, I. U. M., *type*, 126 mm.; 15224, I. U. M.; 7676, C. M., twenty-two *paratypes*, Piura, Peru, Jan. 11, 1919.

7674, C. M.; 15061, I. U. M., fourteen, largest 89 mm., Cultambo, Jan. 12, 1919.

7675, C. M.; 15223, I. U. M., four, largest 80 mm., Llallan, Jan. 15, 1919.

15225, I. U. M., one, 105 mm., Pacasmayo. Jan. 1919.

Habitat: Northern Peru, at least from Eten to Pacasmayo and from sea-level to Llallan.

Head 5; D. III, 8, 1; A. 9. These specimens resemble *Pygidium punctulatum* from the Rimac and *Pygidium dispar*. They differ from the latter in that the origin of the dorsal is uniformly behind the vertical from the base of the ventrals. They differ from the Rimac specimens in that the spots are uniformly larger and quite regularly distributed over the sides and back. The young have an ill-defined, deep lying lateral band.

Origin of the dorsal equidistant from tip of caudal and a point between the

anterior margin of the eye (rarely the nasal barbel) and the ends of the interopercular spines.

73. **Pygidium dispar** Tschudi.

Pygidium dispar EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 299, plate XLV, fig. 5.

Habitat: Peru.

It is doubtful whether the records of this species from the Pacific slope at Callao and Eten are valid. They probably refer to *punctulatum* and its variety *piuræ*.

74. **Pygidium banneaui** Eigenmann.

Pygidium banneaui EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 318, plate XLVIII, fig. 1 (Streams near Honda).

Habitat: Brooks of Upper Magdalena Basin.

75. **Pygidium spilosoma** Regan.

Pygidium spilosoma EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 319, plate XLVIII, fig. 2 (Cordova).

Habitat: Dagua and San Juan Basins.

76. **Pygidium venulosum** Steindachner.

Pygidium venulosum EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 320.

Habitat: Paramo de Cruz Verde, Eastern Cordillera of Colombia, a short distance east of Bogotá.

77. **Pygidium latistriatum** Eigenmann.

Pygidium latistriatum EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 321, plate XLVIII, fig. 4 (Quebrada de Pinchote).

Habitat: Andes of Santander.

78. **Pygidium striatum** Meek and Hildebrand.

Pygidium striatum EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 321 (Quebrada Sarjento, Quebrada Alban, Guadual, Villeta, Rio Guaduas, all between Honda and Facatativa. In Santander: Quebrada de la Ropera, de la Hato, San Gil, Quebrada Chamisal; Rio Dagua, western Colombia).

Habitat: Colombia from Santander to the Rio Dagua in western Colombia, and the Rio Tuyra in Panama.

79. **Pygidium regani** Eigenmann.

Pygidium regani EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 323, plate XLVIII, fig. 5 (Tado, Rio San Juan).

Habitat: San Juan Basin.

80. **Pygidium retropinne** Regan.

Pygidium retropinne EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 324.

Habitat: Headwaters of the Rio Magdalena near St. Augustine, 5,000 ft.

EREMOPHILUS Humboldt.

81. **Eremophilus mutisii** Humboldt.

Eremophilus mutisii EIGENMANN, Mem. Carnegie Mus., VII, 1918, p. 341, plate XLI, figs. 1, 2; plate LIV, figs. 1, 2 (Puenta de Suba, Laguna near Bogotá, Herrera, Madrid, Rio Bogotá, Rio Funjuelo at Usme Sur, all near Bogotá; Rio Chiquinquiere, Boyaca).

Habitat: Plains of Bogotá and slightly to the northward.

Family VIII. CALLICHTHYIDÆ.

A family widely distributed in the waters of the lowlands from Panama to Buenos Aires.

CORYDORAS Lacépède.

This genus occurs at the eastern bases of the Eastern Andes of Colombia.

82. **Corydoras melanotænia** Regan.

Corydoras melanotænia REGAN, Ann. & Mag. Nat. Hist. (8), X, 1912, p. 217 (Honda).

During my short stay at Honda, I did not succeed in securing this species, which was known from two specimens, 50 mm. long. Is it possible that these specimens really came from the Meta Basin east of Bogotá and were shipped from Honda? The species is abundant about Villavicencio on the Meta. (See Appendix I, No. 19.)

HOPLOSTERNUM Gill.

KEY TO THE SPECIES OF HOPLOSTERNUM.

a. Pectoral spine reaching ventrals in the female, considerably beyond origin of ventrals in the male; origin of dorsal about equidistant from tip of snout and origin of adipose; caudal rather deeply concave; three to seven azygous plates in front of the adipose; distance between pectorals considerably less than length of coracoid; plain slate-colored or spotted.....**magdalenæ** Eigenmann.

aa. Pectorals not reaching ventrals, except in young; origin of dorsal nearer tip of snout than adipose; caudal less deeply concave; five (in three specimens) or six (in one) azygous plates in front of the adipose; distance between pectorals but slightly less than length of coracoids. Most of body and dorsal with small black spots.....**punctatum** Meek and Hildebrand.

83. **Hoplosternum magdalenæ** Eigenmann. (Plate VIII, figs. 2–4.)

Callichthys (*Hoplosternum*) *thoracatus* (*non* Cuvier and Valenciennes) STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 66 (Cauca near Caceres).

Hoplosternum magdalenæ EIGENMANN, Ann. Carnegie Mus., VIII, 1913, p. 412; Indiana University Studies, No. 18, March (June) 1913, p. 30 (Soplaviento and Calamar).

Habitat: Magdalena Basin, and Truando River of the Atrato Basin.

A full description appears in each of the last two citations. In addition to the specimens there recorded from Calamar and Soplaviento on the Magdalena River, I have since examined six specimens, 3929 *a–b*, C. M.; 13970, I. U. M., 54–75 mm., from the Rio Truando, collected by Wilson.

The specimens from the Truando River are lighter in color and have numerous spots (smaller than the pupil) on the body, the dorsal fin, and the posterior parts of the caudal fin. The caudal has a dark bar across its base, then a light bar, then a narrower dark bar, or a regular series of spots; the rest of the caudal to the tips of the lobes is spotted, the spots nearer the base are in a more or less regular series.

84. **Hoplosternum punctatum** Meek and Hildebrand.

Hoplosternum punctatum MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1916, p. 264, plates XIV and XV.

Habitat: Four specimens of this species were taken by Meek and Hildebrand in the Rio Marte Arnade, six miles east of Panama City, Panama.

This is the northernmost locality from which members of the family have been recorded, and the only one on the Pacific slope.

Family IX. LORICARIIDÆ.

The members of this family, widely distributed in South America, have received monographic treatment by Dr. C. Tate Regan in "A Monograph of the Fishes of the Family Loricariidæ," Trans. Zoöl. Soc. London, XVII, 1904, pp. 191–350, plates IX–XXI.

KEY TO THE LORICARIIDÆ.

a. Hæmal spines all simple; lower and fourth upper pharyngeal not toothed; anterior rudimentary ray of ventral normally shaped, but internal, and directed forward; lower transverse portion of clavicles and coracoids not exposed, margin of snout naked or with small granular plates (*Plecostominæ*).

b. Operele and interopercule slightly and not independently movable; snout granular to its margin. Teeth bifid. Adipose fin present; operele and interopercle not margined with bristles; body covered with plates.

c. Teeth numerous. . . . . **Plecostomus** Gronow.

cc. Teeth large and few. . . . . **Cheiridodus** gen. nov.

bb. Interopercule more or less freely movable, usually spinate or bristly.

d. Snout granular to its margin.

c. Teeth numerous, bifid.

f. Adipose and anal fins present.

g. Sides of head in the male without bristles; interopereular spines usually small and hidden under operele, when depressed, exeept in *Hemiancistrus landoni*.

h. Dorsal I, 7, or I, 8; abdomen naked or granulose; resembling *Plecostomus*, from whieh some species are seareely distinguishable. **Hemiancistrus** Bleeker.

hh. Dorsal I, 10, to I, 13; abdomen granulose.....**Pterygoplichthys** Gill.

gg. Sides of head, at least in male, with slender bristles.

i. Interoperele with twelve or more spines and a number of bristles, whieh, when ereeted, form a sessile rosette; abdomen naked, or with a few granules; D. I, 7.....**Lasiancistrus** Regan.

ii. Interopereular spines pedieulate, one or two frequently mueh longer than the rest; sides of head with bristles, whieh are always longer in the male than in the female, in whieh they may be wanting; D. I, 7, to I, 9. Speeies under 200 mm..**Pseudancistrus** Bleeker.

ff. Adipose and anal wanting; snout with short bristles; D. I, 8; otherwise like *Pseudancistrus*.....**Leptancistrus** Meek and Hildebrand.

ee. Teeth few, spoon-shaped; D. I, 7. Interoperele with long spines. **Panaque** Eigenmann.

ccc. Teeth few, with a small lateral lobe. Interoperele without spine.

dd. Snout with naked margin.

j. Mouth wide, the length of mandibular ramus nearly equal to the interorbital width; naked margin of snout not very wide, without tentaeles..**Chætostomus** Tsehudi.

jj. Mouth moderate or narrow, the length of the mandibular ramus eonsiderably less than the interorbital width; snout with tentaeles, the naked margin broad in males, narrow in females.....**Ancistrus** Kner.

aa. Hæmal spines of the vertebræ above the anal fin bifid; lower and fourth upper pharyngeals toothed; no anterior rudimentary ray of ventral; eaudal pedunele elongate and strongly depressed. (*Loricariinæ*).

k. Teeth in small or moderate numbers, not setiform. A more or less distinet orbital noteh; snout rounded or pointed, not, or not mueh, produeed.....**Loricaria** Linnæus.

kk. Teeth in the jaws numerous, setiform; orbit eireular, without distinet noteh.

l. Dorsal opposite to the ventrals; snout produeed, forming a distinet rostrum; sides of the head of the male with bristles.....**Sturisoma** Swainson.

ll. Dorsal opposite to the anal; snout very long; body very slender. **Farlowella** Eigenmann and Eigenmann.

Plecostomus Gronow.

Type, *Loricaria plecostomus* Linnæus.

This genus is represented in our area by three species: *P. spinosissimus*, confined to Western Ecuador; *P. tenuicauda* found in the Magdalena Basin; and *P. plecostomus panamensis*, a variety of the common *Plecostomus plecostomus*, which is found east of the Andes of Eastern Colombia.

KEY TO THE SPECIES OF PLECOSTOMUS.

a. Supra-occipital bordered by a single scute; lateral plates thirty-two to thirty-four; caudal pedunele long, round, its depth 4.33–15 in its length, depending on age; depth 6.2–8; head 3.33; interorbital 2.8 in the head; mandible 2.4–3 in interorbital; thirty-two to thirty-four seutes, seventeen to nineteen between anal and caudal; base of dorsal 1.25–1.66 in its distance from the adipose. **spinosissimus** Steindaehner.

aa. Supra-oecipital bordered by a median scute and one or two on eaeh side; depth of caudal pedunele 4–5 in its length; depth 6–7; head 3.33–4; interorbital 2.33–2.66 in the head; mandible 3–4 in the interorbital; twenty-eight to thirty seutes, fourteen or fifteen between anal and caudal; first dorsal ray as long as head; base of dorsal 1.12–1.33 in its distanee from the adipose. **tenuicauda** Steindaehner.

aaa. Supra-oeeipital usually bordered by several seutes; depth 4.4–5.3; head 3–3.44; interorbital 2.2–2.9 in the head; mandible 2–3.35 in interorbital; twenty-six seutes, thirteen to fifteen between anal and caudal; first dorsal ray about equal to the head, base of dorsal a little shorter than head..... **plecostomus panamensis** subsp. nov.

85. **Plecostomus spinosissimus** Steindachner. (Plate XXXIV, figs. 1 and 2.)

"Raspavalsa," "Campeche."

Plecostomus spinosissimus STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 98, plate V, figs. 1, 1 *a* (Guayaquil).

Plecostomus festæ BOULENGER, Boll. Mus. Zoöl. Anat. Comp. Torino, XIII, 1898, no. 329, p. 11 (Rio Vinces, Rio Peripa, the largest specimen 460 mm.); REGAN, Trans. Zoöl. Soc. London, XVII, 1904, p. 208, plate IX, fig. 1 (W. Ecuador, 310 mm.).

Habitat: Western slope of Southern Ecuador.

Head 3.5–5.7; depth 7–10; D. I, 7; A. I, 4; scutes thirty-one or thirty-two + 1; 9 or 10 between dorsals, fifteen + 4 or 5 between anal and caudal; depth of caudal peduncle 4.33–15 in its length.

TABLE OF MEASUREMENTS OF A SERIES OF SPECIMENS FROM YOUNG TO ADULT.

Length to Base of Caudal Plates.	36 mm.	80 mm.	142 mm.	267 mm.	471 ♂	438 ♀
Head	10.5	20.5	32	57	76	76
Depth	5	12	22	38	46	48
Width of head	9.5	18	32	58	78	74
Interorbital	4+	9.5	15	28	36	34
Ramus of lower jaw					11	10.5
Eye in length of head	2.2	4	5	10	11	11
Base of dorsal	7	18	32	55	83	84
Distanee between dorsal and adipose	7	15	32	60	123	112
Caudal pedunele	13	30	53	105	228	202
Depth of eaudal peduncle	3	5	7	12	15	14.5

This species is easily distinguished from its congeners by its long tail and the extreme development of spines, and undergoes marked change in proportions with growth, as may be seen from the table. For instance, the depth of the caudal peduncle in relation to its length changes from 4.33 to 15. *Plecostomus festæ* represents one of the phases of this metamorphosis. The following specimens were collected by Mr. Arthur Henn in Ecuador, during the Landon Expedition.
7561 *a*, C. M.; 13910, I. U. M., four, 500–565 mm., Guayaquil.
7566 *a–c*, C. M.; 13916, I. U. M., seventeen, 45–355 mm., Colimes, Rio Daule. 13917, I. U. M., two, 36–40 mm.; four, 367–485 mm., Vinces.

86. **Plecostomus tenuicauda** Steindachner.

Plecostomus tenuicauda Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 40, plate VI (Magdalena); *ibid.*, XLII, 1880, p. 63 (Cauca near Caceres); Regan, Ann. & Mag. Nat. Hist. (7), XVII, 1906, p. 94 (Barranquilla).
3870 *a–d*, C. M.; 15046, I. U. M., seven, 110–557 mm., Soplaviento. Eigenmann.
7568 *a*, C. M.; 13919, I. U. M., three, 44–51 mm., Peñas Blancas. Eigenmann.
7565 *a–c*, C. M.; 13915, I. U. M., thirteen, 137–485 mm., Puerto del Rio. Gonzales. 13923, I. U. M., one, 75 mm., Apulo. Gonzales.

Habitat: Magdalena Basin.

This species is described in great detail by Steindachner. As stated, the snout is granular at the tip. His largest specimen was 480 mm. in length. In the largest specimens at hand, the spots of the dorsal and caudal fins are elongate in the direction across the fins.

87. **Plecostomus plecostomus panamensis** subsp. nov.

The references for this variety within our territory are:

Plecostomus plecostomus var. Kner and Steindachner, Abhandl. Bayr. Akad. Wiss., München, X, 1865, p. 60 (New Granada); Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1916, p. 247 (Panama on both slopes, except Rio Bayano).

Plecostomus bicirrhosus Günther, Trans. Zoöl. Soc. London, VI, 1866, p. 477 (discussing Kner and Steindachner's specimens).

Plecostomus guacari Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 205; Biologia Centrali-Americana, 1906, p. 111.

Habitat: Both slopes of Panama.

I have examined specimens from the Rio Gatun, taken at Monte Liria and at Gatun by Meek and Hildebrand.

From *P. plecostomus* found abundantly everywhere east of the Eastern Andes,

this variety differs in having the occipital usually bordered by several (three or more) plates.

CHEIRIDODUS [9] gen. nov.

Type, *Plecostomus hondæ* Regan.

This genus is a *Plecostomus* with a very few (seven to twelve) large teeth. It differs from *Cochliodon* in having a small lobe on the outer edge of the base of each tooth. In *Cochliodon* the teeth have but one lobe.

88. **Cheiridodus hondæ** (Regan). (Plate VIII, figs. 6 and 7.)

Plecostomus hondæ REGAN, Proc. Zoöl. Soc. London, 1912, p. 666, plate LXXVI, fig. 3 (Honda, Colombia).

Habitat: Magdalena and San Juan Basins, Colombia.

Plecostomus hondæ was based on two specimens 80 mm. long from Honda. Mr. Wilson collected one specimen (13922, I. U. M.), 108 mm. in total length, at Istmina.

COMPARISON OF SPECIMENS OF CHEIRIDODUS HONDÆ AND PANAQUE GIBBOSUS.

	Cheiridodus hondæ.		Panaque gibbosus.	
	80 mm. Described by Regan. About 70 mm. to End of Middle Caudal Rays.	No. 13922, 108 mm. About 88 mm. to End of Middle Caudal Rays.	No. 13911 *a*, 250 mm. 198 mm. to End of Middle Caudal Rays.	No. 13911 *b*, 238 mm. to End of Middle Caudal Rays.
Head	3	2.77	2.6	2.75
Depth	4.66	4.25	4.6	4.2
D.	I, 7	I, 7	I, 7	I, 7
A.	I, 4	I, 4	I, 4	I, 4
Eye in head	7	6.5	11	13
Ramus in interorbital	3	4	4	4
Scutes	27 or 28 + 1	28 + 1	26 + 1	26 + 1
Teeth	12	12	11 — 15	9 — 10
Length of dorsal spine in head	Nearly as long	Longer than	1.25	I, 33
Interopercular spines in interorbital	7	None	1.5	1.5

Head 2.77; depth 4.25; D. I, 7; A. I, 4, scutes 28 + 1, 6 between dorsal and fulcrum in front of the adipose spine, 11 + 3 between the anal and caudal; eye 4 in snout, 3.33 in interorbital, 6.5 in the head; ramus of lower jaw 6 in the head; interopercle with a few enlarged spinules along its margin, similar to those of the opercle, without trace of spines of the *Chætostomus* type; interorbital with a median and marginal elevations; occipital pointed, entering the scute following it; teeth large, spoon-shaped, with a lateral notch, nine on each side of both upper

[9] χειρίς, χειρίδος, ἡ = glove, ὀδούς, ὁ = tooth, in allusion to the mitten-shaped teeth of this genus.

and lower jaw; belly with spinules between the pectorals and along the middle; dorsal truncate when depressed, the spine and the first two rays extending about to the spine of the adipose; base of dorsal equals its distance from the caudal fulcra, or the anterior margin of the nares; caudal deeply, and a little obliquely, emarginate, the lower ray a little longer than the upper, more than twice as long as the middle one; lateral scutes but faintly keeled.

Everywhere with dark round spots smaller than the eye, six spots in the membranes of the dorsal in front, three in the last one; margin and a sub-marginal band in the caudal dark, basal part and rays with spots, pectoral and ventral with cross-bars.

Hemiancistrus Bleeker.

Hemiancistrus Bleeker, Tijdschr. Dierk., I, 1863, p. 78.

Type, *Ancistrus medians* Kner.

Dorsal I, 7; opercle and interopercle separately movable, the latter with spines, which can or cannot be completely retracted under the opercle; margin of head granular, without bristles; last dorsal ray connected with the following scute by a small membrane. The species within the present area have the general appearance of *Plecostomus* and *Pterygoplichthys*. Body deep, the plates keeled, occipital keeled, ventral surface more or less completely covered with granular plates.

Kner based his *Ancistrus medians* on a specimen named *barbatus* in the Museum at Stuttgart. He describes it in general terms as heavy in form, with few dorsal rays, keeled and spinous plates, a bundle of very long hooks like those in *A. mystacinus*, with short head, broad snout, large eyes, very long ventrals reaching beyond the anal and very spinous pectorals. Body and fins are covered with large dark spots. The ventral surface is completely covered with small plates. In the latter character, the species is intermediate between *Plecostomus* and *Ancistrus*, hence the name *medians*.

Key to the Species of Hemiancistrus.

a. Interopercle freely movable, with about eight long, hooked spines and about thirty much smaller ones in front; occipital keel low, the bone bordered by a single kidney-shaped plate; twenty-eight scutes in the lower series of the side, counting the last one at base of caudal; dorsal not reaching the fulcrum in front of the adipose spine by one scute; six scutes between dorsal and fulcrum of the adipose, twelve + three scutes between the anal and caudal; ventral surface entirely granulose; five or six series of spots on the dorsal . . . . . **landoni** Eigenmann.

aa. Interopercle very little movable, the spines small or absent; from nine to twelve series of spots on the dorsal.

b. Dorsal fin not reaching the spine of the adipose by one or two scutes; ventral surface entirely granulose; occipital bordered by a large median plate and one or two smaller ones on each side. **annectens** Regan.

bb. Dorsal fin reaching the adipose or caudal.

c. Abdomen in specimens 130 mm. long largely naked; occipital bordered by a single scute, or a large median scute and a minute one at the outer angle..... **holostictus** Regan.

cc. Abdomen in specimens 125 mm. long granulose; occipital bordered by a single scute or by a large median scute, and the angles of the first of the lateral series.. **wilsoni** Eigenmann.

aaa. Interoperele armed with a few short spines; dorsal spine as long as head; abdomen largely granulose; head 3; depth 5.5; D. I, 7; A. I, 4; twenty-five scutes, seven between dorsal and adipose; twelve between caudal and anal; supra-occipital bordered by a single plate; eye eight times in head; mandible 1.8 in interorbital; occipital without distinct ridge, scutes strongly carinate, caudal emarginate; caudal peduncle two and two thirds times as long as deep, everywhere covered with numerous small dark spots..... **aspidolepis** (Günther).

89. **Hemiancistrus landoni** Eigenmann. (Plate IX, fig. 3; Plate X, fig. 2.)

Hemiancistrus landoni EIGENMANN, Ann. Carnegie Mus., X, 1916, p. 84 (Naranjito). 13654, I. U. M., *type*, 255 mm., Naranjito, Ecuador. Henn.

Head 3.14; depth 5.35; D. I, 7; A. I, 4; twenty-seven scutes, seven between dorsal and spine of the adipose, twelve + four between anal and caudal; depth at tip of occipital less than snout, width above pectoral spine equal to the length of the head; mandible 2 in interorbital; eye 5.3 in head, 3 in interorbital, 9 in the head; about ten long, graduated interopercular spines and numerous graduated smaller ones in front of these. Longest spine 2.66 in length of the head.

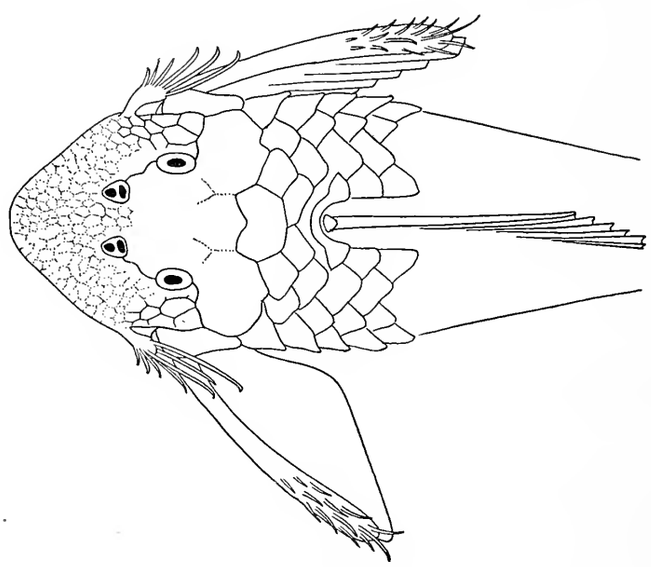

Fig. 16. *Hemiancistrus landoni* Eigenmann. Type, 255 mm. No. 13654, I. U. M.

Occipital scarcely keeled, median plates behind it bicarinate, plates of the sides carinate; dorsal spine a little shorter than head, reaching the fifth scute in front of the adipose spine, last ray reaching the second scute in front of it; caudal but

little emarginate, the lower lobe very little longer than the upper, 3.33 in the length; the middle one $1\frac{2}{7}$ in the lower; a small naked area in front of each ventral; upper surface of pectoral with strong spines similar to those of the interopercle, but stronger, increasing in length toward tip.

Four dark cross-shades, one behind eyes, one at end of dorsal, one at adipose and one at end of caudal peduncle; six large round spots on anterior dorsal membrane, three in last; caudal, anal, ventrals, and pectorals with similar spots on rays and membranes; obscure spots on the sides, larger ones on belly; faint light streaks along the keels of the lower rows of plates.

Named for Mr. Hugh McK. Landon of Indianapolis, who made possible the expedition of Mr. Henn to Ecuador.

90. **Hemiancistrus annectens** Regan. (Plate IX, figs. 1 and 2.)

Plecostomus bicirrhosus (*non* Gronow) Boulenger.

Ancistrus annectens Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 225, plate XI, fig. 2 (St. Javier, and Rio Durango, N. W. Ecuador).

Habitat: St. Javier, and Rio Durango, Ecuador. Patia Basin, Colombia.

7584, C. M.; 13913, I. U. M., two, 274–285 mm., Barbacoas. Henn and Wilson. 13914, I. U. M., two, 250–252 mm., Patia between Magui and Telembi. Henn.

Head 3.3; depth 4.5–5; D. I, 7; A. I, 4; seven scutes between the dorsals, eleven + three or four between anal and caudal; twenty-eight scutes along the sides; depth at tip of occipital equal to snout and eye; width above base of pectoral spine not quite equal to length of head; mandible 2.5–2.8 in interorbital; eye 4.5–5 in snout, 3–3.5 in interorbital, 8 in the head; four small, stiff interopercular spines, the longest not exceeding the pupil.

Occipital with a high keel; median plates behind it bicarinate, plates of the sides carinate, dorsal spine a little longer than head, reaching the fifth or sixth scute in front of the adipose spine, the last ray reaching to the second or third spine in front of the adipose spine; caudal deeply emarginate, the lower lobe longer, about 2.33 in the length; the median rays about 1.4 in the lower one; a small naked area in front of each ventral; lower surface otherwise granulose.

Everywhere covered with round spots, those on caudal peduncle arranged in rows; about twelve series of spots on anterior part of the dorsal, five series on the last membrane, ten to twelve series of spots on the caudal.

91. **Hemiancistrus holostictus** Regan. (Plate IX, fig. 4.)

Hemiancistrus holostictus Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 469 (Rio Condoto).

Habitat: San Juan Basin.

Of this species heretofore known only from the type, 180 mm., I have examined the following:

7569, C. M.; 13920, I. U. M., two, 119–135 mm., Istmina.

Mandible less than three in the interorbital; dorsal spine reaching middle of adipose spine, the last ray to the adipose spine; lower caudal lobe more than half the length; ventral surface in a specimen 130 mm. long, naked, except over the clavicle and very narrowly along the sides; about nine spots in the first dorsal membrane, about nine on the caudal, outer caudal rays dusky. Otherwise as in *H. wilsoni*.

92. **Hemiancistrus wilsoni** Eigenmann. (Plate IX, fig. 5; Plate X, fig. 1.)

Hemiancistrus wilsoni Eigenmann, Proc. Amer. Philos. Soc., LVI, 1917, p. 678.

Habitat: Atrato Basin.

7570 *a–d*, C. M.; 13921, I. U. M., eight, 90–133 mm., the largest the *type*, Truando. Wilson.

15304, I. U. M., 325 mm., same locality.

Similar to *H. holostictus* from the San Juan.

Head 3–3.25; depth 4.3–5; D. I, 7; A. I, 4; twenty-seven scutes, six or seven between the dorsals, eleven + three between the anal and caudal; depth at tip of occipital equals snout and half the eye or a little more than the eye; width above base of pectoral almost equal to length of head; mandible 3–3.6 in the interopercle, eye 4.25 in snout, 3 in interorbital, 7 in head; interorbital sometimes with three minute spines.

Occipital with a high keel, median plate behind it feebly bicarinate, plates of the sides well carinated; dorsal spine equal to head with from one to three scutes behind it, reaching to the adipose spine or the plate in front of it in the type. The last ray reaches the spine of the adipose, but is relatively much shorter in the largest, or the type; caudal deeply emarginate, the lower lobe considerably longer, 2.2 in the length (nearly 3 in the largest); the middle rays about 1.4 in the lower; ventral surface in a specimen about 115 mm. long mostly naked, in the larger ones granulose, except in a small area in front of the ventral.

Everywhere covered with round spots, a double row of about twelve on the anterior dorsal membrane, about five series on the last, fewer rows in smaller individuals, about twelve series on the caudal; in all but one the outer caudal rays are spotted. In the largest specimen, 15304, I. U. M., the spots on the dorsal and caudal all in more numerous rows, twenty on the first dorsal membrane, twelve on the last, and over twenty in the series on the caudal.

93. **Hemiancistrus aspidolepis** (Günther).

Chætostomus aspidolepis Günther, Proc. Zoöl. Soc. London, 1866, p. 603 (Veragua, northeastern Panama); Trans. Zoöl. Soc. London, VI, 1868, p. 477.

Ancistrus aspidolepis Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 230; Biologia Centrali-Americana, 1908, p. 112 (Veragua, Panama).

This appears to be the northernmost locality for the family of *Loricariidæ*. This species is known from a skin 280 mm. long from Veragua on the Pacific slope of Panama.

Pterygoplichthys Gill.

Type, *Hypostomus duodecimalis* Cuvier and Valenciennes.

94. **Pterygoplichthys undecimalis** (Steindachner).

Chætostomus undecimalis Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 43, plate VIII (Magdalena); *ibid.*, XLII, 1880, p. 65 (Cauca near Caceres).

Ancistrus undecimalis Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 226.

Habitat: Lower Magdalena Basin.

7563 *a–b*, C. M.; 13912, I. U. M., four, 237 and 280 mm. to tip of caudal, El Banco. Eigenmann.

7567 *a–e*, C. M.; 13918, I. U. M., fifteen, 271–310 mm., Soplaviento. Eigenmann.

Dorsal usually I, 10, rarely I, 12.

Lasiancistrus Regan.

Lasiancistrus Regan, Trans. Zoöl. Soc. London, XVIII, 1904, p. 224.

Type, *Chætostomus heteracanthus* Günther.

Habitat: Peruvian Amazon to Panama.

Interopercle and opercle separately movable. Interopercle with numerous spines and bristles which may be everted into a sessile rosette; snout with or without bristles; last dorsal ray connected with the following scute by a small membrane; scutes not keeled; ventral surface naked, or with a few granules; D. I, 7.

Key to the Species.

a. Width at base of pectoral equal to snout and two orbital diameters; occipital convex behind, usually entering a notch in the anterior margin of the first median scute; last dorsal ray failing to reach adipose by two or three scutes; fins with faint markings, caudal nearly black, margined by light. **caucanus** Eigenmann.

aa. Width at base of pectoral equal to snout and one and one-half orbital diameters; occipital convex behind, anterior margin of the first median scute truncate, or convex in the middle; last dorsal ray failing to reach adipose by one or two scutes.

b. Dorsal spine equals snout and eye; pectoral spine not reaching middle of ventrals; fin-rays conspicuously spotted. . . . . **mayoloi** (Eigenmann).

bb. Dorsal spine longer than snout and eye; pectoral spines reaching beyond middle of ventrals, membrane of dorsal and pectoral in the adult with hyaline spots about the size of the pupil; fin-rays alternately light and dark. . . . . **planiceps** (Meek and Hildebrand).

95. **Lasiancistrus caucanus** Eigenmann. (Plate XI, figs. 4 and 5.)

Lasiancistrus caucanus EIGENMANN, Indiana University Studies, No. 16, Sept. (Dec. 23) 1912, p. 11.

4824, C. M., *type*, 171 mm.; 4825 *a–d*, C. M.; 12683, I. U. M., eight *paratypes*, 105–175 mm., Cartago. Eigenmann.

7538 *a*, C. M., one, 134 mm., Piedra Moler. Eigenmann.

7580 *a–g*, C. M.; 13947, I. U. M., fourteen, largest 70 mm., Paila. Eigenmann.

7581 *a–b*, C. M.; 13933, I. U. M., four, Bernal Creek near Honda. Eigenmann.

Habitat: Cauca Basin.

Head 2.75; depth 5–5.2; D. I, 7; A. I, 5; scutes twenty-five or twenty-six; seven scutes between dorsal and adipose, ten between anal and caudal; eye 5.5 in snout, 8–9 in head, 3.5–3.75 in interorbital; width of mandibular ramus 2.5–3.33 in interorbital; width of head 1.3 in its length, its depth 2.2.

Head and scutes without ridges; interopercle with about forty spines and bristles, the longest nearly one-third as long as head, the bristles placed anteriorly and above and below along the margins of the spines, the longest bristle nearly as long as the longest spine; snout with bristles laterally, which may be very minute or considerably longer than the eye; supra-occipital bordered with three plates (in one specimen by a single plate), which enter about equally in its border, the middle one concave where it touches the supra-occipital. Pectoral spines extending beyond middle of ventrals, shorter in young.

Fins nearly black in the adult, the caudal narrowly margined with lighter. Head and body very obscurely marbled, back with cross-shades. In the young, the fins have faint markings on the rays. Very similar to *L. mayoloi.*

96. **Lasiancistrus mayoloi** (Eigenmann). (Plate XI, figs. 6 and 7.)

Hemiancistrus mayoloi EIGENMANN, Indiana University Studies, No. 18, Sept. (Dec. 23) 1912, p. 10; REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 469.

Lasiancistrus caucanus (*non* Eigenmann) REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 469.

Habitat: San Juan Basin.

4826, C. M.; *type*, 125 mm.; 4827 *a–b*, C. M.; 12688 *a–c*, I. U. M., five, Istmina. Eigenmann.

Head 3; depth 7.5; D. I, 7; A. I, 5; scutes twenty-four or twenty-five, counting the last one at base of caudal; six scutes between dorsal and adipose, ten + two between anal and caudal; eye 4.55 in snout, 7.5–8 in head, 3–3.33 in interorbital; mandibular ramus 3 in interorbital; width of head 1.33 in its length, its depth 2.25.

Head and scutes without ridges; interopercle with over thirty-five spines, mostly strong, with recurved hooks, some of the marginal spines of the anterior half in the form of long, curved bristles, the longest spines and bristles in the type are about one-fourth of the length of the head, mostly shorter in the paratypes; supra-occipital bordered by three plates, the first median scute forming most of the border. Head below and abdomen naked.

Dark brown with faint mottlings, rays of all fins with conspicuous spots, which tend to form bars, especially on caudal.

97. **Lasiancistrus planiceps** (Meek and Hildebrand).

Ancistrus planiceps Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1913, p. 79 (Boca de Cupe, Rio Tuyra); Ser. X, 1916, p. 253, plate X (Tuyra Basin).

The specimens came from the Tuyra Basin at the mouth of the Rio Yape, Boca de Cupe, Rio Satigante, Rio Caña, Rio Grande, and Rio Cupe.

Pseudancistrus Bleeker.

Pseudancistrus Bleeker, Nederl. Tijdschr. Dierk., I, 1863, p. 77; Eigenmann and Eigenmann, Occasional Papers Cal. Acad. Sci., I, 1890, p. 434.

Type, *Hypostomus barbatus* Cuvier and Valenciennes.

D. I, 7–9; abdomen naked; plates without keels; interopercle with slender spines or bristles, which can not be completely retracted; sides of head usually with bristles; last dorsal ray attached to the scute following it by a small membrane; caudal obliquely truncate; pectoral in the male very long.

Key to the Species of Pseudancistrus.

a. Interoperele without evident transverse articular divisions,[10] with a bundle of spines, which are graduated from the anterior end, or from very near the anterior end, of the interoperele to the last spine, which is about one-third as long as the head, and does not extend beyond the head; sides of head with very short spinules which do not become bristle-like. A. I, 4; D. I, 9 in three-fourths, I, 8 in one-fourth of the specimens..... **daguæ** (Eigenmann).

aa. Interopercle long, with an externally visible articulation separating the posterior spine-bearing portion, the spines not graduated to the anterior end of the interopercle, but confined to the

[10] Dissection shows the superficial part to be divided longitudinally into three parts.

edge and lower surfaee of the hispid interoperele; snout slightly hispid, or with long bristles. One or two interopereular spines mueh longer than the rest, reaehing eonsiderably beyond the head; bristles longest about the end of the snout.

b. A. I, 4; D. I, 8, rarely I, 7, or I, 9; interopercular artieulation below the hispid portion of the operele, the hinder end of the hispid portion of the interoperele below the middle of the hispid portion of the opercle.....**pediculatus** Eigenmann.

bb. A. I, 5; D. usually I, 9; interopereular artieulation well in advanee of anterior end of the hispid portion of opercle, the hispid portion of the interopercle shorter than in *setosus*, its posterior portion below the anterior end of the hispid part of the operele.....**carnegiei** Eigenmann.

aaa. Bristles longest along sides of head; interopereular spines subequal, the longest .4 of head, fifteen in female, twenty-five in male. A. I, 3; D. I, 7 or I, 8; mandibular ramus 1.33 in interorbital. **setosus** (Boulenger).

98. **Pseudancistrus daguæ** (Eigenmann). (Plate XII, figs. 1 and 2.)

Hemiancistrus daguæ Eigenmann, Indiana University Studies, No. 16, Sept. (Dec. 23) 1912, p. 11.

Habitat: Dagua Basin and Andes east of Bogotá.

4842, C. M., *type*, 79 mm.; 4843 *a–g*, C. M.; 12698, I. U. M., thirty-four *paratypes*, largest 95 mm., Caldas. Eigenmann.

4844 *a–d*, C. M.; 12699, I. U. M., eight *paratypes*, Cisnero. Eigenmann.

13661, I. U. M., one, 69 mm., Rio del Fosca. Gonzales.

Head 3–3.2; depth 6–7; D. I, 9 in thirty-two specimens, I, 8 in eleven specimens; A. I, 4; plates twenty-four or twenty-five, five or six between dorsals, ten + two between anal and caudal; width of head nearly equal to its length; eye 5.5–6.5 in snout, 9–10 in head, 2.5–3 in interorbital; mandibular ramus very little if any less than interopercular width; interopercle with a bundle of fifteen or more spines, the longest not much longer than those immediately preceding it, 2.5 in head in a few specimens, usually shorter. Scutes without keels; occipital without keel, bordered by three plates. Margin of head with short, spine-like bristles. Dorsal spine about equal to the snout, tip of last ray sometimes reaching adipose; length of base of dorsal equal to its distance from the base of the caudal or less. Pectoral ray reaching to ventral, or to near its middle; ventrals to the anal, or slightly beyond base of its last ray; caudal obliquely truncate, the lower ray 3–3.66 in the length.

Very dark; rays of all the fins spotted, the spots on the dorsal and caudal rays smallest and most numerous; some specimens with the fin-markings much fainter; the spots in the smallest specimens less numerous.

99. **Pseudancistrus pediculatus** Eigenmann. (Plate X, fig. 4; Plate XII, fig. 3.)

Pseudancistrus pediculatus Eigenmann, Proc. Amer. Philos. Soc., LVI, 1917, p. 679 (Villavicencio, Barrigón, Tengavita).

?Pseudancistrus setosus (*non* Boulenger) REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 469. (Rio Tamana).

Habitat: Rio Meta Basin, east of Bogotá and (?) San Juan Basin.

A specimen purchased from Mr. W. F. H. Rosenberg, as *P. setosus* from the Rio Tamana, proves to be this species. It is possible that Regan's specimens are also *P. pediculatus*, or that the locality is erroneous.

The description of this species occurs in the Appendix to this paper (See Appendix I, No. 10).

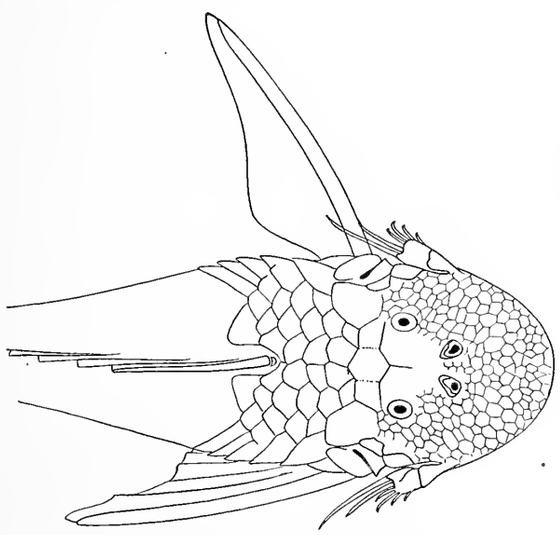

FIG. 17. *Pseudancistrus pediculatus* Eigenmann. Type, 118 mm. No. 7348, C. M.

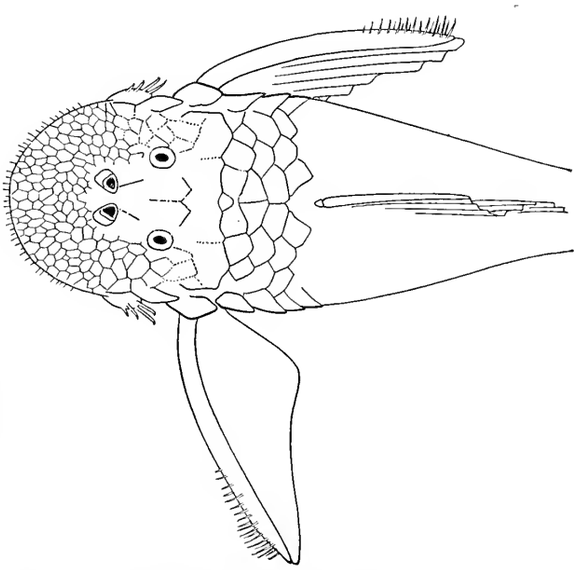

FIG. 18. *Pseudancistrus carnegici* Eigenmann. Type, 110 mm. No. 7346, C. M.

100. **Pseudancistrus carnegiei** Eigenmann. (Plate X, fig. 3.)

Pseudancistrus carnegiei EIGENMANN, Ann. Carnegie Mus., X, 1916, p. 85.

7577 *a*, C. M., one, 31 mm., Rio Guaduas. Gonzales.

7346 *a*, C. M., *type*, 110 mm.; 13661, I. U. M., two *paratypes*, 87–110 mm., Rio San Gil, Santander. Gonzales.

7347 *a–d*, C. M.; 13662, I. U. M., nine *paratypes*, largest 41 mm., Quebrada de Honda, Santander. Gonzales.

7579 *a*, C. M., one, 33 mm., Quebrada de la Pelada, Santander. Gonzales.

13926, I. U. M., two, 120–170 mm., Rio Baipé, Boyaca, Maria.

Habitat: Andes about Bogotá and in Santander.

Head 2.66–2.8; depth 5.46–7; D. I, 9 in ten, I, 8 in three; A. I, 5 in all but one of 13926 which has I, 4; twenty-five to twenty-seven scutes, six or seven between the dorsals; nine or ten + two or three between anal and caudal; eye

6–8 in snout, 3–4 in interorbital, 10–13 in the head; ramus of lower jaw a little greater than interorbital; interopercle with eight to thirteen spines, the longest spine in the largest specimen over half the length of the head, snout with short bristles; depth of head about 2.33 in its length, width of head equal or almost equal to its length. Dorsal spine equal to, or a little less than, the length of the snout, the last ray reaching to the second scute in front of the adipose spine; caudal very oblique, but slightly emarginate, the lower ray 3–3.33 in the length; pectoral in the largest nearly reaching tip of ventrals.

Adult nearly uniform dark brown, all the fins with obscure spots on the rays; caudal in the young with two or more cross-bars.

101. **Pseudancistrus setosus** (Boulenger).

Chætostomus setosus Boulenger, Ann. & Mag. Nat. Hist. (5), XIX, 1887, p. 349 (Colombia).

Ancistrus setosus Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 239, plate XII, fig. 2 (Colombia).

Habitat: Colombia, without nearer designation.

Regan (Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 469) records this species from the Rio Tamana. A specimen from that place secured through Mr. Rosenberg as *P. setosus* proves, however, to be *P. pediculatus* Eigenmann, as stated in the remarks under that species.

The following description is taken from Regan: Head 3; depth 6–6.5; D. I, 7 or 8; A. I, 3; twenty-five scutes, five or six between dorsal and adipose, ten between anal and caudal; eye 10–12 in the head, 2.5–3 in interorbital; mandibular ramus 1.33 in interorbital; sides of snout margined with bristles, scarcely visible in the female, one-seventh of the head in the male; interopercle with fifteen spines in the female, twenty-five in the male, apparently in two bundles, subequal in length, the longest not reaching beyond the head; first dorsal ray .66 of length of head; pectoral spine extending to anterior third, or nearly to middle of ventral. Olivaceous, body marbled, fins barred with dark spots.

Leptancistrus Meek and Hildebrand.

Leptancistrus Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1916, p. 254.

Type, *Leptancistrus canensis.*

Very similar to *Pseudancistrus daguæ,* without anal; adipose replaced by an adnate, slightly movable, median scute, preceded by two similar, less movable scutes. D. I, 8. Sides of head with bristles; some of the interopercular spines very long.

102. **Leptancistrus canensis** Meek and Hildebrand.

Leptancistrus canensis Meek and Hildebrand, *loc. cit.*, p. 254, plate XI (Mountain streams near Cana, upper Tuyra Basin).

Habitat: Tuyra Basin.

Panaque Eigenmann and Eigenmann.

Type, *Chætostomus nigrolineatus* Peters.

The genus *Panaque* is readily distinguished from the other members of the *Plecostominæ* by the small number of spoon-shaped teeth and the large, erectile, interopercular spines. It differs from the genus *Cochliodon* only in the presence of the interopercular spines.

103. **Panaque gibbosus** (Steindachner).

Chætostomus cochliodon (*sive gibbosus*) Steindachner, Sitzb. Akad. Wiss. Wien, LXXX, 1879, p. 185 (Cauca); Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 63, plate IV, figs. 1 and 1 *a* (Cauca near Caceres).

Panaque cochliodon Eigenmann and Eigenmann, Proc. Cal. Acad. Sci. (2), II, 1889, p. 44; Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 243.

Following the rules in the strictest and most literal sense, the name *Panaque cochliodon* should be applied to this species. But Steindachner in using the name *cochliodon* merely intended to say that he was in doubt whether his specimens belonged to Heckel's species *Hypostomus cochliodon*. He did not intend to apply this name as new to his specimens. In fact, he expressly gave the name *gibbosus* in case they should prove to be different. Considering the plain intent as well as the doubt whether the older genus *Cochliodon* is different from *Panaque*, I follow Regan in the use of the name *gibbosus* for this species.

Habitat: Magdalena Basin from near the coast at least to Girardot.

3869, C. M., one, 355 mm., Soplaviento. Eigenmann.

7562 *a*, C. M.; 13911, I. U. M., four, 195–235 mm. to end of middle caudal rays. Apulo. Gonzales.

15301, I. U. M., eight, 160–265 mm. to end of outer caudal rays. Girardot. Eigenmann.

Chætostomus Tschudi.

Type, *Chætostomus loborhynchus* Tschudi.

A genus of *Plecostominæ* characterized by the narrow naked area about the snout which is free from tentacles, and the wide mouth, the mandible being about equal to the interorbital.

The species of this genus, eighteen in number, are confined to the mountain streams of northwestern South America. The southernmost locality recorded is Marcapata of the Rio Madre de Dios of the Beni Basin, east of Cuzco. The northernmost locality is the Chagres Basin, the easternmost Caracas.

KEY TO THE SPECIES OF CHÆTOSTOMUS.

a. Caudal pedunele three and one-half in the length, two and one-fourth to three times as long as deep.
b. Interoperele with one, two, or three spines on two basal bones; D. I, 8; A. I, 5.
fischeri Steindaehner.
bb. Interoperele with four to seven spines on three basal bones. D. I, 8; A. I, 5; interorbital 3–3.33 in the length of the head.
c. Depth of head more than half (half in young) its length from snout to end of temporal plate; eaudal with a narrow light margin.....**marginatus** Regan.
cc. Depth of head equal half its length from snout to end of temporal plate; dorsal and eaudal eonspieuously and narrowly barred.....**leucomelas** Eigenmann.
ccc. Depth of head less than half its length, dorsal and caudal uniform, or with a few wide bars.
thomsoni Regan.
bbb. Interoperele with twenty spines; depth of head more than two in its length; base of dorsal equal to its distanee from the tip of the spine to the adipose. D. I, 8; A. I, 5.
æquinoctialis Pellegrin.
aa. Caudal peduncle three in the length, three and one-half to four times as long as deep; five to eight interopercular spines.....**lepturus** Regan.

104. **Chætostomus fischeri** Steindachner. (Plate XIII, fig. 1.)

Chætostomus fischeri STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLI, 1879, p. 162, plate IV, fig. 9 (Rio Mamoni near Chepo); JORDAN and EVERMANN, Bull. U. S. Nat. Mus., XLVII, 1896, p. 16; REGAN, Trans. Zoöl. Soc. London, XVII, 1904, p. 248; Biologia Centrali-Americana, Pisces, 1906–8, p. 112; MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Series, 1916, p. 249 (Tuyra Basin; Bayano Basin; Rio Chagres).

Chætostomus palmeri REGAN, Proc. Zoöl. Soc. London, 1912, p. 667, plate LXXV, fig. 3 (Rio Tamana, San Juan Basin); Ann. & Mag. Nat. Hist., (8), XII, 1913, p. 470.

Chætostomus paucispinis REGAN, Proc. Zoöl. Soc. London, 1912, p. 667, plate LXXV, fig. 2 (Tado, San Juan Basin); Ann. and Mag. Nat. Hist. (8) XII. 1913. p. 470.

Habitat: Mamoni and Chagres Basins, San Juan Basin, Magdalena Basin, Atrato Basin, and Naranjito, Ecuador.

I have examined specimens of undoubted *C. fischeri* from Panama and undoubted *C. paucispinis* from Istmina and the Condoto and undoubted *C. palmeri*

from Istmina, in the San Juan and from elsewhere. While there are various small differences, I consider that all of these belong to *C. fischeri*. The color of *C. paucispinis* as figured by Regan is the general juvenile color of the genus.

Catalog Numbers.	No. of Specimens	Length in mm.	Locality.	Collector.
13653, I. U. M.	1	230	Naranjito, Ecuador	Henn
7553 *a–c*, C. M.; 13942, I. U. M.	6	Largest 116	Istmina	Eigenmann
7334 *a–c*, C. M.; 13649, I. U. M.	6	58–81	Istmina	Wilson
7333 *a*, C. M.; 13648, I. U. M.	2	67–80	Condoto	"
7575 *a–e*, C. M.; 13941, I. U. M.	9	Largest 132	Girardot	Eigenmann
7576 *a–d*, C. M.; 13943, I. U. M.	8	38–275	Piedra Moler	"
7337 *a*, C. M.	1	70	Raspadura	Wilson
13982, I. U. M.	1		Rio Cupe, Cituro	Meek and Hildebrand

Head to end of temporal plate 2.8–3.2; depth 4.7–5.3; D. I, 8; A. I, 5; twenty-four or twenty-five plates along lower margin including the one at base of caudal; depth of head 1.8–2.2 in its length to end of temporal plate, width of head equal to, or a little less than, its length; interorbital 3–3.33 in length of head; interopercle with two strong spines; base of dorsal equal to its distance from the tip of the spine of the adipose or the caudal (Piedra Moler); pectoral spine reaching a little beyond the base or considerably beyond the middle of the outer ventral ray; depth of caudal peduncle 1.8 (Piedra Moler) to 2.5 in its length.

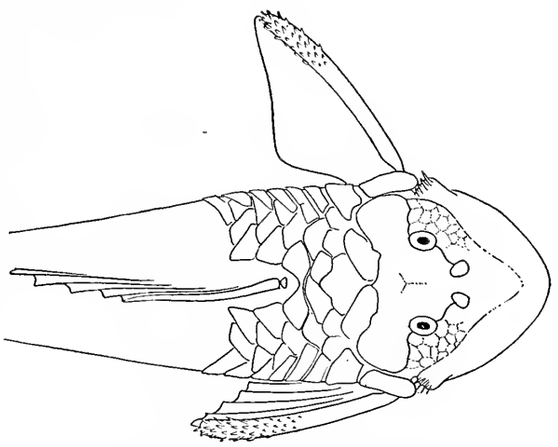

FIG. 19. *Chætostomus fischeri* Steindachner. No. 13653, I. U. M., 230 mm.

Light brown to black, young with cross-shades on the back; tips of caudal and dorsal rusty; dorsal uniform, or with light spots on the rays, especially in the young; caudal uniform in the adult, with two and a half series of light spots near the base in the young.

The specimens from the Magdalena Basin are a little more robust than the others. The spines of the margin of the opercle are graduated, the spine at the angle sometimes quite large, and there may be in addition to the two large spines one or two small spines on the interopercle directed downward. Some of the small specimens from Piedra Moler have several interopercular spines in addition to the two large ones.

105. **Chætostomus marginatus** Regan.

Chætostomus marginatus Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 249, plate XIII, fig. 1 (Salidero, N. W. Ecuador); Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 470, (Rio Condoto).

13658, I. U. M., 69 mm., Rio Durango, N. W. Ecuador. Purchased from Rosenberg as *C. microps.*

13944, I. U. M., 55 mm., Chimbo, Ecuador. Rhoads.

Habitat: Western Ecuador; Rio San Juan, Colombia.

Head 3–3.75; depth 5.5–5.65; D. I, 8; A. I, 5; twenty-four to twenty-five scutes; depth of head 1.75 in its length in the adult, 2 in the young; eye 7–9 in the head, interorbital 3–3.25; interopercle with five or six short spines in three groups; base of dorsal equal to its distance from the adipose or its tip or the tip of its spine; caudal peduncle (2.16 in plate) 2.5 to 3 times as long as deep.

Color olivaceous with yellow dots on the head; dorsal membranes in adult with a light streak in the middle; caudal with a narrow light edge. The young specimen from Durango has a series of light spots on each dorsal ray, and three light bars on the caudal. The young from Chimbo has the dorsal and caudal plain.

The young specimens are scarcely distinguishable from the young of *C. thomsoni.*

106. **Chætostomus leucomelas** Eigenmann. (Plate XII, figs. 5 and 6.)

Chætostomus leucomelas Eigenmann, Proc. Amer. Philos. Soc., LVI, 1917, p. 681.

13652, I. U. M.; 7340, C. M., three, 116–143 mm., the largest the *type.* Rio Patia, halfway between the Rios Magui and Telembi. April 5–6, 1913. Henn.

Head 3.33–3.5; depth 6–6.5; D. I, 8 in two; I, 9 in one; A. I, 5; scutes twenty-four to twenty-five; eye 2.5 in the interorbital, which is 3 in the head; depth of head 2 in its length, its width about .8 of its length; interopercle with three to five strong, recurved, graduated spines; dorsal spine about .8 as long as head, base of dorsal equal to its distance from the middle of the adipose spine; caudal deeply emarginate, the lower lobe longest; depth of caudal peduncle 3 in its length.

Back and sides light olive, faintly mottled. All fins, except the anal, with light bands across the rays, the membranes hyaline, margin of caudal light. The contrast between light and dark bars is strongest on dorsal and caudal. No spot on the second membrane of the dorsal in one of the specimens; a spot on the base of the second membrane of the dorsal in two of the specimens.

107. **Chætostomus thomsoni** Regan. (Plate XII, fig. 4.)

Chætostomus thomsoni Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 250, plate XIV, fig. 2 (Villeta, Colombia, between Honda and Facatativa).

Specimens Collected by Gonzales.

7341 *a*, C. M.; 13659, I. U. M., three, 65–89 mm., Quebrada Guadual.
7342 *a*, C. M., 55 mm., Quebrada Sarjento.
7343 *a*, C. M., 36 mm., Quebrada Alban.
7344 *a–d*, C. M.; largest 57 mm., Quebrade de la Ropera, Santander.
7345 *a–h*, C. M.; 13660, I. U. M., largest 69 mm., Rio San Gil, Santander.

The first three localities are between Honda and Facatativa, Colombia.

Habitat: Santander, and between Honda and Facatativa.

Head 3; depth 5.8–6; D. I, 8; A. I, 5; scales twenty-five; eye 2.5–3 in the interorbital which is 3 in the head; depth of the head 2.15 to 2.2 in its length; width of the head equal to its length; snout broadly rounded; five or six curved, graduate, interopercular spines; dorsal spine about equal to the snout, base of dorsal a little greater than its distance from the tip of the adipose; depth of caudal peduncle 2.33 in its length.

Uniform olivaceous, or with dark cross-shades on the back. Fins nearly uniform with rusty tips, or dorsal and caudal rays alternately light and dark with three and a half dark bands on the caudal.

108. **Chætostomus æquinoctialis** Pellegrin.

Chætostomus æquinoctialis Pellegrin, Bull. Mus. Hist. Natur. Paris, XV, 1909, p. 518; Poissons de l'Equateur, in Mission de l'Equateur, Arc de meridien equatorial, IX, B. p. 2, plate I (Rio Pove, Santo Domingo de los Colorados, at 560 m. above sea-level).

Habitat: Western Ecuador.

Head 3; depth 6; D. I, 8; A. I, 5; twenty-four scales; head as wide as long; 2.5 times as long as deep; eye 8 in head; interorbital 3.25, snout 1.66; interopercle with twenty spines, the posterior strong, 1.5 times the eye; dorsal spine .4 of the head, the last ray nearly equal to the first; base of caudal equals three-fourths of its distance from the caudal; depth of caudal peduncle 2 in its length.

Olivaceous, with some dark spots on the rays of the dorsal. Known from a specimen 72 mm. long.

109. **Chætostomus lepturus** Regan. (Plate XII, fig. 7.)

Chætostomus lepturus Regan, Proc. Zoöl. Soc. London, 1912, p. 667, plate LXXV, fig. 1 (Rio Tamana); Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 470 (Rios Tamana and Condoto).

7332 *a–x*, C. M.; 13647, I. U. M., one hundred and three, 57–193 mm., Istmina. Wilson.

7331 *a–f*, C. M.; 13646, I. U. M., eleven, 76–190 mm., Condoto. Wilson.

7537 *a–b*, C. M.; 15302, I. U. M., four, 150–220 mm., Rio San Juan, halfway between Puerto Negria and Istmina. Eigenmann.

Habitat: Upper San Juan Basin.

This species is easily distinguished by its elongate caudal peduncle.

Head 3.25–3.5; depth 5.33–6; D. I, 8; A. I, 5; scutes twenty-four to twenty-six; depth of head very little over 2 in its length, width of head not quite equal to its length; interorbital 3–3.5 in the head; eye 7–10 in the head; interopercle with from four to eight short, curved spines, arranged in two or three diverging groups, none of them folding under the opercle; dorsal spine six-sevenths the length of the head, the last ray about half as long, the dorsal being obliquely emarginate or truncate, base of dorsal equal to its distance from the anterior half of the adipose spine; depth of caudal peduncle 3.33–4 in its length.

Adult nearly uniform olive, a few light spots on the posterior dorsal rays, a few dusky spots on the basal half of the caudal rays, tip of dorsal and tips of caudal lobes rusty, margin of caudal narrowly light; a dark spot at the base of the first and sometimes at the base of the second dorsal ray.

Young with cross-shades on the back, dorsal spots more numerous, three more or less regular, light bars across basal two-thirds of caudal, which is more broadly margined with light; upper surfaces of pectorals and ventrals with cross-shades; a dark spot at the bases of the anterior dorsal rays.

Ancistrus Kner.

Type, *Hypostomus cirrhosus* Cuvier and Valenciennes.

Distinguished from all other Plecostominids by tentacles on the naked margin of the snout, much more numerous in the male than in the female. Evidently allied to *Chætostomus* and *Xenocara*.

Key to the Species of Ancistrus.

a. Ramus of the lower jaw 3.1–4 in the interorbital, in the young three times.

b. Lower surface with round dark spots, fins with dark spots; females 100 mm. long, with about fourteen marginal tentacles..... **centrolepis** Regan.

bb. Male plain below, female with faint pale spots below and on the fins, females 130 mm. long, with only four small tentacles..... **spinosus** Meek and Hildebrand.

aa. Ramus of lower jaw 1.8–2.3 in the interorbital.

c. A. I, 3; interorbital 1.8–2.33 in length of head; ventral surface with light spots. **triradiatus** Eigenmann (*Extralimital*).

cc. A. I, 3 or 4; interorbital 2.1–2.12 in length of head; dorsal spine 1.2–1.5 in the head. **chagresi** Eigenmann and Eigenmann.

110. **Ancistrus centrolepis** Regan. (Plate XII, fig. 9; Plate XIII, fig. 2.)

Ancistrus centrolepis Regan, Ann. & Mag. Nat. Hist. (8), 1913, p. 470 (Choco, Rio San Juan).

Ancistrus melas Eigenmann, Ann. Carnegie Mus., X, 1916, p. 83 (Condoto; Raspadura).

Head 2.5–2.8; depth 6; D. I, 7; A. I, 4; mandibular ramus 3–4 in the interorbital; median tentacles of the snout not fully developed in a male 122 mm. long, consisting of only three tentacles; in the largest male there are two median tentacles and respectively four and five on the arms of the Y. Dorsal sometimes reaching beyond middle of adipose spine, sometimes not to its base.

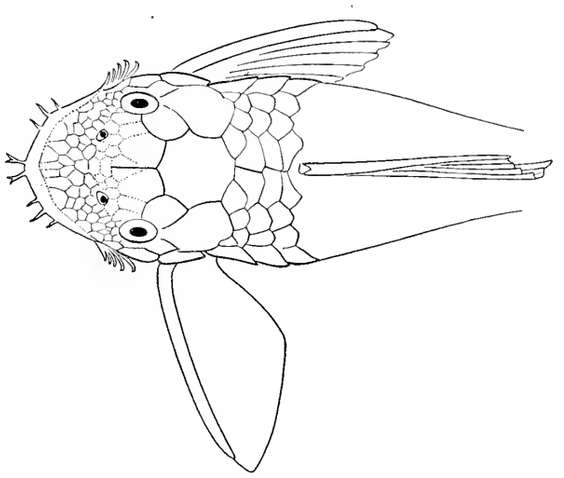

Fig. 20. *Ancistrus centrolepis* Regan. Drawn from the type of *A. melas* Eigenmann. No. 7335, C. M., 106 mm.

Adult black, with obscure spots on the fins. Some small, lighter-colored specimens have the belly covered with round spots about equal to the eye; similar, but more obscure, spots on the back; the spots on the fins more conspicuous, those of the dorsal frequently consisting of oblique dashes on the membranes.

111. **Ancistrus spinosus** Meek and Hildebrand.

Ancistrus spinosus Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1916, p. 252 (Rio Yape, Tuyra Basin; Rio Calobre, Bayano Basin).

Habitat: Western slope of southern Panama.

Known from two specimens 130 and 135 mm. long. It may prove to be a synonym of *A. centrolepis* Regan.

112. **Ancistrus chagresi** Eigenmann and Eigenmann.

Ancistrus cirrhosus (*non* Cuvier and Valenciennes) Kner and Steindachner, Abhandl. Bayr. Akad. Wiss. München, X, 1864, p. 61 (Rio Chagres).

Chætostomus cirrhosus Günther, Trans. Zoöl. Soc. London, VI, 1866, p. 478 (Rio Chagres).

Ancistrus chagresi Eigenmann and Eigenmann, Proc. Cal. Acad. Nat. Sci. (2), II, 1889, p. 47 (Rio Chagres); Occasional Papers Cal. Acad. Sci., I, 1890, p. 446; Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1916, p. 251 (Chagres Basin and Rio Chorrera, a small stream on the Pacific slope west of Panama City).

Xenocara chagresi Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 256, plate XIV, fig. 7 (Rio Chagres); Biologia Centrali-Americana, Pisces, 1906–8, p. 113 (Rio Chagres).

Habitat: Both slopes of Central Panama.

Loricaria Linnæus.

Type, *Loricaria cataphracta* Linnæus.

Key to the Species of Loricaria.

a. Lower lip papillose, the maxillary barbel not reaching the gill-opening.

b. Ventral surface entirely covered with plates; upper caudal lobe but little produced; orbit with a notch.

c. Dorsal truncate, the spine and rays about coterminous; lateral plates scarcely encroaching on the ventral surface, five to nine plates between them at the middle of the pectoral; male without bristles on the nape; lateral keels two, becoming approximated on the fifteenth or sixteenth scute; predorsal scutes feebly carinate; no naked area behind pectoral..... **uracantha** Kner and Steindachner.

cc. Tip of dorsal spine and the first ray extending beyond the tip of the rest; lateral plates encroaching considerably on the sides of the ventral surface; a narrow, naked area behind the pectoral.

d. Lateral keels uniting on the fifteenth or sixteenth scute.

e. Outer ventral ray prolonged in a filament; width at pectoral equal to, or greater than, the distance between pectoral and snout; three or four plates on belly; below the middle of the pectoral..... **magdalenæ** Steindachner.

ee. Outer ventral ray not, or scarcely, prolonged in a filament, except in the young; width at pectoral equal to, or less than, distance between pectoral and snout; five to seven (rarely three) ventral plates at middle of pectorals. **jubata** Boulenger.

dd. Lateral keels uniting on the twenty-second scute; outer ventral rays moderately produced.

f. Width at last anal ray 5–5.5 in caudal peduncle..... **filamentosa** Steindachner.

ff. Width at last anal ray 4 in caudal peduncle..... **latiura** Eigenmann and Vance.

bb. Ventral surface with a narrow, naked strip between two series of median plates and the lateral plates; orbit with a notch.

g. Width in front of pectoral spine a little greater than distance between snout and spine. **seminuda** Eigenmann and Vance.

gg. Width in front of pectoral spine less than distance between snout and spine. **capetensis** Meek and Hildebrand.

bbb. Ventral surface mostly naked; orbit without a notch.

h. Ventrals lanceolate, the outer ray slightly produced, reaching beyond base of last anal ray, first dorsal rays extending beyond the tip of the rest; keels united on the seventeenth scute; upper caudal ray extremely elongate; a series of scutes along the middle of the belly of the adult..... **gymnogaster** Eigenmann and Vance.

hh. Ventrals not reaching beyond base of anal; upper caudal ray less produced. Keels united on about the twenty-first scute, dorsal rays coterminous, longest ray not quite as long as head..... **fimbriata** Eigenmann and Vance.

aa. Lips with short tentacles, the margin with much longer ones, the maxillary barbel extending beyond the gill-opening; ventral rays produced, reaching anal; a row of scutes along middle of belly; ventral surface otherwise naked; upper caudal ray much produced; keels united on the sixteenth scute; orbit with a notch..... **variegata** Steindachner.

113. **Loricaria uracantha** Kner and Steindachner.

Loricaria uracantha Kner and Steindachner, Abhandl. Bayr. Akad. Wiss. München, X, 1866, p. 56, plate VI, figs. 3, 3 *a*, 3 *b* (New Granada; Rio Chagres); Günther, Trans. Zoöl. Soc. London, 1866, p. 393 and 478 (Atlantic and Pacific slopes of Panama); Vaillant, Bull. Mus. Hist. Nat. Paris, 1897, p. 220 (Chagres); Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 278 (Panama); Biologia Centrali-Americana, Pisces, 1906–1908, p. 113; Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1916, p. 256 (Rio Chagres).

Loricaria bransfordi Gill, Proc. Acad. Nat. Sci. Phila., 1876, p. 338 (Panama).

Habitat: Chagres River, eastern slope of central Panama.

Meek and Hildebrand secured this species in the Chagres River. They doubt the record of the species from the Pacific slope. They find that *L. bransfordi* was based on the adult male of this species.

114. **Loricaria magdalenæ** Steindachner. (Plate XV, fig. 4.)

Loricaria magdalenæ Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1879, p. 74, plate VII, figs. 2, 3 *b*; Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 279.

3821, C. M.; 12783, I. U. M., four, 70–96 mm., Soplaviento. Eigenmann.

3822, C. M., one, 100 mm., Calamar. Eigenmann.

7532 *a–c*, C. M.; 13638 *a–b*, I. U. M., six, 48–122 mm., Quibdo. Eigenmann.

7533 *a–c*, C. M.; 13952, I. U. M., seven, 30–120 mm., Managru. Wilson.
7326, C. M.; 13637, I. U. M., six, largest 102 mm., Raspadura. Wilson.
7534 *a–d*, C. M.; 13953, I. U. M., nine, largest 86 mm., Truando. Wilson.

Habitat: Magdalena and Atrato Basins.

115. **Loricaria jubata** Boulenger.

Loricaria jubata Boulenger, Ann. & Mag. Nat. Hist. (7), IX, 1902, p. 70 (St. Javier, elev. 60 ft.; Rio Durango, 350 ft., both in N. W. Ecuador); Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 278, plate XV, fig. 5; Ann. & Mag. Nat. Hist. (8), XIV, 1914, p. 32 (Rio Condoto).

Loricaria magdalenæ (*non* Steindachner) Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 470 (Rio San Juan; Rio Condoto).

Habitat: Northwestern Ecuador to the San Juan and Atrato Basins.

7535 *a*, C. M., 95 mm. (to base of caudal), Raspadura, Atrato River. Wilson.
3823, C. M.; 12784, I. U. M., forty-three, 74–162 mm., Istmina, San Juan River. Eigenmann and Wilson.
7325 *a–c*, C. M.; 13636, I. U. M., six, largest 148 mm., Tado, San Juan River. Wilson.
3820, C. M., one, 47 mm., Puerto Negria, San Juan River. Eigenmann.
7327 *a*, C. M.; 13645, I. U. M., two, Creeks of Rio Telembi, Patia Basin. Henn and Wilson.
7327 $\frac{1}{2}$ *a*, C. M.; 13639, I. U. M., Patia between Magui and Telembi. Henn.
7327 *a*, C. M.; 13645, I. U. M., Rio Telembi, Patia Basin. Henn and Wilson.

No. 13645, I. U. M. is a male with the bristles on sides of head, nape and pectoral extremely developed. The outer ventral rays are not prolonged.

No. 7535, C. M., which is an undoubted *jubata*, extends the range of this species to the Atlantic drainage.

116. **Loricaria filamentosa** Steindachner.

Loricaria filamentosa Steindachner, Denkschr. Akad. Wiss. Wien, XXX, 1878, p. 45, plate IX (Magdalena); *ibid.*, XLII, 1880, p. 65 (Cauca near Caceres); Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 274.

Habitat: Lower Magdalena Basin.

3804 *a–b*, C. M.; 12694 *a–c*, I. U. M., five, 160–276 mm., Soplaviento. Eigenmann.
3805 *a*, C. M., one, 291 mm., Calamar. Eigenmann.

The width of the body at the last anal ray is contained 5–5.5 in its distance from the caudal. The anal buckler is made up of from seventeen to twenty-five

plates. The plates of the ventral surface form a complete armature, which is composed of the very wide lateral plates and two rows of median plates. Between the pectorals the median plates split up into a large number of small plates.

117. **Loricaria latiura** Eigenmann and Vance. (Plate XV, fig. 3.)

Loricaria filamentosa latiura EIGENMANN and VANCE, Indiana University Studies, No. 16, Sept. (Dec. 23), 1912, p. 13.

Loricaria tuyrense MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1913, p. 81 (Tuyra).

Habitat: Tuyra and Atrato Basins.

3806, C. M.; 12695, I. U. M., twelve, Boca de Certegui. Eigenmann.

15303, I. U. M., 320 mm., Truando. Wilson.

The twelve specimens from Boca de Certegui differ from typical *filamentosa* very notably in the width of the body and tail. The width at the base of the last anal ray is contained but four times in the distance of its base from the caudal.

In 15303, I. U. M., the width at the base of the last anal ray is contained but 3.33 times in the distance between the base of the last anal ray and the base of the caudal. The anal buckler is on the average composed of fewer plates. The number usually runs from fourteen to eighteen, but in one example, it reaches twenty-five.

Meek and Hildebrand secured this species in the Tuyra Basin at Boca de Cupe and at the mouth of the Yape.

118. **Loricaria seminuda** Eigenmann and Vance. (Plate XIV, figs. 1 and 2.)

Loricaria filamentosa seminuda EIGENMANN and VANCE, Indiana University Studies, No. 16, Sept. (Dec. 23), 1912, p. 13.

A single specimen from Girardot, 3807, C. M., measuring 182 mm. to base of caudal, differs from *L. filamentosa*. The median plates of the ventral surface are much smaller, leaving a naked area between them and the lateral plates. In other respects this species is like the typical specimens of *filamentosa*.

119. **Loricaria capetensis** Meek and Hildebrand.

Loricaria capetensis MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1913, p. 80; 1913, p. 259, plate XII.

This species is known from two specimens, 164 and 162 mm. long, taken in the Rio Capeti of the Tuyra Basin.

120. **Loricaria gymnogaster** Eigenmann and Vance. (Plate XIV, figs. 3 and 4.)

Loricaria gymnogaster Eigenmann and Vance, Indiana University Studies, No. 16, Sept. (Dec. 23), 1912, p. 12.

Habitat: Upper Magdalena Basin.

12691, I. U. M., *type*, 182 mm. to base of caudal (upper caudal filament about 480 mm.); 12692, I. U. M., seven *paratypes*, Apulo. Gonzales.

3839 *a–j*, C. M.; 12693 *a–j*, I. U. M., forty-one *paratypes*, Girardot. Eigenmann.

Head 4.8; depth 9.3; depth of head at base of occipital about half of its greatest width, which is 1.25 in its length. Eye 3.5 in snout; 6.5 in head, 1.6 in interorbital; D. I, 7; A. I, 5. Scutes eighteen + twelve; width at base of last anal ray 4 in its distance from the caudal.

Lateral keels prominent; the occipital with a single short serrate keel on its posterior half; the two median plates following it, each with two serrate keels. The occipital bordered by three plates behind. The lateral plates of the nape each with a serrated keel. Orbit without a notch, its upper margin spinulose. Belly naked in the adult, except for a few granules on the sides and in front of the anus, and sometimes on the breast; entirely naked in the young. Lips fringed with papillæ, the lower lip broad, with fringed papillæ increasing in size to the mouth. Three or four teeth on each side of the lower jaw, the same number in the upper jaw. Dorsal spine in adult equal to its distance from the anterior margin of the nares, the rays rapidly decreasing in height. Dorsal spine not so high in the young. Pectorals with the outer ray extending to the second third of the ventral, about equal to the head in length. Outer ventral ray thick, reaching about to the middle of the anal. Caudal emarginate, the lower ray but little produced, about twice as long as middle rays; the upper ray very greatly produced, more than twice the length of the rest of the fish.

Five obscure dark cross-bands, the first across the nape, the second just behind the dorsal. In the small specimens the bands are more conspicuous and a narrower fifth band extends obliquely downward and forward from the base of the second and third dorsal rays. In the young the margins of the bands are frequently more intense than the center, and a line behind the bands is frequently much lighter than the rest of the interspace. Dorsal uniformly spotted with faint quadrate spots. Caudal dusky at base and with two more or less distinct, dark bands, the last of which is at the margin; sometimes additional bands across the caudal lobes; the outer caudal rays barred. Anal with one or two faint cross-bands, both frequently above the middle of the fin. Ventral with three or four similar bands. Pectorals with more numerous and less regular bands.

121. **Loricaria fimbriata** Eigenmann and Vance. (Plate XV, figs. 1 and 2.)

Loricaria fimbriata EIGENMANN and VANCE, Indiana University Studies, No. 16, Sept. (Dec. 23), 1912, p. 12; MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1916, p. 261 (Mouth of the Rio Capeti, Tuyra Basin).

Habitat: Tuyra, Truando, and Magdalena Basins.

3808, C. M., *type*, 114 mm. over all. Length to base of caudal, 84 mm. Boca de Certegui. Eigenmann.

3809, C. M.; 12714, I. U. M., two *paratypes*, the largest 52 mm. over all. Bernal Creek near Honda. Eigenmann.

The paratype differs from the type in having seven obscure cross-bands. The caudal is blackish at the base and at its margin. Ventrals with two cross-bars. Lips simple, not fringed. About three teeth in the upper jaw and about six in the lower.

Head 4.25; depth 10; dorsal 8; anal 6; lateral plates twenty + ten or eleven; eye 2.7 in snout, 5.3 in head, a little less than 1 in interorbital. Width at last anal ray 5 in its distance from the caudal; width of head 1.4 in its length. Head moderately depressed, occipital strigate, with a pair of serrated keels, bordered by three plates. Plates of anterior part of body strigate and keeled. Lips broad, anterior with short, fleshy, marginal tentacles, the posterior papillose and with slender marginal fringes. A few granular plates along the middle of the belly, inconspicuous marginal plates at the sides. Lower surface otherwise naked.

Pectoral truncate when opened, the outer ray not prolonged, reaching to the ventrals. Outer pectoral ray slightly produced, the rest of the margin of the fin rounded. Dorsal truncate, the tips of the rays reaching equidistant when the fin is depressed. Upper caudal filament about equal to distance from snout to dorsal. Dorsal rays, each with about seven obscure spots. Caudal with narrow undulating bars of black and white. Pectorals colored like the dorsal, ventrals dusky, anal hyaline. Five obscure cross-bands in the type. Five teeth in the upper jaw, eight in the lower.

122. **Loricaria variegata** Steindachner.

Loricaria variegata STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLI, 1879, p. 163, plate III (Rio Mamoni near Chepo, Panama); REGAN, Trans. Zoöl. Soc. London, XVII, 1904, p. 293; Biologia Centrali-Americana, Pisces, 1906–8, p. 113; REGAN, Ann. & Mag. Nat. Hist. (8), XIV, 1914, p. 32 (Rio Condoto); MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1916, p. 258. (Tuyra Basin.)

13635, I. U. M., one, 132 mm., Tado. Wilson.

3813, C. M.; 12777, I. U. M., 15304, I. U. M., seven, 103–197 mm., Boca de Certegui. Eigenmann and Wilson.

3814, C. M., one, 160 mm., Soplaviento. Eigenmann.

3816 *a–b*, C. M.; 12779, I. U. M., three, 49–66 mm., Peñas Blancas. Eigenmann.

3815 *a–e*, C. M.; 12778, I. U. M., twenty-four, 58–118 mm., Girardot. Eigenmann.

12780, I. U. M., eleven, 53–122 mm., Apulo. Gonzales.

Habitat: Magdalena, Atrato, Tuyra, and Chepo Basins.

Sturisoma Swainson.

Type, *Loricaria rostrata* Spix.

This is the *Oxyloricaria* of Bleeker, recognized by Regan in Trans. Zoöl. Soc. London, XVII, 1904, p. 297. Teeth numerous; orbit without a distinct notch; snout produced and pointed.

Key to the Species of Sturisoma.

a. Three rows of plates on belly.

b. Width in front of the pectoral equal to, or less than, snout; mandible 2.5–3 in interorbital; a dark streak along the sides from snout to end of dorsal; a dark streak on the dorsal just behind the spine. Head 4.06–5.3; scutes thirty-three to thirty-five. **panamense** (Eigenmann and Eigenmann).

bb. Width in front of the pectoral greater than the snout.

c. Fins long and sharply pointed; the dorsal spine almost equal to its distance from the snout; anterior half of dorsal blackish; caudal dark at base; head 5.25–5.33; thirty-one to thirty-three scutes; width of head 1.14–1.25. . . . . **tamanæ** (Regan).

cc. Dorsal fin about equal to its distance from the middle of the snout; fins plain; head about 5; thirty-one scutes; width of head about 1.6 in its length; snout acute, its margin concave. . . . . **aureum** (Steindachner).

ccc. Fins shorter, the dorsal spine equal to its distance from the middle of the eye or the nares; dorsal with spots along the rays; head 4.2–4.5 in the length; thirty scutes; width of head 1.4–1.5 in its length. . . . . **leightoni** (Regan).

aa. Five to eight rows of plates on belly; head 4.55–5.1 in the length; scutes thirty or thirty-one; height of dorsal not much greater than length of head; fins usually with indistinct dark markings. **citurense** (Meek and Hildebrand).

123. **Sturisoma panamense** (Eigenmann and Eigenmann).

(Plate XVI, figs. 4, 5, and 6.)

Loricaria rostrata (*non* Spix) Steindachner, Denksch. Akad. Wiss. Wien, XLI, 1879, p. 165 (Rio Mamoni).

Loricaria panamensis Eigenmann and Eigenmann, Proc. Cal. Acad. Sci. (2), II, 1889, p. 34; Occasional Papers Cal. Acad. Sci., I, 1890, p. 365 (Panama).

Oxyloricaria panamensis Regan, Trans. Zoöl. Soc. London, XVII, 1904, p. 301;

Biologia Centrali-Americana, Pisces, 1906–8, p. 114; MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1916, p. 261 (Rio Calobre, Bayano Basin; Tuyra Basin).

Sturisoma panamense EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1916, p. 416; REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1914, p. 470 (Rios San Juan and Condoto).

?Loricaria aurea STEINDACHNER, Anz. Akad. Wiss. Wien, 1900, p. 206; Denkschr. Akad. Wiss. Wien, LXXII, 1902, p. 138, plate V, fig. 2 (Rio Magdalena).

Loricaria frenata BOULENGER, Ann. & Mag. Nat. Hist. (7), IX, 1902, p. 69 (N. W. Ecuador).

Oxyloricaria frenata (REGAN), Trans. Zoöl. Soc. London, XVII, 1904, p. 302, plate XVIII, fig. 2 (N. W. Ecuador).

Sturisoma frenatum EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1909, p. 416.

Oxyloricaria dariensis MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl Ser., X, 1913, p. 81 (Rio Tuyra and Rio Bayano Basins).

Habitat: Bayano, Tuyra, Magdalena, San Juan, and Patia Basins; Northwestern Ecuador.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
3919, C. M.	1	137	Below Buenavista	Eigenmann
7536, C. M.	1	150	Quibdo	Wilson
13966, I. U. M.	1	194	Certegui	"
13641, I. U. M.; 7329, C. M.	6	140–196	Condoto	"
13644, I. U. M.	1	———	Tado	"
12782, I. U. M.; 3818, C. M.	6	91–161	Istmina	Eigenmann
12781, I. U. M.; 3817, C. M.	4	70–207	Puerto Negria	"
13642, I. U. M.	2	210–245	Rio Magui	Henn
13643, I. U. M.; 7330, C. M.	6	166–196	Patia between Magui and Telembi	"
13992, I. U. M.	2	182–195	Boca de Cupe	Meek and Hildebrand
51985, U. of Michigan	7	Largest 172	Fundación	Pearse and Gaige

124. Sturisoma tamanæ (Regan).

Oxyloricaria tamanæ REGAN, Proc. Zoöl. Soc. London, 1912, p. 669, plate LXXVII, figs. 1, 1 *a* and 1 *b* (Rio Tamana, San Juan Basin.)

Sturisoma tamanæ REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 470 (Rio Tamana; Rio Condoto).

3811, C. M.; 12775, I. U. M., five, 114–224 mm., Istmina. Eigenmann.

3810, C. M.; 12774, I. U. M., two, 172–184 mm., halfway between Puerto Negria and Istmina. Eigenmann.

3812, C. M.; 12776, I. U. M., seventeen, 165–210 mm., Puerto Negria. Eigenmann.

7328, C. M.; 13640, I. U. M., two, 169–187 mm., San Juan Basin. Wilson.

Habitat: San Juan Basin.

125. **Sturisoma aureum** (Steindachner).

Loricaria aurea STEINDACHNER, Anz. Akad. Wiss. Wien, 1900, p. 206; Denkschr. Akad. Wiss. Wien, LXXII, 1902, p. 138, plate V, fig. 2 (Bodega Central, Rio Magdalena and Rio Meta).

This species has been identified with *S. panamense* by Regan. It is known from one specimen 169 mm. long to base of caudal, and a smaller specimen from the Rio Meta. The latter identification may well be left in doubt until direct comparisons of larger specimens can be made. *S. aurea* temporarily at least is here resurrected. It seems to be intermediate between *panamense* and *leightoni*.

Head about 5; D. 8; thirty-one scutes; eye nearly 10 in head; snout a little over 1.6.

126. **Sturisoma leightoni** (Regan). (Plate XVI, figs. 1 and 2.)

Oxyloricaria leightoni REGAN, Proc. Zoöl. Soc. London, 1912, p. 669, plate LXXVII, fig. 2 (Honda).

Habitat: Upper Magdalena Basin; Rio San Juan; and east of Bogota.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
12785, I. U. M.; 3824 *a–j*, C. M.	52	22–93	Bernal Creek, Honda	Eigenmann
12786, I. U. M.; 3824 *a–f*, C. M.	13	58–98	Girardot	"
13788, I. U. M.; 3828 *a–e*, C. M.	5	59–88	Piedra Moler	"
3826 *a*, C. M.	1	91	Cartago	"
12789, I. U. M.; 3829 *a–f*, C. M.	13	48–102	Paila	"
12790, I. U. M.; 3830 *a–e*, C. M.	5	79–105	Cali	"
12787, I. U. M.; 3827 *a*, C. M.	2	79–88	Cauca at Cali	"
12791, I. U. M.	1	86	Istmina, R. San Juan	"
13799, I. U. M.; 13796, I. U. M.	Male and female	97–100	Cumaral, Meta Basin	Maria

The specimens from Cumaral in Eastern Colombia differ slightly in having the fins a little shorter and the spines of the male shorter.

127. **Sturisoma cituren**se Meek and Hildebrand. (Plate XVI, fig. 3.)

*Oxyloricaria cituren**sis* MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser., X, 1913, p. 82 (Rio Cupe and Cituro, Panama); *ibid.*, X, 1916, p. 262, plate XIII (Bayano and Tuyra Basins).

Habitat: Pacific slope of southern Panama.

I have examined specimens (13989–13991 I. U. M.) collected at Rio Yape and Boca de Cupe by Meek and Hildebrand.

FARLOWELLA Eigenmann and Eigenmann.

Type, *Acestra acus* Kner.

128. **Farlowella gracilis** Regan.

Farlowella gracilis REGAN, Trans. Zoöl. Soc. London, XVII, 1904, p. 303, plate XX, fig. 3 (Rio Caqueta, Cauca Valley).

This species, known from the type, a specimen 190 mm. long, was not collected by me in the Cauca Valley.

Order **HETEROGNATHI.**

Family X. CHARACIDÆ.

KEY TO THE TRANSANDEAN GENERA OF CHARACIDÆ.

a. Teeth none; no gill-rakers; intestine very long; an adipose fin; postventral area with a median series of scales, lateral line complete, caudal naked. (*Curimatinæ*). . . . . **Curimatus.**

aa. Teeth of the upper jaw spatulate, none on the middle of the lower jaw; sides of the lower jaw with or without teeth. (*Parodontinæ*).

b. Lower lip with a straight transverse margin; teeth of upper jaw with a narrow base and an expanded peetinate tip, their long axes horizontal; mandible proximally rod-shaped, distally with two flat blades, one of them thin, quadrate, transverse, forming the front of the jaw; the other, at right angles to it, forming the sides of the jaw; it has a large or smaller hollow ampulla protruding from its outer surface near the middle of its free margin.

c. Sides of the lower jaw with one to three outcurved truneate incisors on the inner side of the ampulla. . . . . **Parodon.**

cc. Sides of the lower jaw without teeth, the ampulla comparatively small. . . . . **Apareiodon.**

bb. Lower lip five-lobed, arranged in a erescent; teeth of the upper jaw not serrate, eaeh succeeding one considerably behind the preeeding one; no teeth in the lower jaw. . . . . **Saccodon.**

aaa. Teeth very numerous, minute, freely movable; jaws weak; the mouth protractile, sucker-like; gill-membranes joined to the isthmus; a movable, procumbent, predorsal spine.

aaaa. Teeth well developed in both jaws. (*Prochilodinæ*).

Prochilodus.

d. Teeth compressed, truncate, notched, denticulate, or serrate; sometimes a few canines, eonie in *Grundulus* and *Pyrrhulina*.

e. Mandibular teeth in two series in front; skull without fontanels.

f. No adipose fin; walls of air-bladder normal. Teeth of the outer mandibular series conical. (*Pyrrhulininæ*). . . . . **Pyrrhulina.**

ff. Walls of anterior portion of the posterior air-bladder eellular. Teeth of the outer series of the mandible multicuspid. (*Lebiasininæ*).

g. Adipose absent. . . . . **Lebiasina.**

gg. Adipose present. . . . . **Piabucina.**

ee. Mandibular teeth in a single series in front, sometimes with a pair of eanines near the symphysis.

h. Premaxillary with a single series of teeth.

i. Teeth very few, entire, pointed obliquely forward. (*Anastomatinæ*).

j. Anterior and posterior narial openings separated by a flap; gill-membranes united, joined to the isthmus; intestine short; mouth very small, with few leporine teeth. . . . . **Leporinodus.**

jj. Anterior and posterior narial openings separated by an interspace; gill-membranes united and joined to the isthmus.

k. Back with a distinct hump. . . . . **Abramites.**

kk. Back normal. . . . . **Leporinus.**

ii. Teeth usually three-pointed, no frontal fontanel; a small circular occipital fontanel; gill-membranes free from the isthmus; maxillary without teeth. (*Narmostomatinæ*). . . . . **Characidium.**

iii. Teeth conical, tri- or multicuspid; gill-membranes free from each other and from isthmus; large frontal and parietal fontanels. (*Cheirodontinæ*).

l. No adipose fin; lateral line incomplete.

m. Predorsal area partly naked; teeth all conic, in regular series. Anal short, less than twenty rays. . . . . **Grundulus.**

mm. Predorsal area scaled; part of the teeth tricuspid. Anal long, over fifty rays. . . . . **Phanagoniates.**

ll. Adipose fin well developed.

n. Teeth tricuspid; interhæmals normal; lateral line with but few pores, caudal naked; no pseudotympanum. . . . . **Megalamphodus.**

nn. Teeth in part five-lobed.

o. Lateral line incomplete.

p. Male with a lobe of large scales extending along the base of the middle caudal rays; interhæmals weak. . . . . **Compsura.**

pp. Caudal of male without a median series of scales.

q. Interhæmals of the male weak. . . . . **Pseudocheirodon.**

qq. Interhæmals of the male forming a saw on the lower edge of the caudal peduncle. . . . . **Cheirodon.**

oo. Lateral line complete; interhæmals feeble; maxillary with a few broad-tipped teeth; teeth of the upper and lower jaws similar. **Odontostilbe.**

hh. Premaxillary teeth in two or more series.

r. Breast not compressed to an edge.

s. Dorsal fin near middle of body; teeth with three or more lobes except in *Genycharax*, (which see).

t. Sides of lower jaw with two series of teeth, a pair of canines behind the series near symphysis. (*Bryconinæ*). . . . . **Brycon.**

tt. Lower jaw with a single series of teeth; caudal naked.

u. Teeth of the sides of the lower jaw not on a raised ridge. (*Tetragonopterinæ*).

v. Premaxillary teeth in two series.

w. Second suborbital not in contact with the preopercle below, or with five teeth in the inner series of the premaxillary.

x. Lateral line incomplete; an adipose fin; caudal naked.
y. Few teeth, if any, near the upper angle of the maxillary. . . . . **Hyphessobrycon.**
yy. Maxillary with teeth along its entire edge; lateral teeth of the lower jaw and median teeth of the upper jaw enlarged. . . . . **Pseudochalceus.**
xx. Lateral line complete.
z. Teeth all notched or denticulate; scales cycloid. **Astyanax.**
zz. Teeth all triangular, those of the outer series of the upper jaw much more numerous than those of the inner. Mouth very large, the lower jaw entering the profile. . . . . **Genycharax.**
zzz. Teeth of the lower jaw all similar, those of the side of the jaw wider than the anterior ones; maxillary with two very broad teeth. **Landonia.**
ww. Second suborbital in contact with the lower limb of the preopercle; four teeth in the inner series of the premaxillary.
A. No adipose fin; lateral line incomplete; outer and middle caudal rays of the male filiform. **Nematobrycon.**
AA. Adipose fin present.
B. Anal very short, with but ten rays. . **Microgenys.**
BB. Anal moderate or long.
C. Few teeth along the upper portion of the maxillary.
D. Middle caudal rays with enlarged scales forming a pouch.
E. Lower caudal fulcra in the male separated from the rest. **Argopleura.**
EE. Lower caudal fulcra not separated from the rest. . . . **Phenacobrycon.**
DD. Caudal in the male without glandular scales. . . . . **Bryconamericus.**
CC. Teeth along the entire or nearly entire edge of the maxillary. . . . . **Hemibrycon.**
vv. Premaxillary with three series of teeth, the lower jaw short; anal short . . . . . **Creagrutus.**
uu. Teeth of the sides of the lower jaw large, conical, on a raised ridge. (*Rhoadsinæ*).
F. Lateral line complete. . . . . **Parastremma.**
FF. Lateral line incomplete. . . . . **Rhoadsia.**

ss. Origin of the dorsal behind the middle of the body, anal short, mouth oblique (*Glandulocaudinæ*).

G. Operele in male prolonged, ending in a flap over the anal. **Stevardia** (*extralimital*).

GG. Operele not prolonged.

H. A scale of the sides in the male prolonged, expanded into a dermal flap at its end. Anal short. . . . . **Pterobrycon.**

H H. None of the scales prolonged; three lowest rays of the caudal in the male separated from the rest, a squamous pouch surrounding them.

I. Anal with thirty to thirty-four rays; lateral line complete. **Gephyrocharax.**

II. Anal with eighteen rays; lateral line incomplete. . . **Microbrycon.**

rr. Preventral area trenchant.

J. Body elongate; lateral line continued to the tail. (*Chalcininæ*). . . . **Chalcinus.**

JJ. Body short; lateral line defleeted before the anal and adipose. (*Gasteropelicinæ*). . . . . **Thoracocharax.**

dd. Teeth conical or triangular.

K. Dorsal near middle of the body, adipose fin present, fontanels well developed.

L. No teeth on the palate.

M. Abdominal area long, the pectorals not overlapping the more or less remote ventrals; salmon-like. Teeth in the outer series of both jaws larger than those of the inner. (*Salmininæ*). . . . . **Salminus.**

MM. Abdominal area short, pectorals overlapping the nearby ventrals, anal very long. (*Characinæ*).

N. Breast and belly rounded.

O. Jaws with external tooth-like processes; rakers on upper and lower gill-arches similar, no conspicuous canines. . . . . **Rœboides.**

OO. Jaws without external tooth-like processes; with canines. . . . . **Charax.**

NN. Breast and belly compressed to an edge; lower jaw with a pair of canines on each side, a pair of small canines behind the first series. . **Gilbertolus.**

LL. Teeth on the palate in the adult, none in the young. Dorsal near middle of body, an adipose fin and fontanels present (*Acestrorhamphinæ*). . . . . **Acestrocephalus.**

KK. Dorsal far behind the middle of the body, an adipose fin; snout very long. With the general appearance of a *Lepidosteus* (*Hydrocyninæ*). . . . . **Ctenolucius.**

KKK. Dorsal near middle of body, no adipose fin; no fontanels. A. 10–13. Strong canines. Palate with teeth (*Erythrininæ*). . . . . **Hoplias.**

Subfamily Curimatinæ.

Curimatus Oken.

The term *Curimatus* is here used in its wider sense. Until the entire group is revised the recognition of smaller genera has little advantage. Mouth without teeth; caudal naked; lateral line complete; gill-rakers short.

This genus ranges from its northernmost locality, the Rio Chorrera on the

Pacific side of Panama, to Buenos Aires on the east and to Paita, Peru, on the west.

While there are seven species of *Curimatus* in the area under consideration, so far as known, no locality harbors more than two species. The highest elevation at which *Curimatus* was found is Girardot. Most of them are found within the first three hundred feet above sea-level.

Two species are found in both Atlantic and Pacific drainage areas. These are *C. lineopunctatus*, found abundantly in the entire San Juan Basin and across its headwaters in the headwaters of the Atrato; and *C. magdalenæ*, found in Lake Maracaibo and the Magdalena, Atrato, Tuyra, and the Mamoni Basins.

KEY TO THE SPECIES OF CURIMATUS.

a. Scales in lateral line fewer than sixty; post-ventral area rounded, or very obscurely keeled.

b. A conspicuous black band from tip of snout to end of middle caudal rays, in the adult fainter bands above and below this; no caudal spot; a large black band from near the middle of the anterior dorsal rays to the base of about the fifth to seventh rays; highest anal ray extending much beyond the tip of the last; ventrals under middle of dorsal; scales 5.5–36 to 39–5 or 6; predorsal area scaled; caudal naked; isthmus under posterior margin of eye.

atratoënsis Eigenmann.

bb. Series of spots along the rows of scales; a conspicuous black spot on the caudal peduncle; longest anal rays extending beyond tip of last; ventrals under anterior part of dorsal; caudal naked.

c. Depth 2.66–3; scales 6 to 7–38 to 44–5½ to 7. . . . . **lineopunctatus** Boulenger.

cc. Depth 3–3.33; scales 8 or 9–44 to 48–8. . . . . **patiæ** Eigenmann.

bbb. A black lateral band, separated by an interspace from a sharp black spot at the base of the middle caudal rays. Anal slightly emarginate, the highest ray extending beyond the tip of the last ray; scales 8 to 10–51 to 56–8. . . . . **peruanus** Eigenmann.

bbbb. Sides plain.

d. No spot on caudal peduncle; tip of anal lobe extending beyond tip of last ray; isthmus under posterior margin of eye; depth of caudal peduncle nearly equal to its length, which is equal to the length of head less snout and half of the eye; scales 5.5 or 6–38 to 41–6; A. 9. Silvery. A few scales on the bases of the caudal lobes. Predorsal line with eleven scales. Origin of ventrals under anterior part of dorsal.

magdalenæ Steindachner.

dd. A well-defined spot on caudal peduncle; tip of anal lobe extending little, if any, beyond tip of last ray; isthmus under middle of anterior margin of opercle. Scales 10–57–8; A. 10. Brassy. No regular median series of scales in front of dorsal, the median line partly naked; origin of ventrals in front of vertical from origin of dorsal.

boulengeri Pellegrin.

ddd. A well defined spot on caudal peduncle becoming faint with age; predorsal line naked; post-ventral area rounded; scales 7 or 8–44 to 49–5 to 7; A. 9, the highest rays extending far beyond the tip of the last; pectorals reaching to within about three scales of the ventrals; dorsal obliquely truncate or rounded, the highest rays extending a little beyond tip of antepenultimate; caudal naked. Brassy. . . . . **troscheli** (Günther).

aa. Scales small, 16–70 to 78–14; post-ventral area keeled; predorsal line scaled at least in part, but without a distinct median series of scales; A. 11 or 12, highest anal ray not extending beyond tip of last; pectoral reaching ventrals; dorsal falcate, the highest ray equals length of head, extending beyond tip of antepenultimate; caudal naked. Bright silvery.....**mivarti** Steindachner.

129. **Curimatus atratoënsis** Eigenmann. (Plate XVIII, fig. 1.)

Curimatus atratoënsis Eigenmann, Indiana University Studies, No. 16, 1912, p. 19 (Quibdo).

4814 *a*, C. M., *type*, 105 mm.; 4833 *a–j*, C. M.; 12676, I. U. M., *paratypes*, Quibdo. Eigenmann.

6684 *a–f*, C. M.; 13048, I. U. M., eleven, largest 60 mm., Quibdo. Wilson.

6685 *a–x*, C. M.; 13050, I. U. M., two hundred and sixteen specimens, largest 111 mm., Truando River. Wilson.

Habitat: Atrato Basin.

Head 4–4.33; depth 3–3.33; D. 11; A. 9, very rarely 8; scales 5.5–36 to 39–5 or 6 (36/3, 37/2, 38/4, 39/1, the denominator represents the number of individuals); eye 1 in snout, 3.4 in head, 1.4 in interorbital. Depth of caudal peduncle 1.33 in its length, which is equal to the head, or the head without the snout.

Postventral area rounded. Origin of dorsal about midway between snout and middle of adipose; dorsal obliquely truncate when expanded, its margin making an angle of about forty-five degrees with the horizontal, its highest ray equals length of head; caudal lobes about 3.75 in the length; anal base about equal to length of eye, margin of anal concave, the last rays not prolonged, the second and third rays extending much beyond the tip of the last; length of pectorals equals the head less the snout; ventrals slightly longer, their origin under middle of dorsal.

Scales large and very regularly arranged; ventral surface rounded; few or no radials; anal and caudal entirely naked; predorsal area scaled; about ten to twelve series of scales, sometimes a nearly complete median series, sometimes two series overlapping most of the length.

This species is readily distinguished by its coloration. A conspicuous black band extends from the snout through the eye and the operculum along the lateral line to the end of the middle caudal rays, bordered with a light color above and below. Back dark, with dark zigzag lines between the rows of scales; two or three similar lines below lateral band, the second the most prominent, otherwise silvery below lateral band. A dorsal spot obliquely extending from near the middle of the front margin of the fin to its base at the fifth to seventh rays. In the young the lines above and below the lateral band are faint. This is one of the most conspicuously marked fishes of Colombia and resembles *Leporinus striatus* from the same waters.

130. **Curimatus lineopunctatus** Boulenger. (Plate XVIII, fig. 2.)

Curimatus lineopunctatus BOULENGER, Ann. & Mag. Nat. Hist. (8), VII, Feb., 1911, p. 213 (Novita, Rio Tamana); REGAN, Ann. & Mag. Nat. Hist. (8), XII, Nov., 1913, p. 466 (Tamana).

Habitat: Rio Dagua, Rio San Juan, and upper Atrato Basin.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5077 *a*, C. M.; 12834, I. U. M.	14	Largest 109	Cordova	Eigenmann
5370 *a–c*, C. M.; 13056, I. U. M.	12	51–112	Small creek near Boca del Guineo, Rio Calima	Henn
5007 *a–t*, C. M.; 12807, I. U. M.	80	Largest 151	Puerto Negria, R. San Juan	Eigenmann
5008 *a–m*, C. M.; 12808, I. U. M.	40	Largest 170	Istmina	"
6686 *a–c*, C. M.; 12956, I. U. M.	7	Largest 138	Istmina	Wilson
12958, I. U. M.	—	—	Tado, R. San Juan	"
13057, I. U. M.	1	—	Raspadura, Atrato Basin	"
5076 *a*, C. M.; 12833, I. U. M.	2	72–145	Boca de Raspadura, Atrato Basin	Eigenmann
5371 *a–d*, C. M.; 13058, I. U. M.	16	26–165	Managru, Atrato Basin	Wilson

Head 4; depth 2.66–3; D 11; A. 9; scales 6–38 to 44 (usually 41)–5.5 to 7; eye 1 in snout, 3 in head, 1.4–1.5 in interorbital. Isthmus a trifle behind the posterior margin of the eye; depth of caudal peduncle about 1.25 in its length, which is equal to head without snout.

Origin of dorsal nearer tip of adipose than snout; margin of dorsal subtruncate to rounded, the highest ray about equal to length of head, scarcely, if at all, extending beyond tip of antepenultimate when depressed; caudal lobes 2.75–3.5 in the length; base of anal longer than eye, longest ray equals head less opercle, extending beyond last rays, which are not prolonged; pectorals equal head less opercle; ventrals slightly longer, their origin under anterior part of dorsal; scales regularly arranged, those of the second series above the ventrals, one and one half times as high as those of the second series below the dorsal; usually no radials; caudal and anal naked; about fifteen scales in front of the dorsal, sometimes the predorsal line fully scaled, sometimes naked for a short distance just in front of the dorsal.

A conspicuous black spot about the size of the eye on the caudal peduncle; rows of black spots along the series of scales, most conspicuous on the middle of the sides, fading out above and below; a silvery area below the level of the lower caudal lobe.

Readily distinguished from the rest of the San Juan fishes by the series of spots along the rows of scales. This species is abundant in the San Juan, but is

also occasionally taken immediately across the divide in the Raspadura and Quito Rivers of the upper Atrato Basin.

131. **Curimatus patiæ** Eigenmann. (Plate XVIII, fig. 3.)

Curimatus patiæ Eigenmann, Indiana University Studies, No. 19, 1914, p. 12 (Barbacoas).

5368, C. M., *type* 168 mm., 5369 *a–c*, C. M.; 13055, I. U. M., fifteen *paratypes*, 96–160 mm., Barbacoas. Henn and Wilson.

12957, I. U. M., creek emptying into the Telembi above Barbacoas. Henn and Wilson.

Habitat: Lower Patia Basin.

Head 3.6–4; depth 3–3.33; D. 11 (rarely 12); A. 9; scales 9–48–8 (type), 8 or 9–44 to 48–7 or 8.

Very similar to *C. lineopunctatus*, but a little slenderer, the scales smaller, the faint lateral spots tending to run together to form longitudinal lines.

132. **Curimatus peruanus** sp. nov. (Plate XVIII, fig. 4.)

7684, C. M., *paratype* 151 mm.; 15162, I. U. M., *type* 162 mm., *paratype* 105 mm., Sullana, Peru, Jan., 1919. Eigenmann.

Head 4.29–4.66; depth 3.33–3.5; D. 11; A. 9; scales 8 to 10–51 to 56–8; eye 1.4 in the snout, 4.3 in the head, 2 in the interorbital.

Predorsal line mostly scaled; dorsal obliquely truncate, the longest ray extending beyond the penultimate ray; anal slightly emarginate, the highest ray extending beyond the tip of the last; origin of ventral and base of third to fifth dorsal rays equidistant from snout; origin of ventrals about equidistant from tip of snout and base of middle caudal rays; pectorals scarcely reaching half-way to second-third of ventrals, to the seventh to ninth scales in front of the ventrals.

Silvery; a sharp black spot at the base of the middle caudal rays, separated by an interspace from a black lateral band, which starts abruptly and fades out forwardly.

133. **Curimatus magdalenæ** Steindachner. (Plate XVII, fig. 2.)

Curimatus magdalenæ Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 50 (Rio Magdalena); *ibid.*, XLI, 1879, p. 167 (Mamoni River, Panama); *ibid.*, XLII, 1880, p. 67 (Cauca near Caceres); Eigenmann and Eigenmann, Ann. N. Y. Acad. Sci., IV, 1889, p. 16; Boulenger, Boll. Mus. Zoöl. Anat. Comp. Torino, XIV, April, 1899, No. 346, p. 2 (Laguna della Pita, Darien); Eigenmann, Science, N. S., XXII, July 7, 1905, p. 19 (Mamoni, Magdalena);

Regan, Biologia Centrali-Americana, Pisces, 1908, p. 174; Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl Ser., X, 1916, p. 269 (Pacific slope of Panama from the Rio Chorrera to the Tuyra).

5125, C. M., one, 200 mm., Boca de Certegui. Eigenmann.

5124 *a*, 6687 *a–e*, C. M.; 13047, I. U. M., thirteen, 45–193 mm., Quibdo. Eigenmann and Wilson.

6688 *a–j*, C. M.; 13472, I. U. M., eighty-five, largest 162 mm., Truando. Wilson.

5121, C. M.; 12838, I. U. M., four, 122–142 mm., Soplaviento. Eigenmann.

5122 *a–e*, 5123 *a–c*, C. M.; 12837, 12839, I. U. M., twenty-five, 94–143 mm., Calamar. Eigenmann.

I have also examined specimens from Encontrados, Province of Zulia, Venezuela, collected by Dearborn, 6634, Field Mus. Nat. Hist.

Habitat: Maracaibo, Magdalena, and Atrato Basins; Pacific slope of Panama.

Head 3.33–3.66; depth 2.5–2.8 in Atrato specimens (3 in Magdalena specimens); D. 11, rarely 12; A. 9; scales 5–38 to 41–6 (38/1, 39/4, 40/4, 41/1, the denominator representing the number of individuals); eye 3.5–4 in the head, 1.4 in the interorbital in young, 2 in adult; isthmus under posterior margin of eye. Postventral area very faintly keeled.

Origin of the dorsal equidistant from the tip of the snout and the tip of the adipose, or a little nearer the latter, its margin obliquely rounded, its longest rays not, or scarcely, extending beyond the tip of the penultimate ray; caudal lobes equal to the length of the head; base of anal a little longer than the eye, its anterior rays extending to the caudal in the adult and considerably beyond the tip of the last anal ray, its base equal to the length of the head without the opercle, or shorter; pectorals equal to the head without the opercle; ventrals about equal to the head less half the opercle, their origin under the anterior part of the dorsal.

Scales very regularly placed, those of lower part of sides larger than those on upper part of sides; few radials; anal naked; a few scales on the bases of the caudal lobes; predorsal line completely scaled, but without a complete median series. The specimens from the Atrato Basin are a little deeper and more frequently have forty scales; those from the Magdalena are slenderer, and usually have thirty-nine scales.

Silvery in coloration, darker above, but without distinct markings.

134. **Curimatus boulengeri** Pellegrin. (Plate XVII, fig. 3.)

Curimatus guentheri (*non* Eigenmann and Eigenmann) Boulenger, Boll. Mus. Zoöl. Anat. Comp. Torino, XIII, Dec., 1898, No. 329, p. 4 (Rio Vinces).

Curimatus boulengeri Pellegrin, Bull. Mus. Hist. Nat. Paris, 1908, p. 343 (new name); Eigenmann, Repts. Princeton Univ. Exp. Patagonia, III, 1910, p. 422.

Habitat: Pacific slope of Southern Ecuador.

The name *boulengeri* was independently substituted for the preoccupied *guentheri* by Pellegrin, and by Eigenmann.

Specimens Collected by Arthur W. Henn.

6689 *a–j*, C. M.; 13473, I. U. M., eighty-seven specimens, largest 185 mm., Colimes, Ecuador.

6690 *a*, C. M.; 13474, I. U. M., two specimens, largest 194 mm., Rio Barranca Alta.

6691 *a–j*, C. M.; 13475, I. U. M., four hundred and seventy-six specimens, largest 140 mm., Vinces.

Head 3.66; depth 3.2–3.5; D. 11; A. 10; scales 9 or 10–50 to 57–7 or 8; eyes 3 (in young)–4 in head; 1.33–1.9 in interorbital; depth of caudal peduncle 1.5 in its length; postventral surface keeled; isthmus under anterior margin of opercle.

Origin of dorsal nearer tip of adipose than snout; dorsal very obliquely truncate, pointed, the highest ray but little shorter than head, extending far beyond antepenultimate; caudal lobes equal to length of head; base of anal nearly equal to length of eye and snout; highest ray of anal longer than base of anal, extending little beyond tip of last ray, which is longer than some of the rays preceding it; pectorals and ventrals of nearly equal length, about equal to head less opercle; pectorals reaching to within about one scale of the ventrals; origin of ventrals in front of origin of dorsal.

Scales very regularly placed; those above the ventrals considerably larger than those under the dorsal; several radials; caudal and ventrals entirely naked; predorsal line partly naked, partly covered with small scales.

Brassy, with golden (?) lines following the rows of scales on the middle of the sides. An obscure spot on caudal peduncle.

135. **Curimatus troscheli** (Günther). (Plate XVII, fig. 4.)

"Dika."

Anodus troschelii Günther, Proc. Zoöl. Soc. London, 1859, p. 418 (Western Andes of Ecuador).

Curimatus troschelii Günther, Cat. Fish. Brit. Mus., V, 1864, p. 290; Boulenger, Boll. Mus. Zool. Anat. Comp. Torino, XIII, Dec., 1898, No. 329, p. 4 (Rio Vinces).

Curimatus aureus Pellegrin, Bull. Mus. Hist. Nat. Paris, 1908, p. 342 (Guayas).

Habitat: Western slopes of Ecuador, draining into the Bay of Guayaquil.

SPECIMENS COLLECTED BY ARTHUR W. HENN.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.
6693 *a–c*, C. M.; 13536, I. U. M.	13	Largest 154	Vinces, Ecuador
6692 *a–c*, C. M.; 13536, I. U. M.	24	Largest 203	Guayaquil Market
6694 *a–c*, C. M.; 13537, I. U. M.	28	Largest 177	Colimes
13538, I. U. M.	4	Largest 193	Rio Barranca Alta
13539, I. U. M.	3	Largest 52	" " "
13540, I. U. M.	3	Largest 42	Rio Chanchan

Head 3.66–3.9; depth 3; D. 11 or 12; A. 9; scales 7 or 8–44 to 49–5 to 7; eye 3.5–4 in the head; 1.6–2 in the interorbital.

Postventral area rounded; predorsal line naked; isthmus under posterior margin of the eye. Origin of dorsal nearer tip of adipose than snout; dorsal obliquely rounded or truncate, the highest ray about equal to head less half the opercle, extending a little beyond tip of antepenultimate, caudal lobes equal to length of head; length of base of anal equals eye and half the snout; anal rays decreasing in length to the last, the longest ray extending much beyond the tip of the last and to the caudal in some, their length equal to the head less the opercle; ventrals very little longer than the pectorals, which are equal to the length of the head less the snout, pectorals reaching to within about three scales of the ventrals; origin of ventrals on the vertical from the anterior part of, or from in front of, the dorsal.

Scales very regularly placed, those over the ventrals not notably greater than those below the dorsal; few radials; caudal and anal naked; about sixteen scales between dorsal and occipital process.

Brassy, with golden (?) lines following the scales. Adults with an obscure caudal spot; young with a conspicuous, long, rhomboidal, black spot on the caudal peduncle.

136. **Curimatus mivarti** Steindachner.

"Sardina, Biscayano."

Curimatus mivartii STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 48, plate XIII, fig. 1 (Rio Magdalena); *ibid.*, XLII, 1880, p. 67 (Cauca near Caceres); EIGENMANN and EIGENMANN, Ann. N. Y. Acad. Sci., IV, 1889, p. 18.

Habitat: Lower Magdalena Basin.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5116, C. M.; 12869, I. U. M.	4	205 to about 300	Soplaviento	Eigenmann
5117 *a–j*, C. M.; 12870, I. U. M.	33	34–311	Calamar	"
5118 *a–b*, C. M.; 12871, I. U. M.	3	160–275	Calamar Cienega	"
5119 *a*, C. M.; 12872, I. U. M.	3	118–136	Peñas Blancas	"
13045, I. U. M.	—	Largest about 310	Cienega de Puerto Berrio	Gonzales
5120, C. M.	1	300	Honda	Eigenmann
12896, I. U. M.	1	240	Girardot	"

Head 3.66–4; depth 3–3.25; D. 11; A. 11 or more rarely 12; scales 16–70 to 78–14; eye 3.5–4 in the head, 1.33 in young to nearly 2 in the interorbital in the adult; isthmus under anterior margin of opercle; depth of caudal peduncle 1.5 in its length, which is equal to the length of the head without the snout.

Origin of dorsal about equidistant from tip of snout and tip of adipose; dorsal falcate; the highest rays about equal to the length of the head, extending far beyond the antepenultimate ray; caudal lobes longer than head; base of anal equal to snout and eye, or a little less, the highest ray not extending to the tip of the last, equal to, or a little longer than, the base of the fin; pectorals about equal to head less opercle and reaching the base of the ventrals; ventrals about equal to length of head less half the opercle; the origin of ventrals on, or in advance of, the vertical from the first dorsal ray. Scales small, with few radials, not notably larger on the lower part of the sides; caudal and anal naked; predorsal line naked for over half of its length from the dorsal forward. Postventral area keeled.

Adult uniform silvery; middle caudal rays dusky. Some specimens preserved in formalin have faint rows of spots along the scales.

This is the largest member of the genus *Curimatus* found in Transandean Colombia.

Subfamily PARODONTINÆ.

PARODON Cuvier and Valenciennes.

KEY TO THE SPECIES OF PARODON.

a. Sides with a simple lateral band; D. 11 or 12; mandibulary teeth 2–2 or 3–3; interorbital a little longer than snout, 2.5 in the head (3 in young); head 5 in length to end of lateral line; depth 3.75. **suborbitalis** Cuvier and Valenciennes.

aa. Sides with interrupted cross-bands or spots. **caliensis** Boulenger.

137. **Parodon suborbitalis** Cuvier and Valenciennes. (Plate XIX, fig. 1.)

Parodon suborbitalis CUVIER and VALENCIENNES, Hist. Nat. Poiss., XXII, 1849, p. 51, plate 637 (Maracaibo); GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 301.

Parodon nasus KNER, Denkschr. Akad. Wiss. Wien, XVII, 1859, p. 167, plate VII, fig. 17 (Cuyabá); EVERMANN and KENDALL, Proc. U. S. Nat. Mus., XXXI, 1906, p. 79.

Parodon affinis STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLI, 1879, p. 20, plate III, fig. 3 (La Plata Basin).

Habitat: Atrato, Magdalena, Maracaibo, and La Plata Basins.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5110, C. M.; 12830, I. U. M.	2	121, 135	Soplaviento	Eigenmann
5111, C. M.	1	49	Honda	"
5112, C. M.; 12831, I. U. M.	3	42–45	Peñas Blancas	"
5113, C. M.	1	60	Quibdo	"
5379, C. M.; 13071, I. U. M.	2		Truando	Wilson

D. 12; A. 8 or 9; scales 4–35 to 37–3.5 to 4.

138. **Parodon caliensis** Boulenger. (Plate XIX, fig. 2.)

Parodon caliensis BOULENGER, Ann. & Mag. Nat. Hist., XVI, 1895, p. 480 (Colombia).

Habitat: Magdalena Basin.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5107 *a–g*, C. M.; 12863, I. U. M.	23	Largest, 89	Cauca at Cali	Eigenmann
5108 *a*, C. M.; 12864, I. U. M.	2	81– 84	Paila	"
5109 *a–d*, C. M.; 12865 *a–d*, I. U. M.	8	58–125	Cartago	"
5115, C. M.	1	43	Peñas Blancas	"

D. 12; A. 9; scales 4–39–4.

APAREIODON Eigenmann.

Type, *Apareiodon piracicabæ* Eigenmann. This genus was described and monographed by me in the Annals of the Carnegie Museum, X, 1916, pp. 71–76, plates XI and XII.

KEY TO THE SPECIES OF APAREIODON.

a. Fins plain.

b. Mouth inferior; lateral band moniliform; scales 37. . . . . **ecuadoriensis** (Eigenmann and Henn).

bb. Mouth terminal; a simple lateral band. . . . . **terminalis** (Eigenmann and Henn).

aa. Dorsal and caudal with cross-bands; sides with three stripes; D. 11; A. 9; scales 35 to 37. **dariensis** (Meek and Hildebrand).

139. **Apareiodon ecuadoriensis** (Eigenmann and Henn). (Plate XIX, fig. 3.)

Parodon ecuadoriensis EIGENMANN, Indiana University Studies No. 19, 1914, p. 12.

5413 *a–c*, C. M.; 13103, I. U. M., *type* and *paratypes*, 34–51 mm., river and forest pools at Vinces, Ecuador. Henn.

5423 *a–f*, C. M.; 13110, I. U. M., twenty-eight *paratypes*, 30–42 mm., Colimes, Rio Daule. Henn.

Habitat: Guayas Basin of Ecuador.

Head 4; depth usually 5.5, rarely 4.5. D. 12; A. 9; scales 4–37–3.5. Eye equals snout, 3.5 in head, less than interorbital.

Subcylindrical, elongate. Preventral area flattish, with a median series of about twenty scales; predorsal area rounded with a median series of eleven or twelve scales; skull smooth, no fontanels, the two frontals and the parietals interlacing; occipital crest decurrent, not superficially evident; second suborbital covering entire cheek; mouth small, distinctly inferior, as in other members of the genus; four broad, graduated, straight-edged or rounded-edged teeth in each premaxillary, each tooth with eleven to sixteen notches; mandible without apparent teeth; maxillary with a single small dentate tooth. Gill-rakers short, slender, about fifteen in the lower arch.

Origin of dorsal in advance of the middle of the body, usually equidistant from tip of snout and end of adipose, its height about 4.5 in the length; adipose well developed; caudal lobes 4 in the length, anal 6 in the length; ventrals under posterior part of dorsal, not nearly reaching anal, pectorals not reaching ventrals by about four scales.

Lateral line straight, scales everywhere regularly arranged; scales of sides with as many as five more or less divergent radials. Axillary scale well developed; caudal and anal naked.

A moniliform band from the eye along the lateral line and on, but usually not to the end of, the middle caudal rays; area below the band white; a light stripe above the band; back dark with the margins of the dark area and eight streaks from margin to margin darker; base of caudal with a dark spot or streak on each lobe.

140. **Apareiodon terminalis** (Eigenmann and Henn). (Plate XIX, fig. 4.)

Parodon terminalis EIGENMANN, Indiana University Studies No. 19, 1914, p. 12.

5415 *a–b*, C. M.; 13104, I. U. M., *type* and ten *paratypes*, 32–50 mm., river (?), and forest pools at Vinces, Ecuador. Henn.

Habitat: Forest-pools and river (?) at Vinces, Ecuador.

Very similar to *A. ecuadoriensis.*

Head 3.7; depth usually 4.5, rarely 5; mouth terminal or subterminal, which is very different from the distinctly inferior mouth with projecting snout of other species of this genus. Lateral band continuous, sometimes not extending forward behind the edge of the preopercle, not moniliform. Back uniformly dark; spots at base of caudal lobes more diffuse than in *ecuadoriensis.* Coloration otherwise like *ecuadoriensis.*

A. ecuadoriensis and *terminalis* are unquestionably very closely related. It is possible that one is the form found in rivers and the other in forest-pools. The specimens from the two localities have not been kept distinct.

141. **Apareiodon dariensis** (Meek and Hildebrand).

Parodon dariensis MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1913, p. 83.

Apareiodon dariensis EIGENMANN, Ann. Carnegie Mus., X, 1916, p. 76; MEEK and HILDEBRAND, *loc. cit.,* 1916, p. 271, plate XVII (Rio Cupe at Cituro, Tuyra Basin).

Habitat: Tuyra Basin.

This strikingly marked species is known from three specimens. The teeth vary with age, so that according to Hildebrand "only the largest specimen, the type, is a typical *Apareiodon.*"

SACCODON Kner and Steindachner.

Saccodon KNER and STEINDACHNER, Abhandl. Bayer. Akad. Wiss., X, 1864, p. 31. Type: *Saccodon wagneri* Kner and Steindachner.

Catostomoid fishes with a small head and very large pectoral fins placed low.

No fontanel, the skull evenly arched; snout with numerous warts on its lower surface; mouth inferior, crescentiform; three teeth on each premaxillary; no maxillary or mandibular teeth; each tooth with a ⌒⌒-shaped cutting edge, each successive tooth considerably behind the one in front of it. Lower lip five-lobed; gill-membranes united, free from the very broad isthmus; nares close together; maxillary concealed under the cavernous preorbital; suborbitals cover the entire cheek; dorsal largely in front of the ventrals; anal short, emarginate, lateral line complete, scales cycloid; scales above and below the lateral line of almost the same size. Pectorals very large, the tips of the outer rays abruptly thickened, the middle ray longest; the outer half of the fin gently rounded, the inner half truncate, with a rounded corner; ventrals similar, but smaller; dorsal emarginate.

KEY TO THE SPECIES OF SACCODON.

a. D. 11; A. 11; scales 4–40–3.....**wagneri** Kner and Steindachner.
aa. D. 12; A. 9; scales 4–37–3.....**craniocephalum** Thominot.

142. **Saccodon wagneri** Kner and Steindachner. (Plate XIX, figs. 7 and 7*a*.)

Saccodon wagneri KNER and STEINDACHNER, Abhandl. Bayer. Akad. Wiss., X, 1864, p. 31, plate IV, fig. 2 (Ecuador); GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 301.

Habitat: Western slope of Ecuador.

I have examined the types in the Vienna Museum, which are the only known specimens.

143. **Saccodon craniocephalum** Thominot.

Saccodon craniocephalum THOMINOT, Bull. Soc. Philom. Paris (7), VI, 1882, p. 248 (Rio Guayaquil).

Habitat: Western slope of Ecuador.

It is very probable that this is a synonym of *S. wagneri*.

The types of *Saccodon craniocephalum* from the Rio Guayaquil are in Paris. I was able to examine them, but they are to a large extent shriveled and mutilated; the lower jaw has been pierced to suspend the fish in the bottles and this has in part destroyed its structure. The specimens are 87, 90, and 140 mm. long respectively. D. 12; A. 9; lateral line in largest, 37.

Subfamily PROCHILODINÆ.

PROCHILODUS Agassiz.

?*Ichthyoelephas* POSADA, Estudios Cientificos, 1909, p. 300, figs.

The species of *Prochilodus* are generally distributed on the Atlantic slope from the La Plata to the Orinoco to Santa Ana on the Urubamba, and to the Perené.

The distribution of the species of this genus in the area under consideration is peculiar. There are three species in the Magdalena Basin, of which one, *Prochilodus magdalenæ*, is abundant everywhere from sea-level to over 3000 feet elevation. The other two are rare, or the area of their distribution is restricted. *P. magdalenæ* is abundant also in the Atrato Basin at least as far as Quibdo. The genus has no representative in the San Juan, the Dagua, and the Patia, but is again found in the streams which empty into the Bay of Guayaquil. In these streams *P. humeralis* is found abundantly, while *P. stigmaturus* has been taken only by Rhoads.

KEY TO THE SPECIES OF PROCHILODUS.

a. Snout equal to half the length of the head; ventrals behind the vertical from the middle of the dorsal; mouth inferior, teeth long.....**longirostris** Steindachner.

aa. Snout much less than half the length of the head.

b. Anal margin concave, the highest anterior rays extending beyond the tips of the last.

c. A. 10 or 11.

d. Lateral line 36 or 37; A. 10 or 11; depth 3.33–3.4; postventral area not keeled. Posterior part of dorsal with small dots; sides with light streaks along the rows of scales; sides in young with twelve or more cross-bands; a small dark spot on the fifth and sometimes on the sixth and seventh scales of the lateral line. **humeralis** Günther.

dd. Lateral line 40–46; D. 10, rarely 11; depth 2.75–3.5; dark iridescent above. Sides with obscure cross-bars in the young; light streaks along the rows of scales with dark stripes between the rows of scales, the latter color very variable in intensity. Adult dark above, lighter below..... **magdalenæ** Steindachner.

cc. A. 13; caudal plain; postventral area trenchant..... **steindachneri** Eigenmann.

bb. Anal margin subtruncate, rounded in front; D. 12; A. 10; scales 9–41–6; a black spot on caudal peduncle, continued to the end of the middle caudal rays..... **stigmaturus** Fowler.

144. **Prochilodus longirostris** Steindachner.

Prochilodus longirostris STEINDACHNER, Sitzb. Akad. Wiss. Wien, LXXX, 1879, p. 186 (Cauca); Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 69, plate VII, fig. 1 (Cauca near Caceres).

Habitat: Magdalena Basin.

This species probably represents a distinct genus. It is known from the two specimens recorded by Steindachner respectively 310 and 460 mm. long.

Head 3.75–4; depth 3.33; D. 11 or 12; A. 11; scales 6.5–38 or 39–5; eye 6–6.66; interorbital about 2 in the head; equals length of snout.

Snout conic, very long; mouth inferior, with longer teeth than in other species of *Prochilodus*. Scales with cilia, not ctenoid.

Dorsal with short, oblique, longitudinal stripes; caudal without spots. Upper half of body with light-colored longitudinal stripes following the series of scales.

145. **Prochilodus humeralis** Günther. (Plate XX, fig. 1.)

Local names, "Guavina" and "Boca Chica."

Prochilodus humeralis GÜNTHER, Proc. Zoöl. Soc. London, 1859, p. 419 (Western Andes of Ecuador); Cat. Fishes Brit. Mus., V, 1864, p. 294; BOULENGER, Boll. Mus. Zoöl. Anat. Comp. Torino, XIII, 1898, No. 329, p. 5 (Rio Peripa).

5424 *a–b*, C. M.; 13111, I. U. M., nine, 180–207 mm., Vinces. Henn.

5425 *a–j*, C. M.; 13112, I. U. M., fifty-two, 96–200 mm., Colimes, Rio Daule. Henn.

5707 *a–f*, C. M.; 13577, I. U. M., twenty-three, largest 280 mm., Rio Barranca Alta. Henn.

Habitat: Western Ecuador, streams draining into the Bay of Guayaquil.

Head 3.5–4; depth 2.8–3.2; D. 12; A. 10; scales 6–36 or 37–5; eye 4–5, interorbital 2 in the head, snout conic, its depth at the nares greater than its length, a little greater than its width at the same place; bony opercle more than twice as high as long; naked portion of the cheek much wider than the covered part. Postventral area rounded. Upper lip thick, equaling two-thirds of the diameter of the eye; head compressed; eye a little above the middle. Dorsal rounded, its highest ray equal to head less opercle, or shorter; second, third, and part of fourth anal rays forming a lobe, which extends to the caudal in the adult, the margin of the remaining rays forming a straight vertical line when the fin is expanded. Pectorals about equal to head less opercle; not reaching base of ventrals by two or three scales. Scales smooth. Dorsal with a few small faint spots on its posterior half. Fifth scale and frequently the sixth and rarely also the seventh scales of the lateral line black; sides of the adult with light bands along the rows of scales; sides in young with numerous alternating light and dark cross-bars, most definite in front.

146. **Prochilodus magdalenæ** Steindachner. (Plate XIX, figs. 5 and 6.)

"Boca Chica."

Prochilodus asper Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1879, p. 51 (Rio Magdalena); *ibid.*, XLII, 1880, p. 67 (Cauca near Caceres); *ibid.*, LXXII, 1902, p. 141 (Santander).

Prochilodus asper magdalenæ Steindachner, *ibid.*, XXXIX, 1879, p. 78, plate XII, fig. 1.

Prochilodus beani Eigenmann and Ogle, Proc. U. S. Nat. Mus., XXXIII, 1907, p. 5, fig. 2.

Habitat: Atrato and Magdalena Basins.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5136, C. M.; 12886, I. U. M.		Largest 390	Soplaviento	Eigenmann
5135, C. M.; 12885, I. U. M.	Many		Calamar	"
5138 *a*, C. M.	1	60	Calamar Cienega	"
5014 *a–e*, C. M.; 12811, I. U. M.	21	Largest 345	Peñas Blancas	"
5137 *a*, C. M.; 12887, I. U. M.	2		Puerto Berrio	Gonzales
5139 *a–b*, C. M.; 12888, I.U.M.	3		Puerto Berrio	"
13046, I. U. M.	2		Cienega of Puerto Berrio	"
5142, C. M.; 12891, I. U. M.	2	305	Honda	Eigenmann
5140 *a–b*, C. M.; 12889, I. U. M.	4		Girardot	"
13043, I. U. M.	6	Largest 325	Apulo	Gonzales
5141 *a–b*, C. M.; 12890, I. U. M.	4	Largest 270	Piedra Moler	Eigenmann
5143 *a–e*, C. M.; 12892, I. U. M.	9	160–255	Paila	"
5012 *a–c*, C. M.; 13044 and 12809, I. U. M.	7	Largest 320	Quibdo	"
5013 *a–c*, C. M.; 12810, I. U. M.	19		Rio Sucio	"
5708 *a–j*, C. M.; 13578, I. U. M.	Many	Largest 315	Truando	Wilson

Distributed in the Magdalena Basin from the coast inland and up the Cauca at least as far as Cali. Occurs also in the Atrato, but not in the San Juan.

Prochilodus magdalenæ, the "boca chica," is a fish of considerable economic importance. It is caught in numbers, dried, and transported to Cartagena and to the San Juan. In riding from Istmina to Tambo, I encountered thirty women loaded with dried "bocas chicas" which were being taken from the Atrato Basin to the mines along the San Juan.

In January it was found in millions along the shores of the Magdalena River, where it was probably ascending the river and its tributaries to spawn. At night, evidently when pursued by the Caiman and the *Bagre tigre*, it frequently leaped out of the water over the shallow sand-bars.

Head 3.66–4; depth 2.75–3.5 (rarely 3.75); D. 11 or 12; A. 10 or 11; scales 8 or 9–42 to 44 (rarely 45 or 46)–7 or 8; eye 3.5–5; interorbital 1.875–2.125; snout depressed, its depth at the nares less than its width at the same point; bony opercle striate, its margin very convex, its height less than twice its width; naked portion of cheek usually narrower than the suborbital. Postventral area with a median keel; upper lip comparatively thin, .4–.5 of the diameter of the eye; head rather depressed, the eye looking a little downward, its center midway between the mid-dorsal and mid-ventral lines. Dorsal subtruncate or pointed, its highest rays only slightly shorter than the head; anal margin concave, the highest rays not reaching the caudal; pectorals reaching the ventrals, shorter than the highest dorsal rays. Scales very rough. Nearly the entire dorsal with conspicuous undulating bands, or series of spots; other fins plain, except that the middle caudal rays of specimens from the Atrato and the upper Cauca are dusky. Sides variously marked with silvery bands along the middle of the scales and dark lines between them. The dark color is especially well marked in specimens from Paila. Opercle sometimes dark, or with a dark spot. In the adult in life the caudal, anal, ventrals, and pectorals are edged with red; breast reddish. Young with alternating light and dusky cross-bars.

The fins in specimens from the upper Cauca valley are shorter than in those from the lowlands, and the pectorals do not reach the ventrals. The lateral bands are more evident and the middle caudal rays are dusky.

147. **Prochilodus steindachneri** nom. nov.

Prochilodus rubrotæniatus (*non* Schomburgk) Steindachner, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 68 (Cauca near Caceres).

No specimens of this species were secured. It seems that the specimen 270

mm. long, recorded by Steindachner, is distinct from *P. rubrotæniatus*, although it may be merely a variety of *P. magdalenæ*.

Head 3.8; depth nearly 3; D. 11; A. 13; scales 8–44–7; eye 4; interorbital 2 in the length of the head. Origin of dorsal in advance of the vertical from the ventrals; light streaks along the rows of scales. Caudal unspotted.

P. rubrotæniatus from the Essequibo has but ten, or rarely eleven, anal rays; the middle caudal rays are barred.

148. **Prochilodus stigmaturus** Fowler.

Prochilodus stigmaturus Fowler, Proc. Acad. Nat. Sci. Phila., 1911, p. 494, fig. 1 (Affluent of the Chimbo River near Bucay, Province of Guayas, Ecuador).

This species is known only from the type, a specimen 5.5 inches long in the Academy of Natural Sciences of Philadelphia.

Head 3.6; depth 3.75; D. 12; A. 10; scales 9–41–6; eye 4.33 in the head; interorbital 2.5. Anal subtruncate.

A large blackish blotch on caudal peduncle, continued to the tip of the middle rays.

Subfamily Anostomatinæ.

Leporinodus[11] gen. nov.

Type, *Leporinodus retropinnis* Eigenmann.[12]

Resembling *Leporinus*. Gill-membranes united with the isthmus; nareal openings separated by a flap only; four teeth in each side of both upper and

[11] λέπορις,ό = a hare; ὀδούς,ό = a tooth.

[12] *Leporinodus retropinnis* sp. nov.

3875 C. M., *type*, 230 mm., Piracicaba. Sept. 9, 1908. Haseman.

Head 3.5; depth 3.75; D. 12; A. 10; scales 6–42 (to 45)–4; eye 3 in snout, 7 in head, 2.75 in interorbital; depth of the head at the occipital equal to its length without the operele; width of head at the opercles equal to half its length; interorbital very convex, profile rounded, sharply decurved in front; lips very broad, both of them broadly reflexed in the middle; gill-membrane united to the isthmus, the branchiostegals broad, the lower three subparallel; mouth small, the maxillary not reaching to below the nares, which are much nearer the eye than the snout. Origin of dorsal about equidistant from snout and caudal, its margin slightly concave, the highest rays reaching tip of last ray when depressed; adipose well developed; caudal deeply forked; anal slightly falcate, the highest rays reaching beyond the tip of of the last; origin of ventrals under second or third dorsal ray, not nearly reaching anal; pectoral broad (eighteen rays), about equal to snout and eye in length. Scales regularly imbricate, without interpolated rows; anal without a basal sheath; the scales of the sides continued without line of demarcation into the basal .4 of the caudal lobes; lateral line nearly straight.

Head spotted above and on the sides; predorsal scales with a dark spot at the base; a dark lateral band continued to the end of the caudal; light bands above and below it, two darker lines along the two

lower jaws,* rapidly graduated from the broad mesial ones to the small lateral ones, the tips broad and in contact, forming a continuous cutting edge; cheeks deep, the suborbitals feeble, covering less than half the cheeks; basal parts of caudal lobes scaled; lips reflexed, with a free margin.

149. **Leporinodus sexdentatus** nom. nov.

Leporinus vittatus (*non* Cuvier and Valenciennes) Steindachner, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 71 (Cauca near Caceres).

Habitat: Magdalena Basin.

I did not secure any specimens of this species. Steindachner had a specimen 200 mm. long, distinguished from *vittatus* by three, instead of four, teeth on each side of the jaw; by a black band on the anal as well as on the dorsal; and by the position of the origin of the dorsal, which is more than the length of the snout nearer to the tip of the snout than to the base of the middle caudal rays.

Abramites Fowler.

150. **Abramites eques** (Steindachner).

Leporinus eques Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 56, plate X, figs. 2 and 2*a* (Rio Magdalena); ? Boulenger, Trans. Zoöl. Soc. London, XIV, 1896 (Descalvados and San Luis).

Habitat: Rio Magdalena and (?) Rio Paraguay.

I did not secure any specimens of this species. Boulenger records it from the Paraguay Basin. This record may well be questioned, however, until specimens from the Magdalena and the Paraguay can be compared.

Snout conical, the profile of the nape ascending rapidly. Head 4.25; depth 3; D. 13; A. 15 or 16; scales 7–41 or 42–5; eye 3.25–3.75; interorbital 2.33–2.16 in the head.

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rows of scales below the lateral band; dorsal with a dark spot extending obliquely from about the middle of the anterior rays to the tip of the seventh, another along the middle of the last five rays; three oblique bands across the caudal lobes.

A third species of this genus is *Leporinodus vittatus* (Cuvier and Valenciennes), of which *Leporinus pictus* Kner is a synonym.

Leporellus Lütken.

Leporellus timbore Eigenmann, nom. spec. nov.

Lütken erroneously identified a species from the Rio das Velhas as the *Leporinus pictus* of Kner. He however recognized the fact that his species belonged to a genus differing from *Leporinus*, which he named *Leporellus*. Thus *Leporellus pictus* (*non Leporinus pictus* Kner) Lütken from the Rio das Velhas is a homonym and being not admissible, Lütken's species may receive the substitute name *Leporellus timbore*.

* Three in lower jaw of Steindachner's specimens from the R. Magdalena.

Sides with dark cross-bands, the first through the dorsal and ventral, and the second over the origin of the anal.

Leporinus Agassiz.

The distribution of the genus *Leporinus* within the area covered by this paper is very similar to that of *Prochilodus* with one reservation. It is found in the Magdalena from the coast at least to Honda and in the Atrato from the coast to Raspadura. It is also found in the streams emptying into the Bay of Guayaquil, but has not been taken in the Patia, the Dagua, or the San Juan, with one exception. *Leporinus striatus* is abundant in the upper Atrato at least as far as Raspadura and *rarely this species occurs also in the San Juan.*

This genus is widely distributed on the Atlantic slope.

Key to the Species of Leporinus.

aa. Profile of head and nape continuous, without a distinct hump.

b. Sides with light and dark longitudinal bands; D. 12; A. 10; head 4.25–4.6; depth 3.2–3.8; scales 5–36 or 37–4.....**striatus** Kner.

bb. Sides with three dark spots. Frequently transverse markings in the young.

c. Origin of dorsal equidistant from snout and a point about midway between adipose and caudal; distance between dorsal and adipose less than the length of the head; origin of ventrals equidistant from tip of snout and tip of anal. D. 12; A. 10; head 3.66–4.2; depth 3.25–3.75; scales 5–40 or 41–4; anal not reaching caudal; lateral spots of nearly equal prominence.....**ecuadoriensis** Eigenmann and Henn.

cc. Origin of dorsal equidistant from snout and some part of the adipose, except in the young; distance between dorsal and adipose greater than head in adult, less than the head in the half-grown. D. 12; A. 10; head 4–4.66; depth 3.33–4.5; scales 5–40 to 43–5. Spot on caudal peduncle more prominent, except in the young.....**muyscorum** Steindachner.

151. Leporinus striatus Kner.

Leporinus striatus Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 55, plate X, fig. 1–1*a* (Rio Magdalena); Regan, Ann. & Mag. Nat. Hist. (8), XIV, 1914, p. 32 (Rio Condoto).

Habitat: Irisanga, Caiçara, and Descalvados in Matto Grosso; Paraguay; Canelos, Eastern Ecuador; Magdalena and Atrato Basins.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5710 *a–e*, C. M.; 13049, I. U. M.	30	Largest 83	Truando, Atrato Basin	Wilson
5079 *a–j*, C. M.; 12834, I. U. M.	80	Largest 170	Quibdo, Atrato Basin	Eigenmann
5080 *a*, C. M.; 12835, I. U. M.	2		Boca de Certegui, Atrato Basin	"
13053, I. U. M.	—	165	Managru, Atrato Basin	Wilson
5111 *a–d*, C. M.; 13054, I. U. M.	8	Largest 175	Raspadura, Atrato Basin	"
5169 *a*, C. M.	1	240	Puerto Negria, Rio San Juan.	Eigenmann

Head 4.25–4.6; depth 3.2–3.8; D. 12; A. 10; scales 5–36 or 37–4; eye 4–5; interorbital 2–2.33 in the head. Origin of dorsal nearer snout than adipose; dorsal rounded, its height less than the length of the head; upper caudal lobe longer; pectoral equals head less opercle, or a little shorter.

Sides black; region below level of pectorals silvery; a bright silvery band from below eye to lower caudal lobe, a duller one from snout to upper caudal lobe, another from upper part of head to the middle one at a point on a vertical from the origin of the anal. Color-pattern most intense in the young, becoming obscure with age.

152. **Leporinus ecuadoriensis** Eigenmann and Henn. (Plate XX, fig. 6.)

"Raton."

Leporinus frederici (*non Salmo friderici* Bloch) Günther, Proc. Zoöl. Soc. London, 1859, p. 418 (Andes of Western Ecuador); Boulenger, Boll. Mus. Zoöl. Anat. Comp. Torino, 1898, No. 329, p. 4 (Rio Vinces).

Leporinus ecuadoriensis Eigenmann and Henn, Ann. Carnegie Mus., X, 1916, p. 88.

13116 *a*, I. U. M., *type*, 325 mm.; 5428 *a–b*, C. M.; 13116, I. U. M., six *paratypes*, largest 187 mm., Rio Barranca Alta near Naranjito.

5426 *a–i*, C. M.; 13113, I. U. M., nineteen, 128–264 mm., Vinces.

5427 *a–b*, C. M.; 13114, I. U. M., several, 210–240 mm., Guayaquil.

13115, I. U. M., several, Colimes.

Habitat: Guayas Basin of Ecuador.

The complete description of this species appears with the original description cited above.

This species differs from typical specimens of *L. friderici* from British Guiana, chiefly (*1*) in having the dorsal set farther back, *i.e.*, equidistant from snout and a point midway between the adipose and caudal; (*2*) in having the anal set somewhat farther forward and very seldom reaching the caudal; and (*3*) in the presence of three persistent lateral spots. *L. muyscorum* has the dorsal as in *L. friderici*, but the sharp caudal and the anal placed as in this species. *L. muyscorum* and the present form should probably be regarded as subspecies of *L. friderici*.

153. **Leporinus muyscorum** Steindachner. (Plate XX, fig. 5.)

"Quatrojo," "Monelolo."

Leporinus elongatus (*non* Cuvier and Valenciennes) Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1879, p. 53, plate X, figs. 3–5 (Magdalena); *ibid.*, XLII, 1880, p. 70 (Cauca near Caceres).

Leporinus muyscorum STEINDACHNER, *ibid.*, XLII, 1902, p. 142, plate II, fig. 2 (Rio Lebrija, Colombia).

Habitat: Lower Magdalena and Atrato Basins.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5709 *a–c*, C. M.; 13579, I. U. M.	11	140–212	Truando, Atrato Basin	Wilson
6696 *a–b*, C. M.; 13582, I. U. M.	4	139–190	Quibdo, Atrato Basin	"
5011 *a–c*, C. M.; 12813 *a–b*, I. U. M.	5	Largest 410	Quibdo, Atrato Basin	Eigenmann
5020 *a–b*, C. M.; 12814 *a–b*, I. U. M.	9	Largest 430	Soplaviento, Magdalena	"
5145 *a–b*, C. M.; 12893, I. U. M.	5		Soplaviento, Magdalena	"
5172 *a*, C. M.; 12988, I. U. M.	3	40–53	Soplaviento, Magdalena	"
5151 *a*, C. M.	1		Calamar Cienega, Magdalena	"
5170 *a*, C. M.; 12916, I. U. M.	2	145 & 175	Calamar Cienega, Magdalena	"
5171 *a*, C. M.; 12917, I. U. M.	3	41, 170, 220	Calamar Cienega, Magdalena	"
12927, I. U. M.	1		Cienega at Puerto Berrio, Magdalena Basin	Gonzales
5144 *a*, C. M.; 12901, I. U. M.	2		Below Buena Vista	Eigenmann
5022 *a–d*, C. M.; 12812, I. U. M.	14	Largest 393	Honda, Magdalena R.	"

Head in adult 4.2–4.66 (in those about 180 mm. long, 4–4.25); depth 3.8–4.5 (3.33–3.5); D. 12; A. 10; scales 5–40 to 43–5; eye 5–6 (4); interorbital 2 in head; depth of caudal peduncle equals postorbital part of head.

Origin of dorsal equidistant from tip of snout and origin of adipose (in the adults), posterior part of adipose (in half-grown), and caudal (in very young); dorsal rounded or subtruncate, its height equals head less the portion of the snout in front of the nares; distance between the dorsals greater than the length of the head, equal, or a little less than, the head in the half-grown; anal slightly concave, the highest ray reaching tip of last, sometimes not to the tip of the last in the adult.

Three black spots on middle line of sides; one below the posterior part of the dorsal, one in front of the anal, and one on the end of the caudal peduncle. These fade with age, the one on the caudal peduncle remains most prominent. Very small specimens have the three spots and about fifteen cross-bands on the upper half of the sides, shortest over the two anterior spots; fewer cross-bands on lower part of sides not directly continuous with the upper ones. These cross-bands break up and become obscured with growth, giving rise to the pattern described for the type of *muyscorum*. With age the surface-color replaces these juvenile markings. In life the ventrals, pectorals, anal, and caudal are pale yellow; an orange line extends below and back of the eye. The gill-membranes are yellow.

In the very young the proportions are: head 3.33–3.5; depth 3.25–3.75; origin of dorsal equidistant from snout and a point nearer caudal than adipose.

Subfamily Nannostomatinæ.

Characidium Reinhardt.

A widely distributed genus living like and resembling the species of *Etheostoma* of North America.

Key to the Species of Characidium.

a. Caudal with a sharply defined dot on the base of the middle caudal rays, the middle rays otherwise plain; a narrow band from tip of snout to, but not on, the middle caudal rays; ten or eleven chain-like cross-bars, a deeply lying crescent-shaped bar on the bases of the fully developed caudal rays; lateral line 32–35, depth 4.5–5; dorsal rounded, first fully developed anal ray extending beyond the tip of the penultimate..... **fasciatum** Reinhardt.

aa. Middle caudal rays dusky, darkened at base, but without a distinct spot; a broad black longitudinal lateral band, faint or absent on the head. Female and young with fourteen transverse bars, becoming broader and fewer with growth and scarcely evident in the adult; lateral line 32 or 33; depth 3.3–3.5; dorsal rounded, longest anal ray extending very little beyond the tip of the last. **caucanum** Eigenmann.

aaa. About ten dark bars across the lateral band; dark lines along the scales of the back; lateral line 36; depth 4–4.3; dorsal truncate; longest anal ray extending considerably beyond the tip of the penultimate ray..... **phoxocephalum** Eigenmann.

154. **Characidium fasciatum** Reinhardt.

This species was originally described from the Rio das Velhas in eastern Brazil. It has since been reported from Paraguay, the Essequibo and Orinoco Rivers, and from Canelos, Ecuador. For the full synonymy, etc. see Mem. Carnegie Mus., V, 1912, p. 291.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
4852 *a–j*, C. M.; 12705, I. U. M.	Many	—	Boca de Raspadura	Eigenmann
7663, C. M.; 15318, I. U. M.	Many	Largest 38	Raspadura	Wilson
7664, C. M.; 15319, I. U. M.	10	Largest 38	Managru	"
7665, C. M.; 15320, I. U. M.	13	Largest 33	Certegui	"
7666, C. M.; 15321, I. U. M.	Many	Largest 30	Truando	"
3847 *a*, C. M.	1	About 50	Cali	Eigenmann

155. **Characidium caucanum** Eigenmann. (Plate XIX, fig. 9.)

Characidium caucanum Eigenmann, Indiana University Studies No. 16, 1912, p. 25 (Cali; Piedra Moler; Cartago).

4847 *a*, C. M., *type*, 51 mm.; 4848 *a–j*, C. M.; 12701 *a–j*, I. U. M., thirty-two *paratypes*, Cali. Eigenmann.

4849, C. M.; 12702, I. U. M., two *paratypes*, largest 63 mm., Piedra Moler. Eigenmann.

4850, C. M.; 12703, I. U. M., two *paratypes*, largest 58 mm., Cartago. Eigenmann.

Habitat: Cauca Basin.

Head 3.75–4; depth 3.3–3.5; D. 11; A. 8 or 9; lateral line 32 or 33; eye .66–1 in snout, 3.5–4.5 in the head, 1–1.3 in interorbital. Seven scales between dorsal and ventral. Outer pectoral rays thickened; pectorals not reaching ventrals, ventrals to the anal in males.

Males with a dark lateral band from snout to middle of caudal, back dark with fainter streaks; female lighter, its dark median band crossed by numerous bands, which in the region of the anal extend entirely across the body.

156. **Characidium phoxocephalum** Eigenmann. (Plate XIX, fig. 8.)

Characidium phoxocephalum Eigenmann, Indiana University Studies No. 16, 1912, p. 26 (Paila).

4851, C. M., *type*, 68 mm., a female; 12704, I. U. M., *paratype*, 63 mm., Paila. Eigenmann.

Habitat: Cauca Basin.

Head 4; depth 4–4.3; D. 11 or 12; A. 8; lateral line 36; seven scales between dorsal and ventral. Eye equals snout, 4 in head, 1 in interorbital. Snout pointed, mouth subterminal, maxillary reaching to below anterior edge of eye; outer rays of pectoral thickened, the eighth ray longest, reaching to within one scale of the ventrals; ventrals not quite reaching to anal.

A dark bar from snout to middle caudal rays, crossed by about ten bars; dark line along the upper parts of the scales of the back; base of dorsal hyaline, next a dark band, then a series of hyaline spots, tips dusky; anal similar to dorsal; margins of thickened pectoral rays dark.

Similar to *caucanum* but slenderer, snout more pointed, and scales in lateral series more numerous.

Subfamily Pyrrhulininæ.

Pyrrhulina Cuvier and Valenciennes.

Type *Pyrrhulina filamentosa* Cuvier and Valenciennes. Small fishes. Premaxillary and dentary with two or more series of conical teeth; mouth very oblique.

157. **Pyrrhulina semifasciata** Steindachner.

This species, widely distributed in the Amazon and the Guianas, is recorded by Regan, Ann. & Mag. Nat. Hist. (8), X, 1912, p. 390, as having been collected by

Cutter at Bogotá and by Leighton at Honda. Bogotá is certainly not the place where Cutter secured his specimen. It probably came from the base of the Andes east of Bogotá, and may belong to *Pyrrhulina lugubris* Eigenmann, which is abundant between Cumaral, Villavicencio, and Barrigón in the headwaters of the Meta system.

I secured no specimens during my short stay at Honda.

Subfamily Lebiasininæ.

Lebiasina Cuvier and Valenciennes.

Walls of the anterior portion of the posterior air-bladder cellular; upper jaw with a single series of tricuspid teeth; lower jaw with two series, those of the outer tricuspid, those of the inner much finer, conical, recumbent; no canines; usually no adipose; lateral line short or obsolete.

This genus differs from *Piabucina* in the absence of an adipose, but a certain per cent. of specimens of *Lebiasina bimaculata* develop the adipose and an adipose is certainly occasionally developed in *Lebiasina multimaculata*.

Key to the Species of Lebiasina.

a. Sides with a faint band; a conspicuous black spot at base of middle caudal rays; a fainter one behind head; a spot at base of dorsal; depth 3.5–4..... **bimaculata** Cuvier and Valenciennes.

aa. Sides with a series of black spots; upper caudal lobe much longer than lower; depth 4.6–5. **multimaculata** Boulenger.

158. **Lebiasina bimaculata** Cuvier and Valenciennes. (Plate XXI, fig. 2.)

"Huaija, Chalquoque, Liza de Agua Dulce."

Lebiasina bimaculata Cuvier and Valenciennes, Hist. Nat. Poiss., XIX, 1846, p. 531, plate 587 (Rio Rimac near Lima); Günther, Proc. Zoöl. Soc. London, 1859, p. 418 (Andes of Western Ecuador); *ibid.*, 1860, p. 240 (Esmeraldas); Cat. Fishes Brit. Mus., V, 1864, p. 286 (Bay of Callao; Western Andes of Ecuador); Steindachner, Denkschr. Akad. Wiss. Wien, XLI, 1879, p. 22 (Rio Rimac near Callao and Lima; Rio Zurumilla; Pacasmayo); Eigenmann and Eigenmann, Proc. Cal. Acad. Sci., 2 Ser., II, 1889, p. 113; Boulenger, Boll. Mus. Zoöl. Anat. Comp. Torino, XIII, 1898, No. 329, p. 1 (Rio Vinces).

Habitat: Western slopes of Peru and Ecuador, from sea-level to over 7000 ft.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length of Largest in mm.	Locality.	Date.	Collector.
7669, C. M.; 15167, I. U. M.	Many	146	Puenta Piedra, near Lima	Jan. 29, 1919	Eigenmann
7670, C. M.; 15168, I. U. M.	Many	118	Rio Rimac, Lima	Aug. 1918	"
7671, C. M.; 15169, I. U. M.	Many	144	Rio Jequetepeque, at Llallan	Jan. 15, 1919	"
7672, C. M.; 15170, I. U. M.	Many	130 (to base of caudal)	Rio Jequetepeque, at Cultambo	Jan. 12, 1919	"
7673, C. M.; 15171, I. U. M.	Many	145	Piura, Rio Piura	Jan. 11, 1919	"
15202, I. U. M.	Many	115	Chosica, Rio Rimac	Oct. 10, 1918	"
15299, I. U. M.	1	29	Matucana, Rio Rimac	Aug. 1918	"
6638 *a–j*, C. M.; 13526, I. U. M.	137	120	Porto Viejo		Henn
13527, I. U. M.	8	93	Porto Viejo		"
6639 *a–j*, C. M.; 13528, I. U. M.	374	188	Vinces		"
13529, I. U. M.	20	110	Vinces		"
6640 *a–j*, C. M.; 13530, I. U. M.	100	135	Chone		"
13531, I. U. M.	4	120	Chone		"
6643, C. M.; 13502, I. U. M.	70	74	Colimes, Rio Daule		"
13533, I. U. M.	3	65	Colimes, Rio Daule		"
13069, I. U. M.	1	175	Rio Chanchan, Naranjito		"
Field Museum	1	85	Trujillo		Osgood

Out of a total of 715 specimens from Ecuador about 35 or 4.9 per cent. have the adipose developed and therefore might be referred to *Piabucina*. Specimens with a developed adipose were found at all places where a large number of specimens were collected. They do not differ in other respects from typical specimens. The adipose may be fully developed or may be a mere rudiment. One specimen in about two hundred taken in Piura, Peru, also has an adipose.

Head 4.3–4.5; depth 3.5–4; D. 9/1, 10/19; A. 10/18, 11/2; scales 25/1, 26/2, 27/2, 28/11, 29/4;* 6 and one-half between dorsal and ventrals; eye 4–6; interorbital 2.2–2.8. Middle caudal rays naked, the lobes scaled for about half their length.

A conspicuous small round spot at the base of the middle caudal rays, a more or less dark blotch on the bases of the dorsal rays; a dark humeral spot just behind the head; a dark band from the shoulder-spot to the caudal spot, most intense from above ventrals to above end of anal. This band fades out with age,

* The denominators give the number of specimens.

and in formalin specimens sometimes appears broken up into spots by the unequal effect of the formalin on the silvery markings of the scales; a bright red spot at the base of the scale on the lateral line just behind the shoulder-spot.

This species has recently been found useful because it feeds on the larvæ of the yellow-fever mosquito.

159. **Lebiasina multimaculata** Boulenger. (Plate XXI, fig. 3.)

Lebiasina multimaculata Boulenger, Ann. & Mag. Nat. Hist. (8), II, Feb. 1911, p. 212 (Condoto); Regan, Ann. & Mag. Nat. Hist. (8), XII, Nov. 1913, p. 463 (Condoto).

Piabucina aureoguttata (*non* Fowler) Regan, *loc. cit.* (Rio Lisa and Rio Tamama, San Juan Basin).

Habitat: San Juan and Atrato Basins, respectively of the Atlantic and Pacific slopes of northwestern Colombia.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
6681 *a–c*, C. M.; 12964, I. U. M.....	20	47–100	Condoto	Wilson
12965, I. U. M.....	2	84– 94	Tambo	"
5377 *a–c*, C. M.; 13068, I. U. M.....	11	Largest 177	Small creek near mouth of Rio Calima	Henn

Head 4.5–4.75; depth 4.6–5; D. 9/1, 10/8, 11/1; A.10½; scales 27/2, 28/3, 29/2, 30/2, six scales between dorsal and ventral; eye 5 in head; interorbital 2.25–2.5.

A few scales on the base of the middle caudal rays, the lobes well scaled for over half their length.

Three rows of red spots on each side; anal yellow, edged with black; base of caudal red, the remainder yellow; pectorals yellow; a red ring about the eye, a series of nine dark spots from the middle of the opercle to the caudal, the one at the base of the caudal most conspicuous; a dark humeral spot on second scale of the lateral line; all spots becoming fainter with age.

Regan recorded *P. aureoguttata* from the Rio San Juan. A re-examination of the specimens shows them to be *L. multimaculata* with adipose fins. One of our specimens from the Rio Calima, which in all other respects is like the rest from the same place, has a well-developed adipose behind the dorsal and would, if found alone, be referred without doubt to *Piabucina*.

Piabucina Cuvier and Valenciennes.

Piabucina Cuvier and Valenciennes, Hist. Nat. Poiss., XXII, 1848, p. 161.

Type: *Piabucina erythrinoides* Cuvier and Valenciennes. Like *Lebiasina*, but with an adipose. *P. erythrinoides* is found in Lake Maracaibo.

Habitat: Lake Maracaibo to eastern Ecuador; Guiana; western Ecuador to Panama.

KEY TO THE SPECIES OF PIABUCINA.

a. No spots on dorsal or caudal; no bands; D. 9; A. 11; depth 4; head 4.33; lateral line 28; eye equal to snout, 4.25 in head, 2 in interorbital; twenty-six teeth in upper jaw, thirty-two in lower. **festæ** Boulenger.

aa. A black spot on anterior dorsal rays, or one at base of caudal, or both spots present.

b. A dark lateral band; no spots along sides; head 3.5; depth 4; D. 10; A. 12; lateral line 30; a dark lateral band from humeral spot to dark area at base of caudal; a dark spot on base of dorsal. . . . . **panamensis** Gill.

bb. A dark lateral band along the upper parts of the sides; a series of spots more or less confluent along the middle of the sides, a narrow light streak between them. A small vertical spot at base of caudal; head 4.33; depth 4.2; D. 10; A. 11; lateral line 29. . . **aureoguttata** Fowler.

bbb. No dark lateral band. A series of dark spots along middle of sides; a dark spot on base of caudal; depth 4.5–5; head 4.5; D. 10; A. 11; lateral line 29. . . . . **astrigata** Regan.

160. **Piabucina festæ** Boulenger.

Piabucina festæ BOULENGER, Boll. Mus. Zoöl. Anat. Comp. Torino, XIV, No. 346, p. 1 (Laguna della Pita, Darien); JORDAN and EVERMANN, Bull. U. S. Nat. Mus., XLVII, 1900, p. 3145; REGAN, Biologia Centrali-Americana, Pisces, 1901, p. 168; MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 301 (Tuyra Basin).

Habitat: Panama.

Head 4.33; depth 4; D. 9; A. 11; scales 28; eight scales between dorsal and ventrals; eye 4.5; interorbital 2.25.

Dark above, light below; fins uniformly gray.

161. **Piabucina panamensis** Gill. (Plate XXI, figs. 4 and 5.)

Piabucina panamensis GILL, Proc. Acad. Nat. Sci. Phila., 1876, p. 336 (Rio Frijoli); JORDAN and EVERMANN, Bull. U. S. Nat. Mus., XLVII, 1896, p. 333; REGAN, Biologia Centrali-Americana, Pisces, 1907, p. 167; MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 300 (Toro Point, Agua Clara, Rio Indio, Gorgona, Empire, Culebra and Porto Bello, Atlantic side; Corozal, Araijan, Culebra, Rio Calobre, Bayano Basin; Cerro Azul, Pacific side of Panama).

Habitat: Panama on both slopes, Atrato Basin, and San Juan Basin.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5376 *a–y*, C. M.; 13067, I. U. M.....	306	Largest 100	Truando	Wilson
5114, C. M.; 12832, I. U. M.....	2	130, 149	Boca de Raspadura	Eigenmann
6683 *a–h*, C. M.; 12861, I. U. M.....	11	43–165	Raspadura	Wilson
13070, I. U. M.....	1		Calima, small creek near Boca del Guineo	Henn
12962, I. U. M.....	—	—	Istmina	Wilson
12963, I. U. M.....	—	—	Tambo	"

One of the specimens from Truando has no trace of an adipose, in four others it varies in its development from the merest rudiment to about one fifth of its normal size. It is possible that in some of the latter the fin has been mutilated or is regenerating.

Head 4–4.8; depth 3.25–3.75; D. 10; A. 10/4, 11/2; lateral line 28/5, 29/2;* eye 3–4.2; interorbital 2.5–2.75 in the length of the head.

162. **Piabucina aureoguttata** Fowler.

Piabucina aureoguttatus FOWLER, Proc. Acad. Nat. Sci. Phila., 1911, p. 513, fig. 6 (Tributary of the Rio Chimbo, near Bucay, Province Guayas, Ecuador).

Habitat: Western Ecuador.

Head 4.33; depth 4.2; D. 10; A. 11; scales 27; seven scales between the dorsal and ventral; eye 6 in head; interorbital 2.6.

A dark band from upper angle of gill-opening to adipose; a series of spots along middle of sides, a narrow light band between them. A narrow vertical spot at base of caudal. The spots along the middle of the sides are a little wider than in the figure, the light line a little narrower.

163. **Piabucina astrigata** Regan. (Plate XXI, fig. 6.)

Piabucina astrigata REGAN, Ann. & Mag. Nat. Hist. (7), XII, 1903, p. 622 (St. Javier, elev. 60 ft., Paramba, 3,500 ft., and the Rio Sapayo, N. W. Ecuador).

6682 *a–d*, C. M.; 13534, I. U. M., forty-two, largest 120 mm., Mindo, Ecuador (4,108 ft.). Henn.

Habitat: Ecuador, in the Mira, Santiago, and Esmeraldas Basins from near sea-level to over 4,000 feet elevation.

Subfamily CHEIRODONTINÆ.

This subfamily has recently been monographed by me in the Memoirs Carnegie Museum, VII, 1915, pp. 1–100, plates I–XVII, where figures and descriptions of the species will be found.

* The denominators indicate the number of specimens.

GRUNDULUS Valenciennes.

164. **Grundulus bogotensis** Humboldt.
"Guapuche."

Grundulus bogotensis EIGENMANN, Mem. Carnegie Mus. VII, 1915, p. 17, plate II, fig. 1, text-fig. 3 (Plains of Bogotá; Rio Chiquinquiseto, Boyaca; Quebrada Suaita, Santander).

This is one of the three species of fishes found on the plains of Bogotá, where it occurs in enormous numbers.

PHANAGONIATES Eigenmann and Wilson.

165. **Phanagoniates macrolepis** (Meek and Hildebrand).

Rœboides macrolepis MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1913, p. 84 (Rio Cupe).

Phanagoniates macrolepis MEEK and HILDEBRAND, *ibid.*, 1916, p. 272 (Tuyra Basin).

Phenagoniates wilsoni EIGENMANN, Indiana Univ. Studies No. 19, 1914 (Managru).

Phanagoniates wilsoni EIGENMANN, Mem. Carnegie Mus., VII, 1915, 43 (Managru; Certegui; Truando).

Habitat: Atrato and Tuyra Basins.

COMPSURA Eigenmann.

166. **Compsura gorgonæ** (Evermann and Goldsborough).

Cheirodon gorgonæ EVERMANN and GOLDSBOROUGH, Proc. Biol. Soc. Washington, XXII, 1909, p. 99, figs. 1 and 3 (Gorgona, Atlantic slope of Panama).

Cheirodon insignis EIGENMANN (in part), Mem. Carnegie Mus., VII, 1916, p. 69.

Compsura gorgonæ MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 274, text-fig. 2 (both slopes of Panama).

Habitat: Both slopes of Panama.

Upon a cursory examination of the typical specimens, I had identified this species with *Cheirodon insignis*. Mr. Hildebrand after a careful examination found it to belong to the genus *Compsura*, showing that all superficial examination of these minute fishes is without value.

PSEUDOCHEIRODON Meek and Hildebrand.

Pseudocheirodon MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 275.

Type, *Pseudocheirodon affinis* Meek and Hildebrand.

Scales on caudal of the male like those in the female; lateral line incomplete; interhæmal spines of the male not protruding; adipose fin well developed; teeth in part at least with five or more points. This genus is evidently very closely related to, if not synonymous with, *Mixobrycon*.

167. **Pseudocheirodon affinis** Meek and Hildebrand.

Cheirodon insignis (*non* Steindachner) Evermann and Goldsborough, Proc. Biol. Soc. Washington, XXII, 1909, p. 98, fig. 2 (Tabernilla, Atlantic slope of Panama).

Cheirodon insignis Eigenmann (in part), Mem. Carnegie Mus., VII, 1916, p. 69.

Pseudocheirodon affinis Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 275 (both slopes of the Canal Zone).

Habitat: Both slopes of Panama.

Cheirodon Girard.

168. **Cheirodon insignis** Steindachner.

Cheirodon insignis Eigenmann, Mem. Carnegie Mus., VII, 1915, p. 69, plate XVII, fig. 29 (Truando; Fundación).

Habitat: Atrato and Magdalena Basins.

Odontostilbe Cope.

169. **Odontostilbe hastata** Eigenmann.

Odontostilbe hastata Eigenmann, Indiana University Studies No. 18, 1913, p. 27 (Soplaviento; Bernal Creek); Mem. Carnegie Mus., VII, 1916, p. 91 plate XVI, fig. 7 (Soplaviento; Certegui; Quibdo; Truando).

Habitat: Magdalena and Atrato Basins.

Subfamily Bryconinæ.

Brycon Müller and Troschel.

Distributed from Guatemala to Buenos Aires and on both slopes of Colombia and Ecuador.

Mr. Samuel F. Hildebrand, looking over my material in connection with his study of Panama specimens, has kindly prepared the following brief key:

Key to the Species of Brycon.

a. Anal fin long, with more than thirty rays (*alburnus* rarely with only thirty).

b. Premaxillary teeth laterally in two series.

c. Scales small, sixty-three to eighty in lateral series.

d. Upper jaw strongly projecting; base of anal notably longer than head.

e. Teeth in lower jaw very large and strong, eight in outer series...**striatulus** (181).

ee. Teeth in lower jaw notably smaller, fourteen in outer series.....**chagrensis** (182).

dd. Jaws subequal, or the upper only slightly in advance of lower; base of anal shorter than head.

f. Scales sixty-three to sixty-eight; jaws subequal.....**alburnus** (170).

ff. Scales fifty-six to fifty-nine; lower jaw a little shorter than the upper. **atricaudatus** (171).

cc. Scales larger, fifty-three or fifty-four in lateral series.....**guatemalensis** (*extralimital*).

bb. Premaxillary teeth laterally in three series.

g. Scales small, sixty-six in a lateral series; D. 31; caudal spot indefinite, reaching end of caudal.....**rubricauda** (174).

gg. Scales small, sixty-seven to seventy in lateral series; A. 33–35; shoulder-girdle with distinct black border. No caudal spot.....**meeki** (172).

ggg. Scales larger, forty-eight to fifty-four in lateral series; shoulder-girdle without black border.....**dentex** (173).

aa. Anal fin shorter, with fewer than thirty-one rays.

h. Scales large, fifty-one or fewer in lateral series.

i. Base of anal notably shorter than head, with twenty-one to twenty-four rays; opercle with dark spot.....**henni** (157).

ii. Base of anal about equal to length of head, with twenty-four to twenty-eight rays; no opercular spot.

j. Upper jaw only slightly in advance of the lower; the second series of premaxillary teeth covered by lower lip; last series of premaxillary teeth close in front of outer mandibular teeth.....**argenteus** (176).

jj. Upper jaw more strongly projecting; second series of premaxillary teeth somewhat in advance of mandibular teeth, leaving a space between when mouth is closed. **oligolepis** (177).

hh. Scales smaller, fifty-three or more in lateral series.

k. Outer series of premaxillary teeth about twenty-four in number.....**moorei** (179).

kk. Outer series of premaxillary teeth about fourteen in number.

l. Body slender, the depth 3.15 to 3.9 in length; caudal spot not much longer than deep, and not extended to end of middle caudal rays; no shoulder-spot, except in very young **petrosus** (178).

ll. Body deeper, the depth about three in length; caudal spot very large, much longer than deep, extended to tips of middle caudal rays; a large obscure shoulder-spot present. **ecuadoriensis** (180).

170. **Brycon alburnus** (Günther). (Plate XXIII, fig. 2.)

"Dama."

Chalceus alburnus Günther, Proc. Zoöl. Soc. London, 1859, p. 419 (Western Andes of Ecuador).

Chalcinopsis alburnus Günther, Cat. Fishes Brit. Mus., V, 1864, p. 338.

Brycon alburnus Eigenmann and Eigenmann, Proc. U. S. Nat. Mus., XIV, 1891, p. 55; Boulenger, Boll. Mus. Zoöl. Anat. Comp. Torino, XIII, 1898, No. 329, p. 4 (Rio Peripa; Rio Vinces).

6618 *a–j*, C. M.; 13464, I. U. M., many, largest 184 mm., Colimes, Rio Daule. Henn.

6619 *a–b*, C. M.; 13465, I. U. M., seven, largest 326 mm., Vinces. Henn.

6621 *a–g*, C. M.; 13466, I. U. M., many, largest 214 mm., Rio Barranca Alta near Naranjito. Henn.

Habitat: Western Ecuador, in streams draining into the Bay of Guayaquil.

Jaws subequal; snout very sharply pointed; mandible with about ten teeth, the third mandibular tooth much larger than the first two; fang-like, separated from the fourth by an interspace; the teeth of the two rami arranged in a narrow crescent; premaxillary teeth in three series; seven small teeth in the outer series, about eight teeth in the inner series, which is bent forward opposite the fang of the lower jaw, the teeth being smaller at this point; two or three teeth between the outer and inner series; no marked difference in size between the last premaxillary and first maxillary teeth; head 3.5–3-6; depth equal to head; base of anal a little shorter than the head; D. 11; A. 30/1, 32/4, 33/2, 34/2; scales 11 or 12 — 63/3, 64/1, 66/1, 67/2, 68/2 * — 4.5 or 5, about thirty predorsal scales; eye 4.5–5; interorbital 3–3.75; gill-rakers fourteen; origin of dorsal equidistant from end of lateral line and anterior margin or middle of eye.

Humeral girdle margined with dark in the adult; an obscure humeral spot; a large conspicuous oval spot on the middle of the caudal peduncle, fading out forward and narrowly extending on the bases only of the middle caudal rays; sometimes faint zig-zag lines between rows of scales and sometimes vertical lines; all the fins frequently dark; caudal narrowly margined with dark.

171. **Brycon atricaudatus** (Kner). (Plate XXIII, fig. 3.)

"Sabalo."

Chalceus atricaudatus Kner, Sitzb. Bayer. Akad. Wiss. München, 1863, p. 227; Kner and Steindachner, Neue Fische aus Cent. Am., Abhand. Bayer. Akad. Wiss. München, X, 1864, p. 44, plate IV, fig. 3 (Western Ecuador).

Brycon atricaudatus Günther, Cat. Fishes Brit. Mus., V, 1864, p. 336; Boulenger (part), Boll. Mus. Zoöl. Anat. Comp. Torino, XIII, 1898, No. 329, p. 3 (Paramba, Rio Mira; Rio Peripa; (?) Rio Zamora); Pellegrin, Mission Geod. de l'Equateur, 1912, IX, p. B, 5; Starks, Proc. U. S. Nat. Mus., XXX, 1906, p. 777 (Payta and Eten, Peru).

Brycon scapularis Fowler, Proc. Acad. Nat. Sci. Phila., Sept. 1911, p. 502, fig. 3 (Chimbo River near Bucay, Province Guayas, Ecuador).

* The denominators give the number of specimens.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Date.	Collector.
6622 *a*, C. M.; 13463, I. U. M.	3	167–273	Rio Barranca Alta, Naranjito, Ecuador		Henn
9328, Stanford U.	4	103–132	Paita, Peru		P. O. Simons
7685 *a–c*, C. M.; 15158, I. U. M.	Many	40–142	Sullana, near Paita	Jan. 1919	Eigenmann
7686 *a–c*, C. M.; 15160, I. U. M.	Many	Largest 137	Piura, Rio Piura	Jan. 1919	"
15159, I. U. M.	4	Largest 155	Cultambo, near Pacasmayo	Jan. 12, 1919	"
7687 *a–c*, C. M.; 15161, I. U. M.	Many	Largest 237	Llallan, near Pacasmayo	Jan. 15, 1919	"

Habitat: Western slopes of southern Ecuador and northern Peru.

Snout moderately pointed; lower jaw a little the shorter; mandible with ten or eleven similar teeth; first, second, and third, or second, third, and fourth teeth of the mandible of nearly uniform size, closely set, graduated from the last of these backward; teeth of the two sides in a wide crescent; premaxillary teeth in three series; seven or eight closely set teeth in the outer row, four to six teeth in the inner series, two or three between these; a distinct break between the series of premaxillary and maxillary teeth, the latter smaller. Head 3.6–3.8; depth equal to head; base of anal shorter than head by the prenasal portion of the snout or less; D. 11; A. 31; scales 8 or 9–56 to 59–4; eye 3.75–5; interorbital 3–3.3; gill-rakers 14. Origin of dorsal equidistant from end of lateral line and snout or nares; pectorals reaching ventrals in young.

A large oval black spot on the middle of the caudal peduncle, fading out forward and on the middle caudal rays; an obscure humeral spot or bar.

These characters were drawn from the Naranjito specimens, which are typical. In the Paita specimens (9328, Stanford University) there is a sharply defined humeral spot, while the caudal spot is lacking. The anal has twenty-nine or thirty rays; there are ten scales between the dorsal and the lateral line and five between the ventrals and the lateral line.

The species *atricaudatus* has been known from the type, from two specimens 150 and 170 mm. long from Paramba, Rio Chota, and from ten specimens in the British Museum from the Rios Mira, Peripa, and Zamora. Boulenger gives the formula for these as: Head 3.75/1, 3.8/4, 4/2, 4.5/1, 4.66/2; Depth 3/2, 3.5/7, 3.6/1, A. 27/1, 28/1, 29/1, 30/1, 31/3, 32/1, 33/2. Lateral line 46/1, 47/1, 48/1, 49/2, 50/2, 51/1, 55/1, 58/1. Scales between the lateral line and dorsal as 8/3, 9/3, 10/4.*

* The denominators give the number of specimens.

Boulenger considers *B. moorei* synonymous with *B. atricaudatus*, but a comparison of typical specimens of the two species shows them to be quite different. Considering the great variation in the scales as given by Boulenger it seems quite probable that Boulenger has confused specimens of *B. oligolepis* with specimens of *B. atricaudatus*, in which case the specimens from the Mira are probably *B. oligolepis*.

I have examined the type of *B. scapularis* and it is without doubt an *atricaudatus*.

The specimens from Piura, all of which had been starved, are slender, the lower jaw is oblique, the lower lip in some is thin and very wide, projecting beyond the margins of the snout; the lower fins are greenish yellow in life, merging into rose, bordered by hyaline or dusky. The sides are marked with thin vertical lines.

172. **Brycon meeki** Eigenmann and Hildebrand. (Plate XXIII, fig. 4.)

Brycon striatulus (*non* Kner) Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 462 (Rio San Juan, Colombia).

Brycon atricaudatus (*non* Kner) Eigenmann, Indiana University Studies, 18, 1913, p. 27 (Rio Dagua).

Brycon meeki Eigenmann and Hildebrand, Proc. Amer. Philos. Soc., LVI, 1917, p. 688.

6614, 6623, 6632–6635, C. M.; 12982–12985, 12987, 13461, 13467, I. U. M., numerous specimens, largest 315 mm., collected January 13–17, 1913, at numerous stations on the Telembi River from Barbacoas to eight miles above. Henn and Wilson.

6613 *a–f*, C. M.; 13460, I. U. M., Magui River, tributary of Patia. Henn.

6617 *a–j*, C. M.; 13459, I. U. M., Patia half-way between Magui and Telembi Rivers. Henn.

6624 *a*, C. M., one, 244 mm., Rio Calima, small creek near Boca del Guineo. Henn.

12912, I. U. M., one, 190 mm., Creek near mouth of San Juan. Henn.

6637 *a–h*, C. M.; 12988, I. U. M., young, Condoto, Feb. 1913. Wilson.

5164 C. M., 302 mm., Puerto Negria. Eigenmann.

5167 *a–b*, 6636 *a–d*, C. M.; 12914, I. U. M., 12986, I. U. M., many, 41–58 mm., Istmina. Eigenmann and Wilson.

5156 *a*, 5168 *a–h*, C. M.; 12913, 12915, I. U. M., thirty-five, 70–322 mm., Caldas and mouth of Dagua River. Eigenmann.

Habitat: Rios San Juan, Dagua, and Patia of the Pacific drainage of Colombia.

Teeth of the sides of the mandible abruptly smaller behind the fourth, the first three or four subequal; lower jaw much the shorter. Premaxillary teeth in

four or more recognizable series; caudal spot obscure or absent; anal basis longer than the head; maxillary more than 3 in the head; gill-rakers seventeen or eighteen. Scales 12 to 14–67 to 70–7 or 8; D. 11, rarely 10; A. 33/2, 34/5, 35/2;* head 4.3; depth 3–3.25; eye 3–4; interorbital 2.25–2.75; premaxillary with six to nine very slightly graduated teeth in a regular outer series, the first tooth, and if nine, the last also, withdrawn somewhat from the line; about six teeth in the second series, more or less parallel with the first, sometimes the last tooth might be counted with either the first or second series; five teeth in the third series, which extends from the first tooth of the first series to the third of the innermost series; five or six teeth in the inner series; a single tooth in front of the first tooth of the inner series may be counted as the fourth series.

A conspicuous black border upon the shoulder-girdle in the adult; sometimes vertical lines on the sides; no caudal spot.

This species was named by Eigenmann and Hildebrand in honor of their late friend, Dr. Seth E. Meek, Curator of Fishes in the Field Museum of Natural History, who contributed much to our knowledge of the fishes of Central America and Mexico and who in his zeal for exploration in the tropics contracted the disease which caused his death on July 6, 1914.

This species is very highly prized as a food-fish in Western Colombia.

173. **Brycon dentex** Günther. (Plate XXII, fig. 1.)

"Sabalo."

Brycon dentex Günther, Proc. Zoöl. Soc. London, 1860, p. 240 (Esmeraldas, Ecuador); Boulenger, Boll. Mus. Zoöl. Anat. Comp. Torino, XIII, 1898, No. 329, p. 3 (Rio Peripa).

Chalcinopsis dentex (*in part*) Günther, Cat. Fishes Brit. Mus., V, 1864, p. 337 (Esmeraldas).

6620 *a–c*, C. M.; 13462, I. U. M., nine, 43–147 mm., Colimes, Rio Daule. Henn. 15048, I. U. M., one, 340 mm., Guayaquil market. Henn.

Habitat: Western slope of Ecuador.

Head 4.33–4.6; depth about 3.75; scales 8–48 to 54–4 to ventrals; D. 11; A. 34/2, 35/3, 37/2, 38/3;† eye 3; interorbital 3; teeth very similar to those in *B. striatulus* with probably a difference in the number of teeth in some of the series.

Silvery, without distinct markings.

Regan has pointed out that Günther confused two species under *B. dentex*, and that his specimens from the north are *B. guatemalensis*. I entirely agree with

* Denominators indicate number of specimens.

† The denominators give the number of specimens.

this conclusion. The fancied resemblance of the faunas of western Ecuador and Guatemala is entirely due to the "lumping" of species from the two localities. If my identification and also that of Boulenger are correct, this species is found in both northern and southern Ecuador.

174. **Brycon rubricauda** Steindachner.

Brycon rubricauda Steindachner, Sitzb. Akad. Wiss. Wien, LXXX, 1879, p. 186 (Cauca); Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 77, plate VIII, figs. 1 and 1*a* (Cauca near Caceres).

Habitat: Cauca River.

Head 4.5; depth 3.25; D. 11; A. 31; eye 4; interorbital 2.6; scales 12–66–6; caudal spot indefinite, reaching to end of caudal.

I did not succeed in securing specimens of this species from the Magdalena Basin. Among the species of trans-andean Colombia the possession of four series of teeth in the premaxillary places it nearest *B. meeki* and *B. dentex*.

175. **Brycon henni** Eigenmann. (Plate XXII, fig. 2.)

Brycon henni Eigenmann, Indiana University Studies No. 18, 1913, p. 26 (Upper Cauca and Dagua).

Habitat: Rios San Juan, Dagua, and Patia of the Pacific slope and upper Cauca of the Atlantic drainage. Most abundant in the Dagua, rare in the Patia.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5152, C. M.	*Type*	247	Caldas	Eigenmann
5153 *a–f*, C. M.; 12902 *a–e*, I. U. M.	*Paratypes* 21	Largest 270	Caldas	"
5154 *a–o*, C. M.; 12903, I. U. M.	*Paratypes* 4 6 18	235, 240, 290, 325; 60–107; largest 50	Cisnero	"
5155 *a–c*, C. M.; 12904, I. U. M.	*Paratypes* 6	34–165	Cali	"
5156 *a–e*, C. M.; 12905, I. U. M.	*Paratypes* 9	32–110	Paila	"
5158 *a–z*, C. M.; 12907, I. U. M.	164	Largest 74	Cartago	"
5157 *a–z*, C. M.; 12906, I. U. M.	*Paratypes* 70	Largest 83	Piedra Moler	"
	1	100	Patia at mouth of Rio Guaitara, March 13–14, 1913	Henn

This species is readily distinguished from all other species of this genus found in Colombia and on the Pacific slope by its short anal, its scales, and the color.

Head 3.66–3.8; depth 3.5–3.66; D. 11, rarely 10; A. 21/2, 22/8, 23/4, 24/3;* scales 7 to 9–48 to 51–5 or 6; eye 4.5–5 in the head; interorbital 2.75–3; gill-rakers 12; origin of dorsal very little nearer end of lateral line than tip of snout; origin of anal a little more remote from the snout than the last dorsal ray; opercle with an irregular black spot at its middle; caudal spot ill defined at the end of the peduncle, continued on the interradial membranes of the middle caudal rays to their tip; sides with vertical lines, and obscure humeral bar. Premaxillary with an inner and an outer series of teeth and three or four teeth between the anterior halves of the two series. Preventrals distinctly rounded; scales large. Base of anal a little less than length of head without the opercle.

176. **Brycon argenteus** Meek and Hildebrand.

Brycon argenteus Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1913, p. 84 (Pacific slope of Eastern Panama; Rio Aruza at Aruza); *ibid.*, 1916, p. 298, plate XXV (Rio Chorrera, Bayano and Tuyra Basins).

Habitat: Pacific slope of Panama.

Base of anal equal to or a little longer than head; head 3.8–4 in the length, scales 51–56. A well-defined oval, slightly asymmetric, spot on the end of the caudal peduncle, encroaching a little on the bases of the middle caudal rays, not continued to the middle of these rays. Upper jaw projecting but slightly beyond the lower; second series of premaxillary teeth covered by the lower lip; last series of premaxillary teeth close in front of outer mandibular teeth.

This species is very closely related to *B. oligolepis*, differing only in the points mentioned above. It is found from the Tuyra to the Canal Zone on the Pacific slope of Panama, *B. oligolepis* being found south of the Tuyra on both slopes.

177. **Brycon oligolepis** Regan. (Plate XXII, fig. 3.)

?*Brycon atricaudatus* Boulenger (part ?), Boll. Mus. Zoöl. Anat. Comp. Torino, XIII, 1898, No. 329, p. 3 (Mira).

Brycon oligolepis Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 462 (Rio Condoto and Western Ecuador).

Habitat: Patia, Dagua, and San Juan Rivers of the Pacific slope; Raspadura on the Atrato of the Atlantic slope.

* The denominators indicate the number of specimens.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Date.	Collector.
6626–6629, C. M.; 12975–12979, 15057, I. U. M.	Many	Largest 241	Rio Telembi between Barbacoas and the Yambi	Jan. 13–16, 1913	Henn and Wilson
6625 *a*, C. M.; 13458, I. U. M.	3	Largest 106	Patia at mouth of Rio Guaitara	March 13–14, 1913	Henn
5160 *a–l*, C. M.; 12909, I. U. M.	74	105–228	Caldas, R. Dagua		Eigenmann
5161 *a–j*, C. M.; 12910, I. U. M.	80	30–238	Cisnero, R. Dagua		"
5159 *a–d*, C. M.; 12908, I. U. M.	7	158–220	Cordova, R. Dagua		"
6616, C. M.; 13457, I. U. M.	9	Largest 120	Small creek near mouth of Calima, San Juan		Henn
6630 *a–b*, C. M.; 12980, I. U. M.	—		Istmina	Feb. 1913	Wilson
6631 *a–f*, C. M.; 12981, I. U. M.	28	Largest 149	Condoto	Feb. 1913	"
6615, C. M.	1	140	Raspadura	Feb. 1913	"
13469, I. U. M.	1	155	Quibdo		Eigenmann

Head 3.8–4.2; depth 3.4–3-5; D. 11/8, 12/1; A. 25/2, 26/3, 27/11, 28/12, 29/6, 30/2;* Lateral line 44/1, 46/2, 47/4, 48/5, 49/12, 50/4, 52/1;* Scales 8 or 8.5–44 to 523.5 or upper jaw more strongly projecting, second series of premaxillary teeth somewhat in advance of mandibular teeth, leaving a space when the mouth is closed; thirteen gill-rakers; caudal spot faint.

It seems quite probable that Boulenger confused specimens of this species with *B. atricaudatus*. This species is very abundant in the Patia, Dagua, and San Juan Rivers and probably extends to the Esmeraldas. A single specimen was taken by Wilson at Raspadura in the Atrato Basin at a point near the upper San Juan, and another by Eigenmann at Quibdo on the Atrato.

178. **Brycon petrosus** Meek and Hildebrand. (Plate XXIII, fig. 1.)

Brycon petrosus Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, p. 84; *loc. cit.*, 1916, p. 297, plate XXIV (Rio Chagres).

Habitat: Chagres Basin of Panama.

I have examined specimens collected by Meek and Hildebrand in the Rios Mandingo, Indio, and Gatun.

A. 29; scales 10–54–5 left, 10–58–5 right side (10–56–4.5); outer series of

* The denominators give the number of specimens, the numerators the number of rays, or scales, as the case may be.

premaxillary teeth about 14; depth 3.15–3.9; caudal spot not much longer than deep, not extending to the end of the middle caudal rays.

179. **Brycon moorei** Steindachner.

Brycon moorei Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 58, plate V, figs. 2 and 2*b* (Rio Magdalena); *ibid.*, XLII, 1880, p. 78 (Cauca near Caceres).

Habitat: Magdalena Basin.

A large game-fish, abundant in the Magdalena, where we caught it with hook and line trailed over the side of the steamer whenever the boat stopped. It is not very highly esteemed as food.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5146 *a–b*, C. M.; 12858, 12859, I. U. M.	4	Largest 400	Soplaviento	Eigenmann
5150 *a*, C. M.; 12863 *a–b*, I. U. M.	–		Calamar	"
12861 *a*, I. U. M.	3		Magdalena	"
5148, C. M.	1		Puerto Wilches	"
5149, C. M.; 12863, 12863, I. U. M.	–		Puerto Berrio	"
5147, C. M.	1		Honda	"

Head 4–4.5; depth 3–3.5; anal base about 4 in the length; D. 11; A. 27/6, 28/2; Scales 11– 55/2,–57/2,–59/1,–60/1–6/1 or 7/6;* interorbital 2–2.33 in the head; about 24 teeth in outer series of premaxillary; gill-rakers 17; upper part of sides, especially on the tail with longitudinal lines between the rows of scales, a longitudinally oval humeral spot. Caudal spot large, diffuse, shading to the end of the middle caudal rays and forward.

180. **Brycon ecuadoriensis** Eigenmann and Henn. (Plate XXII, fig. 4.)

Brycon ecuadoriensis Eigenmann and Henn, Proc. Amer. Philos. Soc., XVI, 1917, p. 687 (Rio Barranca Alta near Naranjito, Ecuador).

Habitat: Rio Barranca Alta, a coastal stream of Ecuador, south of Guayaquil.

Head 3.6; depth 3.3; D. 11; A. III, 29.5; scales 9–56–4 to ventrals; eye about 4.1; base of anal equals length of head.

Additional descriptive details will be found in the original description.

Dark on sides and above, a steel-blue or brassy luster; fins dusky; a large, obscure, humeral band; a large black spot on the caudal peduncle, fading out forward and most intense toward its end, where it is continued to the tips of the membranes of the middle caudal rays.

* The denominators indicate the number of specimens examined.

In its general characters this species greatly resembles *B. atricaudatus*, living in the same waters. It differs notably in the teeth of both the premaxillary and the mandible; in its dentition it agrees closely with *B. oligolepis*, from which it differs in its shape, color, scales, etc.

181. **Brycon striatulus** (Kner).

Chalcinopsis striatulus Kner, Sitzb. Bayer. Akad. Wiss. München, 1863, p. 226; Kner and Steindachner, Abhandl. Bayer. Akad. Wiss. München, 1864, p. 38, plate V, fig. 2 (New Granada and Pacific side of Panama).

Brycon striatulus Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1914, p. 109; *ibid.*, X, 1916, p. 294 (Rio Chorrera; Rio Juan Diaz; Rio Bayano; Tuyra Basin).

Habitat: Pacific slope of Panama from the Canal Zone to the Tuyra. 3955 C. M., three, Rio Frijoles; 14026, I. U. M., one Boca de Cupe, R. Fugra.

Base of anal notably longer than head; scales 63–80; upper jaw strongly projecting; teeth in lower jaw very large and strong, eight, rarely seven or nine in the outer series; teeth on outer edge of maxillary very small, nine to ten in number; eighteen to twenty-one scales between dorsal and adipose.

182. **Brycon chagrensis** (Kner).

Chalcinopsis chagrensis Kner, Sitzb. Bayer. Akad. Wiss. München, 1863, p. 226; Kner and Steindachner, Abhandl. Bayer. Akad. Wiss. München, 1864, p. 42, plate V, fig. 3 (Rio Chagres).

Brycon chagrensis Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 295 (Chagres Basin).

Habitat: Chagres Basin, Panama.

I have examined several specimens (14021–14023, I. U. M.) from the Rio Gatun, and five (C. M., No. 3954) from the R. Fugra, collected by Meek and Hildebrand.

Teeth in lower jaw small, thirteen to fourteen in outer series; teeth on outer edge of maxillary moderately developed, twelve to thirteen in number; twenty-one to twenty-five scales between dorsal and adipose.

Othonophanes Eigenmann.

183. **Othonophanes labiatus** (Steindachner).

Brycon labiatus Steindachner, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 75, plate III, fig. 1 (Cauca near Caceres); *ibid.*, LXXII, 1902, p. 143 (Baranquilla; Barrancas on Rio Lebrija).

Habitat: Magdalena Basin.

I did not succeed in securing any specimens of this species.

Subfamily Tetragonopterinæ.

This subfamily has recently been monographed by me in "The American Characidæ" published in the Memoirs of the Museum of Comparative Zoölogy, Vol. XLIII, 1917. All of the species are fully described and most of them figured therein, so that in the present account I have limited myself to a list of the species, to keys, and references to the monograph, where a fuller treatment of each species may be found.

Pseudochalceus Kner.

Pseudochalceus Kner, Sitzb. Akad. Wiss. München, 1863, p. 225.

Type, *Pseudochalceus lineatus* Kner.

184. **Pseudochalceus lineatus** Kner.

Pseudochalceus lineatus Kner, Sitzb. Akad. Wiss. München, 1863, p. 225; Kner and Steindachner, Abhandl. Bayer. Akad. Wiss. München, X, 1864, p. 35, plate V, fig. 1 (Western Ecuador); Wagner, *ibid.*, 1864, p. 98; Eigenmann, Mem. Mus. Comp. Zoöl., 1921, p. 227, plate 64, figs. 3 and 5.

This species is known from the types in the Vienna Museum. Wagner states that it occurs only at about 1,000 feet elevation.

Hyphessobrycon Durbin.

This genus is found from southern Mexico and Guatemala southward to Ecuador. The species are abundant east of the Cordilleras. Two species in the area under consideration, *H. daguæ* and *H. inconstans*, vary, and appear to indicate a transition into the genus *Astyanax*. For detailed accounts of the species *Cf.* Mem. Mus. Comp. Zoöl., XLIII, pp. 172–221.

185. **Hyphessobrycon inconstans** (Eigenmann and Ogle).

Hyphessobrycon inconstans Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, p. 199, plate 27, figs. 1, 2; plate 33, figs. 1, 2 (Quibdo; Soplaviento; Calamar; Cienega at Calamar; Puerto Wilches; Buena Vista; Honda; Bernal Creek).

Habitat: Amazon; Magdalena from Calamar to Honda; Atrato.

186. **Hyphessobrycon pœcilioides** Eigenmann. (Plate XXIV, fig. 1.)

Hyphessobrycon pœcilioides Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, p. 211 (Cali).

Habitat: Upper Cauca Basin.

187. **Hyphessobrycon ecuadoriensis** Eigenmann and Henn.

Hyphessobrycon ecuadoriensis EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, p. 218, plate 93, fig. 6 (Vinces).

Habitat: Southwestern Ecuador.

188. **Hyphessobrycon panamensis** Durbin.

Hyphessobrycon panamensis EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, p. 186, plate 26, fig. 1; plate 33, fig. 4 (Calamar; Tambo; Raspadura; Managru; Certegui; Truando; Calima; Condoto; Istmina); MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 287 (Chagres).

Hyphessobrycon condotensis REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 465 (Rio Condoto, Rio San Juan).

Habitat: San Juan, Atrato, lower Magdalena and Chagres Basins.

189. **Hyphessobrycon panamensis daguæ,** var. nov.

Habitat: Dagua and Patia Basins.

Mr. S. F. Hildebrand examined part of the material enumerated under *panamensis* and *daguæ* and writes:

"Your specimens labeled as *H. panamensis* and *H. panamensis daguæ*, can apparently be separated into two fairly distinct groups—those from the Rio Dagua and Rio San Juan having twelve scales in a vertical series between base of ventrals and base of dorsal—and those from the Atrato Basin having ten scales in this vertical series.

"The former, with respect to the scales, are like our Panama specimens, but they are larger, and the lateral line is often nearly complete, which is never the case in the Panama specimens; the fins also have fewer punctulations. In the Panama specimens, the anal fin usually has a dark tip.

"The Atrato Basin specimens differ from both the Panama, and the Dagua and San Juan specimens in the fewer scales in the vertical series. In size they agree with the Panama specimens, but in color with the Dagua and San Juan specimens. The development of the lateral line in them is identical with the Panama specimens."

ASTYANAX Baird and Girard.

This genus is monographed in my larger work on "The American Characidæ," Mem. Mus. Comp. Zoöl., XLIII, where full descriptions, list of specimens, etc., will be found.

KEY TO THE SPECIES OF ASTYANAX.

a. Predorsal line usually without a complete median series of scales, usually partly naked and partly covered by the bent-over margins of the scales of either side of the middle line.

b. Scales below the lateral line in series parallel to the line except on the anal muscles (*Pœcilurichthys*).

c. Two conspicuous humeral spots; maxillary without teeth; A. 33–40; lateral line 41–47. **festæ** (Boulenger).

cc. A single horizontally oval humeral spot.

d. Anal with 36–39 rays; lateral line 39 or 40. . . . . **borealis** Eigenmann.

dd. Anal with 30–33 rays; lateral line 37–41; depth 2.4. . . . . **orthodus** Eigenmann.

bb. Scales below the lateral line and behind the pectorals decurrent to the anal; preventral area with modified scales (*Zygogaster*).

e. Second suborbital leaving a narrow naked area on the cheek, except sometimes in very old individuals.

f. Anal rays 36–41; depth 2.4–3. . . . . **stilbe** (Cope).

ff. Anal rays 33–34; depth 2–2.33. . . . . **magdalenæ** Eigenmann and Henn.

cc. Second suborbital in contact with the preopercle below, except in young specimens.

g. Dorsal and ventrals in the male not filamentous; origin of the anal in the male nearer the base of the last anal ray than to the origin of the dorsal; anal rays 37–42.

h. Depth 1.9–2.2. . . . . **atratoënsis** Eigenmann.

hh. Depth 2–2.33. . . . . **caucanus** (Steindachner).

gg. First dorsal and outer ventral rays filiform in the male; origin of anal nearer origin of dorsal than base of last anal ray in the male; depth in the male 3, in the female 2.5; A. 38 or 39; lateral line 38 or 39. . . . . **filiferus** Eigenmann.

aa. Predorsal area completely scaled (*Astyanax*).

i. Lateral line 50–55; A. 23–25. . . . . **microlepis** Eigenmann.

ii. Lateral line with less than forty-two scales.

j. Third mandibular tooth normal. Anal usually with twenty-five or more rays.

k. No caudal spot; A. 31; lateral line 35; maxillary with four teeth. . **daguæ** Eigenmann.

kk. A conspicuous caudal spot not continued to the end of the middle rays.

l. A. 23–28; eye 3 in the head, 1.2 in the interorbital, maxillary equals snout; depth 2.2–2.75; caudal spot conspicuous, across the entire caudal peduncle in younger individuals. . . . . **ruberrimus** Eigenmann.

kkk. A black caudal band, extending to the end of the middle rays, sometimes faint, or absent.

m. Depth of caudal peduncle usually more than half the length of the head; usually one maxillary tooth; depth 2.3–3; scales below the lateral line in series parallel with it.

n. Caudal band simple, median. . . . . **fasciatus** (Cuvier).

nn. Caudal band median, a spur from its base extending downward. **fasciatus heterurus** Eigenmann and Wilson.

jj. Middle point of the third mandibular tooth recurved, thorn-like; depth 2.6–2.75; A. 24. **aurocaudatus** Eigenmann.

190. **Astyanax festæ** (Boulenger).

Astyanax festæ EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 236, plate 40, fig. 4; plate 95, fig. 5 (Vinces; Colimes; Puerto Viejo; Chone; Rio Chanchan; Mirador).
Habitat: Western Ecuador, from Puerto Viejo southward.

191. **Astyanax bimaculatas borealis** Eigenmann.

Astyanax bimaculatas borealis EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 254 (Cauca near Caceres; Magdalena).
Habitat: Lower Magdalena Basin.

192. **Astyanax orthodus** Eigenmann.

Astyanax orthodus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 260, plate 42, fig. 3 (Truando; Quibdo; Creek Altacar near Barbacoas).
Habitat: Atrato and Patia Basins.

193. **Astyanax stilbe** (Cope).

Astyanax stilbe EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 263, plate 43, fig. 3 (Pará; Truando; Quibdo; Certegui).
Habitat: Atrato Basin and Pará.

194. **Astyanax magdalenæ** Eigenmann and Henn. (Plate XXIV, fig. 2.)

Astyanax magdalenæ EIGENMANN and HENN, Ann. Carnegie Mus., X, 1916, p. 89 (Girardot; Apulo); EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 265 (Girardot; Apulo).
Habitat: Upper Magdalena Basin.

195. **Astyanax atratoënsis** Eigenmann.

Astyanax atratoënsis EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 266, plate 43, fig. 2 (Truando; Quibdo).
Habitat: Atrato and Magdalena Basins.

196. **Astyanax caucanus** (Steindachner).

Astyanax caucanus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 268, plate 43, fig. 1 (Soplaviento; Calamar; Calamar Cienega; Puerto Wilches; Buena Vista; Peñas Blancas; Puerto del Rio; Honda; Girardot).
Habitat: Magdalena Basin.

197. **Astyanax filiferus** (Eigenmann).

Astyanax filiferus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 269, plate 51, fig. 2 (Apulo).

Habitat: Upper Magdalena Basin.

198. **Astyanax microlepis** Eigenmann.

Astyanax microlepis EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 274, plate 48, fig. 4 (Piedra Moler; Cartago; Paila; Cali).

Habitat: Upper Magdalena Basin.

199. **Astyanax daguæ** Eigenmann.

Astyanax daguæ EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 282, plate 33, fig. 3 (Cordova).

Habitat: Rio Dagua.

200. **Astyanax ruberrimus** Eigenmann.

Astyanax ruberrimus MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 281 (the most abundant of all the fishes of Panama, extending from the lowlands to the highest mountain streams, and present on both slopes of Panama); EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 284, plate 44, fig. 1 (Istmina; Puerto Negria; Mouth of Cucurrupi; Condoto; Rio Calima; Rio Munguido; Cordova; Barbacoas, Creek Altacar of Rio Telembi; Mouth of Rio Guaitara; Rio Patia; Rio Obispo).

Astyanax æneus REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1914, p. 465.

Habitat: Both slopes of Panama; and Pacific drainage area of Colombia.

201. **Astyanax fasciatus** (Cuvier).

Astyanax fasciatus MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 280 (Pacific slope of Panama); EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 293, plate 45, figs. 1 and 2, plate 95, fig. 1 (Atrato Basin at Quibdo, Boca de Certegui, Boca de Raspadura, Truando, Managru, and Raspadura; San Juan Basin at Condoto; Cauca Basin at Piedra Moler, Cartago, Paila, and the Cauca River near Cali; and Magdalena Basin at Calamar, Puerto Wilches, Puerto Berrio, Peñas Blancas, Buena Vista, Honda, Girardot, and Apulo).

Habitat: Pacific slope of Panama; Atrato Basin; Magdalena Basin; and rarely in the San Juan Basin of the Pacific slope.

202. **Astyanax heterurus** Eigenmann and Wilson.

Astyanax fasciatus heterurus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 303, plate 89, fig. 3 (Truando).

Habitat: Atrato Basin.

203. **Astyanax aurocaudatus** Eigenmann.

Astyanax aurocaudatus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 274, plate 51, fig. 1; plate 69, figs. 6, 8, 10 (Boquilla).

Habitat: Upper Cauca Basin.

GENYCHARAX Eigenmann.

A genus allied to the *Tetragonopterinæ* on the one hand, and to *Exodon* on the other. Its mouth parallels that of the Tarpon. Type, the single known species, *G. tarpon.*

204. **Genycharax tarpon** Eigenmann.

Genycharax tarpon EIGENMANN, Indiana University Studies No. 16, 1912, p. 22; Mem. Mus. Comp. Zoöl., XLIII, 1921, plate 51, fig. 3 (Cauca River at Cartago, Paila and Cali).

Habitat: Upper Cauca River.

CREAGRUTUS Günther.

KEY TO THE SPECIES OF CREAGRUTUS.

a. Premaxillary with an inner series of three or four teeth; a series of four or five teeth extending obliquely from the third of the inner series to the foremost tooth; a tooth lateral to the fourth tooth of this series from in front, another tooth in the angle between the inner series and the oblique outer series.

b. Pores of the lateral line alike, normal.

c. Second suborbital not as wide as eye, leaving a narrow naked area; A. 13; scales 4–40–3. **beni** Eigenmann.

cc. Second suborbital as wide as, or nearly as wide as, eye, in contact with the preopercle below, leaving a naked area behind.

d. A. 10 to 11; depth about 3.5; lateral line 36–38; eye a little greater than snout; caudal peduncle more than 2 in the head..... **brevipinnis** Eigenmann.

dd. A. 12 or 13, occasionally 11, rarely 10 or 14; lateral line 33–36; depth 2.75–3.25; depth of caudal peduncle 1.6–2 in the head..... **magdalenæ** Eigenmann.

ddd. A. most frequently 14, rarely 15, or 16, more rarely 12.

e. Lateral line 33–36; depth of caudal peduncle 2 in head, depth 3–3.7. **affinis** Steindachner.

ee. Depth 3.6–4.3; A. 14–16; scales 5–34 to 38–4; upper jaw less strongly projecting, gill-rakers more numerous..... **notropoides** Meek and Hildebrand.

bb. Pores of the posterior part of the lateral line broad, slit-like, covered by a scale-like flap; first tooth of the premaxillary placed well in advance of the rest, the median toothless space of the premaxillary bordered by four teeth on each side; A. 13–15; lateral line 39–40.

caucanus Eigenmann.

205. **Creagrutus beni** Eigenmann.

Creagrutus beni Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, plate 56, fig. 3; plate 93, figs. 4, 5, 7 (Rio San Gil; R. Guadriga; Rio Roncador; Villavicencio; Barrigon; Merida).

Habitat: Santander and East of the Andes from Caracas to the Beni.

206. **Creagrutus brevipinnis** Eigenmann.

Creagrutus brevipinnis Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, plate 34, fig. 1 (Piedra Moler; Paila; Cartago).

Habitat: Upper Cauca Basin.

207. **Creagrutus magdalenæ** Eigenmann.

Creagrutus magdalenæ Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, plate 34, fig. 4; plate 80, figs. 12–16 (Apulo; Girardot; Honda; Peñas Blancas; Quebrada Alban; Bernal Creek; Soplaviento).

Habitat: Upper and lower Magdalena Basin.

208. **Creagrutus affinis** Steindachner.

Creagrutus affinis Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, plate 34, fig. 3 (Puerto Negria; Condoto; Tado; Istmina; Boca de Tambo; Raspadura; Certegui; Managru; Quibdo; Truando).

Creagrutus leuciscus Regan, Ann. & Mag. Nat. Hist. (8), XII, 1914, p. 463 (Rio Lisa, Rio Condoto).

Creagrutus simus[13] Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 290 (Tuyra Basin).

Habitat: San Juan, Atrato and Tuyra Basins; Lower Cauca Basin.

209. **Creagrutus notropoides** Meek and Hildebrand.

Creagrutus notropoides Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 289, plate XXI (Upper Chagres Basin).

Habitat: Upper Chagres Basin.

[13] Mr. Hildebrand writes, "*C. notropoides* and *C. simus* constantly have one or two more longitudinal series of scales between the dorsal and anal than *C. affinis*. This is the only difference noted between *C. affinis* and *C. simus*, but *C. notropoides* is a more slender fish, with the upper jaw less strongly projecting and with the gill-rakers more numerous."

210. **Creagrutus caucanus** Eigenmann.

Creagrutus caucanus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 34, fig. 5 (Cartago; Paila; Cali).

Habitat: Upper Cauca Basin.

MICROGENYS Eigenmann.

211. **Microgenys minutus** Eigenmann.

Microgenys minutus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 35, fig. 2 (Piedra Moler).

Habitat: Cauca Basin.

PHENACOBRYCON[14] gen. nov.

Type, *Bryconamericus henni* Eigenmann.

First ten and last ten rays of the anal of the male with hooks. Lower caudal fulcra of the male not separated from the rest and not prominent. Middle caudal rays of the male with a glandular scale; cheeks entirely covered by the suborbital; four teeth in the inner series of the premaxillary.

212. **Phenacobrycon henni** (Eigenmann).

Bryconamericus henni EIGENMANN, Indiana University Studies No. 19, 1914, p. 6; Mem. Mus. Comp. Zoöl., XLIII, plate 90, figs. 1 and 2 (Colimes; Puerto Viejo; Chone).

Habitat: Western slope of southern Ecuador.

ARGOPLEURA Eigenmann.

Argopleura EIGENMANN, Indiana University Studies No. 18, 1913, p. 10.

Xenurocharax REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1914, p. 463 (*spurrellii*).

Type, *Argopleura magdalenensis* (Eigenmann).

The species of this genus are confined to the Magdalena, Atrato, and San Juan Basins.

Slender; a brilliant lateral band; a glandular scale on the base of the middle caudal rays of the male overarching a cavity beneath it; hooks on the anal of the male confined to a circular patch, covering part of the tenth to fifteenth (about) rays; lower caudal fulcra in the male prominent, continuous in profile with the tips of the anal rays. Anal with thirty-three to forty-five rays. Caudal margined with dark.

KEY TO THE SPECIES OF ARGOPLEURA.

a. Maxillary reaching suture between first and second suborbital, its tip frequently touching second suborbital. Scales 7 (rarely 6)–42 to 45–5; A. 33–36; lateral band shading downward; numerous

[14] $\phi\acute{\epsilon}\nu\alpha\xi$ = false; *Brycon* = a genus of the Characidæ.

chromatophores between anal and lateral line, those near the anal arranged along the inter-hæmals. **conventa** (Eigenmann).

aa. Maxillary not reaching suture between first and second suborbitals. No interpolated rows of scales; lateral band sharply defined below.

b. Six scales between origin of dorsal and lateral line; scales 6–41 to 43–5; A. usually 35 to 36, rarely 33 or 34, 37 or 38; base of anal 2.66–2.75 in the length; head 4.8–5; depth 3.9–4.2; a few chromatophores half-way between anterior part of anal and lateral line; chromatophores along base of anal rays..... **diquensis** (Eigenmann).

bb. Five scales between the origin of the dorsal and the lateral line.

c. A. usually 31 or 32, sometimes 29, 30, 33 or 34; base of anal 3 or a little more than 3 in the length..... **chocoënsis** Eigenmann.

d. Head 4.3–4.5; depth 3.4–3.75; scales 5–39 to 41–5..... **chocoënsis** from San Juan.

dd. Head 4.33–4.75; depth 3.75–4; scales 5–39 to 41–4..... **chocoënsis** from Atrato.

cc. A. 35–45; head 4.75–5.33; depth 3–4; D. 10; scales 5–40 to 43–4; eye 2.33–3 in the head, equal or a little greater than interorbital; base of anal 2.4–2.6 in the length; origin of anal under anterior half of dorsal..... **magdalenensis** (Eigenmann).

e. A. 34–43 (usually 35 to 37); origin of anal nearer base of middle caudal rays than to snout; some chromatophores along inter-hæmals; a small spot at base of middle caudal rays..... **magdalenensis** from Rio Viejo.

ee. A. 40–45; origin of anal equidistant from snout and caudal; a row of chromatophores along the base of the anal rays; a few chromatophores half-way between lateral line and anterior part of anal; no caudal spot.

magdalenensis from Magdalena and Cauca.

213. **Argopleura conventa** (Eigenmann).

Bryconamericus conventus Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, plate 36, fig. 2 (Soplaviento).

Habitat: El Dique, between Cartagena and the Magdalena.

214. **Argopleura diquensis** (Eigenmann).

Bryconamericus diquensis Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, plate 36, fig. 3 (Soplaviento; Quebrada Alban).

Habitat: El Dique and Santander.

215. **Argopleura chocoënsis** (Eigenmann).

Bryconamericus chocoënsis Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, plate 36, figs. 4, 5 (Puerto Negria Istmina and Tado, San Juan Basin; Tambo, Boca de Raspadura, Certegui, Managru, Quibdo, and Truando, Atrato Basin).

Xenurocharax spurrellii Regan, Ann. & Mag. Nat. Hist. (8), XII, 1914, p. 463 (Condoto).

Habitat: Atrato and San Juan Basins.

216. **Argopleura magdalenensis** (Eigenmann).

Bryconamericus magdalenensis EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 36, fig. 1; plate 75, figs. 1, 4, 12, 14 (Cauca Basin at Cali, Cartago, and Piedra Moler; Magdalena Basin at Apulo, Honda, Girardot, Peñas Blancas, and Puerto Berrio).

Habitat: Magdalena and Cauca Basins.

BRYCONAMERICUS Eigenmann.

KEY TO THE SPECIES OF BRYCONAMERICUS.

a. Six to nine scales between the lateral line and dorsal; depth 2.5–3.5 (Pacific slope of Peru and Ecuador, and both slopes of Colombia and Central America).

bb. Maxillary with from 2 to 4 teeth confined to the upper anterior margin.

c. Origin of dorsal about equidistant from tip of snout and base of middle caudal rays, or nearer the latter. (Peru to Panama.)

d. Middle caudal rays pale, no caudal spot; scales 6 or 7–36 to 40–7; A. 26–30; head 4.4; depth 3.4; pectorals reaching to or nearly to ventrals, ventrals to or nearly to anal; origin of dorsal equidistant from base of middle caudal rays and from snout or an orbital diameter nearer the latter. Two teeth on the maxillary; interorbital much larger than eye.....**simus** (Boulenger).

dd. A black spot on caudal peduncle, not continued to the end of the rays.

e. Scales 8–40 to 45–6 or 7; head 3.6; maxillary equal to length of eye; eye equal to or larger than interorbital.....**emperador** Eigenmann.

ee. Scales 40–48; head 3.8–4; maxillary a little longer than snout; eye equal to interorbital; lateral band dark; breeding males with tubercles on the head. **cascajalensis** Meek and Hildebrand.

eee. Scales 6–38–5; head 3.66; maxillary three fourths as long as eye; eye greater than interorbital. Three teeth on the maxillary; caudal spot without a definite colorless area anterior to it.....**ortholepis** Eigenmann.

eeee. Scales 6 (or 7)–39 or 40–5 or 6; head 4–4.6; maxillary three fourths as long as eye; eye equals interorbital, or not quite equal to it, 2.4–2.7 in head; males with tubercles on head, fins, and scales; caudal spot well defined, sometimes extending on part of the middle caudal rays; area anterior to it without chromatophores below.....**scopiferus** Eigenmann.

eeeee. Scales 6–38–6; head 4.35; maxillary five sixths as long as eye; eye 1.1 to 1.33 in interorbital, 3–3.33 in the head; caudal spot not sharply defined; no chromatophores in the area anterior to the caudal spot on the under side. **scopiferus guaitaræ** Eigenmann and Henn.

ddd. Middle caudal rays black.

f. D. 10, rarely 9.

g. Eye 3–3.5 in the head, 1.1–1.25 in the interorbital; depth 2.9–3.25; head 4–4.5; maxillary equals eye; A. 25–28, lateral line 6–37 to 40–5 or 6. **caucanus** Eigenmann.

h. A. 27–30; lateral line 37–40.....**peruanus** (Müller and Troschel).

hh. A. 36–43. Lateral line 43–50; two humeral spots. **brevirostris** (Günther).

cc. Origin of dorsal an orbital diameter nearer the snout than to the base of the middle caudal rays. (Costa Rica and Ecuador.)

gg. Eye 1.3–1.5 in the very convex interorbital. A. 28 or 29; scales 7–37 to 39–6. **scleroparius** (Regan).

217. **Bryconamericus simus** (Boulenger).

Bryconamericus simus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 69, fig. 8.

Habitat: Chota Valley, Ecuador.

218. **Bryconamericus emperador** Eigenmann.

Bryconamericus emperador EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 37, fig. 3 (Empire Station); MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 283 (both slopes of Panama, Chagres, Bayano and Tuyra Basins).

Habitat: Panama on both slopes; Rio Grande de Terraba, Costa Rica.

219. **Bryconamericus cascajalensis** Meek and Hildebrand.

Bryconamericus cascajalensis MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 284, plate XIX (Rio Cascajal).

Habitat: Atlantic slope of Panama at Cascajal, near Porto Bello.

220. **Bryconamericus ortholepis** Eigenmann.

Bryconamericus ortholepis EIGENMANN, Indiana Univ. Studies No. 18, 1913, p. 15; Mem. Mus. Comp. Zoöl., XLIII, plate 38, fig. 3 (mouth of R. Calima; Condoto; Istmina; Tambo; Boca de Raspadura; Raspadura; Truando).

Bryconamericus rubricauda REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1914, p. 464 (R. Condoto).

Habitat: San Juan and Atrato Basins.

221. **Bryconamericus scopiferus** Eigenmann.

Bryconamericus scopiferus EIGENMANN, Indiana Univ. Studies No. 18, 1913, p. 16; Mem. Mus. Comp. Zoöl., XLIII, plate 38, fig. 2 (Patia Basin; Cisnero and Cordova, Dagua Basin; Mouth of Calima, Condoto, Tado, and Istmina, San Juan Basin).

Bryconamericus juanensis REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1914, p. 464 (Rios Condoto, San Juan and Tamana).

Habitat: San Juan, Dagua and Patia Basins.

222. **Bryconamericus scopiferus guaitaræ** Eigenmann and Henn.

Bryconamericus scopiferus guaitaræ EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 67, fig. 3 (Mouth of Guaitara).

Habitat: Patia Basin.

223. **Bryconamericus caucanus** Eigenmann.

Bryconamericus caucanus EIGENMANN, Mem. Mus. Comp. Zoöl., LXIII, plate 75, figs. 2, 9, 11; plate 38, fig. 1 (Boquilla; Piedra Moler; Cartago; Paila; Cali; Patia).

Habitat: Upper Cauca and Patia Basins.

224. **Bryconamericus peruanus** (Müller and Troschel).

Bryconamericus peruanus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 88, fig. 1; plate 37, fig. 4.

Habitat: Western slope of Ecuador and Peru from Guayaquil to the Rimac.

The following specimens were collected in Peru during the Irwin Expedition:

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Date.	Collector.
7688 *a–c*, C. M.; 15172, I. U. M.	Many[15]	92	Puenta Piedra near Lima	Jan. 29, 1919	Eigenmann
7689 *a–c*, C. M.; 15178, I. U. M.	Many	88	Lima, Rio Rimac	Aug. 18, 1918	"
7682 *a–c*, C. M.; 15179, I. U. M.	Many	106	Tributary of Rimac, Chosica	Aug. 29, 1918	Allen and Eigenmann
7690 *a–c*, C. M.; 15177, I. U. M.	Many	87	Cultambo, Rio Jequetepeque	Jan. 12, 1919	Eigenmann
7691 *a–c*, C. M.; 15175, I. U. M.	Many	86	Llallan, Rio Jequetepeque	Jan. 1919	"
15174, I. U. M.	Three	86	Laguna near Pacasmayo	Jan. 1919	"
7692 *a–c*, C. M.; 15176, I. U. M.	Many[16]	92	Piura	Jan. 11, 1919	"
7697 *a*, C. M.; 15173, I. U. M.	Five	76	Sullana	Jan. 1919	"

225. **Bryconamericus brevirostris** (Günther).

Bryconamericus brevirostris EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 93, fig. 1 (Vinces; Rio Chanchan; Colimes).

Habitat: Western slope of southern Ecuador.

[15] A very large proportion of the specimens have a peculiar deformation in the spine behind the dorsal. This region is much foreshortened and the spine is very crooked. The base of the anal is 3–3.5 in the length.

[16] Base of anal 2.5–3 in the length; a large predominance of males.

226. **Bryconamericus scleroparius** Regan.

Bryconamericus scleroparius Regan, Ann. & Mag. Nat. Hist. (8), XII, 1914, p. 465 (San Juan); Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, plate 38, fig. 4.

Habitat: Atlantic slope of Costa Rica, Pacific slope of Ecuador. San Juan ?

Landonia Eigenmann.

227. **Landonia latidens** Eigenmann and Henn.

Landonia latidens Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, plate 84, figs. 2, 3; plate 86, figs. 1–5.

Habitat: Vinces, Ecuador.

Hemibrycon Günther.

Key to the Species of Hemibrycon.

a. A. 21–25; scales not deflected toward the anal.

b. Pectorals extending beyond, or to origin of, ventrals; maxillary with tricuspid teeth along the greater part of its length, reaching to the third suborbital; A. 21; scales about 5–41–5.
tridens Eigenmann (extralimital, Rio Apurimac at Uruhuasi).

bb. Pectorals not reaching ventrals; maxillary not reaching third suborbital; depth 3–3.5; predorsal area without complete median series of scales.

c. Scales 6 or 7–41 to 43–5 or 6; eye 1.3–1.5 in interorbital; maxillary teeth extending not over half the margin of the bone; mandibular teeth graduated; lateral line sagging but little.
tolimæ (Eigenmann).

cc. Scales 8 or 9–47 to 53–7 or 8; eye 1.25–1.33 in interorbital; maxillary teeth extending almost the entire length of the bone; mandibular teeth abruptly smaller on the side.
colombianus Eigenmann.

aa. A. 26–32; pectorals reaching ventrals or further.

d. Lateral line 42 to 45.

e. Depth 3.66–4.5; eye 3; pectorals reaching to or nearly to the ventrals; lateral teeth of the mandible suddenly minute. . . . . **boquillæ** (Eigenmann).

ee. Depth 3.5; eye 3 in head, 1 in interorbital; pectorals extending beyond origin of ventrals; maxillary reaching to end of the first suborbital. Lateral line 45. . . . **polyodon** (Günther).

dd. Lateral line 38–41; A. 27–30; origin of anal behind middle of base of dorsal.
dariensis Meek and Hildebrand.

ddd. Scales 44–48; lateral line sagging, so that a line connecting its origin and end passes under the dorsal through the middle or upper corner of the second row of scales above it; scales deflected towards the anal, pectoral reaching ventrals. Eye equals interorbital; origin of anal under middle or anterior part of dorsal.

f. Scales 7 or 8–45 to 48–5 or 6; depth of caudal peduncle less than its length; depth 3.2–3.4; A. 30–34; maxillary teeth 3–9, usually extending over less than half the free margin.
dentatus (Eigenmann).

ff. Scales 9–44–6; origin of anal in front of middle of base of dorsal; depth of caudal peduncle equal to its length; depth 3; A. 31; maxillary teeth 6 on about half of the free margin; lateral teeth of the mandible suddenly minute. . . . . **decurrens** (Eigenmann).

228. **Hemibrycon tolimæ** (Eigenmann).

Hemibrycon tolimæ EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 39, fig. 4 (Upper Patia; Ibagué; various localities on the western slope of the Cordillera of Bogota).

Habitat: Upper Patia, and elevated points in the Magdalena Basin.

229. **Hemibrycon colombianus** Eigenmann.

Hemibrycon colombianus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 88, fig. 1.

Habitat: Santander.

230. **Hemibrycon boquillæ** Eigenmann.

Hemibrycon boquiæ EIGENMANN, Ind. Univ. Stud., 18, 1913, p. 20 (Boquilla).

Habitat: Cauca Valley.

231. **Hemibrycon polyodon** (Günther).

Hemibrycon polyodon EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII.

Habitat: Western and eastern slopes of Ecuador.

232. **Hemibrycon dariensis** Meek and Hildebrand.

Hemibrycon dariensis MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 285, plate XX (Rio Yape).

Habitat: Tuyra Basin.

233. **Hemibrycon dentatus** Eigenmann.

Hemibrycon dentatus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 39, fig. 3; plate 80, figs. 3, 5, 7, 8, 9, 10, 11 (Piedra Moler; Paila; Cali).

Habitat: Upper Cauca and Atlantic side of the Cordillera of Bogotá.

234. **Hemibrycon decurrens** Eigenmann.

Hemibrycon decurrens EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 39, fig. 1 (Soplaviento).

Habitat: El Dique, between Cartagena and Calamar.

NEMATOBRYCON Eigenmann.

Distribution: Headwaters of the San Juan and Atrato Basins, on opposite sides of the continental divide.

235. **Nematobrycon palmeri** Eigenmann.

Nematobrycon palmeri EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 60, figs. 1, 2 (Condoto, Rio Condoto; Novita, Rio Tamana).

Habitat: Upper San Juan Basin.

236. **Nematobrycon amphiloxus** Eigenmann and Wilson.

Nematobrycon amphiloxus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 60, figs. 3, 4 (Istmina; Tambo, Boca de Raspadura).

Habitat: Upper San Juan and upper Atrato Basins.

Subfamily RHOADSINÆ.

The species of this subfamily of the *Characidæ* are confined to the Atlantic slope of Costa Rica (La Junta of the Rio Reventazon Basin) and to the Pacific slope of Colombia and Ecuador. The subfamily has been monographed by me in "The American Characidæ," Memoirs Museum of Comparative Zoölogy, Vol. XLIII, and the present account is confined to a list of the genera and species, with their distribution.

PARASTREMMA Eigenmann.

237. **Parastremma sadina** Eigenmann.

"Sadina."

Parastremma sadina EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 72, figs. 1–6; plate 74, figs. 5, 8, 10, 11, 12, 14, 15, 16, 17; plate 94, fig. 4.

This species was found in the San Juan Basin at Istmina (Eigenmann and Wilson), Condoto and Tado (Wilson), and in the Rio Telembi of the Patia Basin (Henn and Wilson).

RHOADSIA Fowler.

In addition to the two species enumerated below, a third species of this genus, *Rhoadsia eigenmanni* (Meek), is found in Costa Rica.

238. **Rhoadsia altipinna** Fowler.

Rhoadsia altipinna EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 73, fig. 3; plate 74, figs. 1, 2, 3, 4, 6, 9, 13, 14; plate 94, fig. 3.

This species was taken by Rhoads in the Chimbo (between 700 and 800 feet), by Henn at Naranjito, both of the foregoing localities being in the Chanchan Basin; and by Henn in the Rio de Chone, Province of Manabi, Ecuador.

239. **Rhoadsia minor** Eigenmann and Henn.
"Doradilla."

Rhoadsia minor EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 73, fig. 1.

This is a smaller edition of *R. altipinna*, from the Rio Blanco, of the Esmeraldas Basin at Mindo, with an elevation of 4136 feet. It was also reported, but not taken, in the Chota valley of northern Ecuador at an elevation of 4900 feet.

Subfamily GLANDULOCAUDINÆ.

The genera and species of this subfamily were considered in brief in the Indiana University Studies No. 20, April 25 (dated March 15), 1914, pp. 32–42. The subfamily is monographed in "The American Characidæ," Mem. Mus. Comp. Zoöl., XLIII, where complete descriptions with figures may be found. The members of the subfamily are found in Trinidad, in Colombia, in Paraguay, in Buenos Aires, and in the Rio São Francisco, Brazil.

PTEROBRYCON Eigenmann.

240. **Pterobrycon landoni** Eigenmann.

Pterobrycon landoni EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 67, fig. 4.

Known only from the type, No. 5051, C. M., 25 mm. long, taken in a minute rivulet back of Boca de Raspadura in the upper Atrato Basin.

MICROBRYCON Eigenmann and Wilson.

241. **Microbrycon minutus** Eigenmann and Wilson.

Microbrycon minutus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 89, fig. 1.

Known only from the type, No. 5422, C. M., 24 mm. long, and the paratype, 13109, I. U. M., 24 mm. long, both taken by Wilson in the Truando River, in the lower Atrato Basin.

GEPHYROCHARAX Eigenmann.

242. **Gephyrocharax chocoënsis** Eigenmann.

Gephyrocharax chocoënsis EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 63, fig. 1 (Rio Calima; Condoto; Istmina; Managru).

Habitat: San Juan and Atrato Basins.

243. **Gephyrocharax caucanus** Eigenmann.

Gephyrocharax caucanus EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, plate 88, fig. 5 (Cartago; Paila; Cali).

Habitat: Upper Cauca Basin.

244. **Gephyrocharax melanocheir** Eigenmann.

Gephyrocharax melanocheir Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, plate 63, fig. 3 (Soplaviento; Bernal Creek).

Habitat: Magdalena Basin from the coast to Honda.

245. **Gephyrocharax atricaudata** Meek and Hildebrand.

Gephyrocharax atricaudata Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, plate 63, fig. 4 (Rio Cardenas; Agua Clara; Canal Zone).

Habitat: Panama on both slopes.

246. **Gephyrocharax intermedius** Meek and Hildebrand.

Gephyrocharax intermedius Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 278 (Rio Chame).

Habitat: Rio Chame, Pacific slope of Panama north of the Rio Bayano.

Subfamily Chalcininæ.

Chalcinus Cuvier and Valenciennes.

247. **Chalcinus magdalenæ** Steindachner.

"Harenga."

Chalcinus magdalenæ Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 60, plate XI, figs. 1, 2 (Rio Magdalena); *ibid.*, XLII, 1880, p. 79 (Cauca near Caceres); Garman, Bull. Essex Inst., XXII, 6, 1890.

Habitat: Magdalena Basin.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5128, C. M.; 12878, I. U. M.	27 large, many small		Soplaviento	Eigenmann
5126 *a–z*, C. M.; 12876, I. U. M.	Many	35–235	Calamar	"
5127, C. M.; 12877, I. U. M.	8; 9	40–60; 187–200	Calamar Cienega	"
5129, C. M.	1	About 260	El Banco	"
5131 *a–b*, C. M.; 12880, I. U. M.	3	Largest 85	Puerto Wilches	"
15037, I. U. M.	3	204–260	Puerto Berrio	Gonzales
5134, C. M.; 12883, I. U. M.	Many		Puerto del Rio	"
5132 *a–b*, C. M.; 12881, I. U. M.	41	Largest 165	Peñas Blancas	Eigenmann
5133 *a–f*, C. M.; .12882 *a–f*, I. U. M.	29	Largest 220	Honda	"
12884, I. U. M.	8	58–215	Apulo	Gonzales
5130 *a–k*, C. M.; 12879, I. U. M.	21	Largest about 200	Girardot	Eigenmann

Subfamily Gasteropelecinæ.

Thoracocharax Fowler.

A widely distributed genus, its species being found in Paraguay, in the Amazon basin, in the Orinoco, Magdalena, Atrato, and San Juan Rivers, and in the streams of the Pacific slope of Panama.

Key to the Species of Thoracocharax.

a. A narrow black spot along the back at the base of the dorsal; a dusky lateral stripe; tip of dorsal narrowly black; A. 34; thirty-three scales in a median series; three or four teeth of nearly equal size on the maxillary, the last near its tip. . . . . **magdalenæ** Eigenmann.

aa. Back below the dorsal without a spot; a dusky lateral stripe; tip of dorsal and narrow margin of the posterior half of the pectoral disk, black; vertical series of dots usually present on the sides; A. 31–36; scales 30–35 in a median series; three to five teeth on the maxillary.

maculatus (Steindachner).

248. **Thoracocharax magdalenæ** Eigenmann. (Plate XXIV, fig. 4.)

Thoracocharax magdalenæ Eigenmann, Indiana University Studies, No. 16, Dec. 1912, p. 25 (Girardot).

Habitat: Magdalena Basin.

4846 *a*, C. M., *type* 50 mm.; 12700, I. U. M., *paratype* 53 mm., Girardot. Eigenmann.

This species is known only from these two specimens.

249. **Thoracocharax maculatus** (Steindachner). (Plate XXIV, fig. 3.)

Gasteropelecus maculatus Steindachner, Denkschr. Akad. Wiss. Wien, XLI, 1879, p. 168, plate 1, fig. 4 (Rio Mamoni, Chepo, Panama); Jordan and Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, p. 338; Regan, Biol. Centr.-Amer., Pisces, 1908, p. 173.

Thoracocharax maculatus Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 288 (Chorrera, Rio Bayano and Rio Tuyra Basins, Pacific slope of Panama).

Thoracocharax brevis Eigenmann, Indiana University Studies, No. 16, Dec. 23, 1912, p. 25 (Raspadura).

4997 *a–n*, C. M.; 13305, I. U. M., one hundred and seventy-seven specimens, 35–77 mm., Truando River, Atrato Basin. Wilson.

3850 *a–d*, C. M.; 13004, I. U. M., thirty-one, largest 76 mm., Quibdo, Atrato Basin. Wilson.

3850 *a–c*, C. M.; 13003, I. U. M., seven, largest 61 mm., Raspadura, Atrato Basin. Wilson.

4845, C. M., 47 mm., Boca de Raspadura, Atrato Basin. Eigenmann.

3851 *a–c*, C. M.; 13002, I. U. M., thirteen, largest 75 mm., small creek of Rio Calima, San Juan Basin. Henn.

Habitat: Atrato Basin of the Atlantic slope and from the San Juan to Chorrera, Panama, on the Pacific slope.

Subfamily SALMININÆ.

Salminus Agassiz.

This genus consists of four species with the following recorded distribution: *Salminus maxillosus* Cuv. & Val. in the La Plata Basin, and the Amazon; *S. brevidens* in the Rio São Francisco and the Rio Cipo; *S. hilarii* in the Orinoco, the Amazon, the São Francisco and the upper Parana; *S. affinis* from the Magdalena Basin and the Rio Santiago in southeastern Ecuador, although I doubt the correctness of the identification of the specimens from the latter locality. The species are so similar that but little confidence can be placed in the identification of isolated specimens. All of them ought to be reëxamined by some one author. I have examined specimens from the Rio São Francisco and southward and caught some at La Merced in the Chanchamayo Basin in Peru, but these were later lost in transportation. A key to the species is given in the Annals of the Carnegie Museum, X, 1916, p. 91.

250. **Salminus affinis** Steindachner.

Salminus affinis Steindachner, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 80, plate VII, figs. 2 and 2*a* (Cauca near Caceres); ? Boulenger, Boll. Mus. Zoöl. Anal. Comp. Torino, XIII, 1898, p. 4 (Rio Santiago); Eigenmann, Ann. Carnegie Mus., X, 1916, p. 92 (Honda).

Three specimens were purchased by me at Honda, Colombia, but no others were seen. These specimens, 5023, C. M.; 12816, I. U. M., measured 455, 530, and 600 mm., respectively.

Subfamily CHARACINÆ.

Charax Scopoli.

A widely distributed genus, the species of which range from the Atrato River to the La Plata, and from Pará to Ecuador. The species of this genus differ but little from each other and it is difficult to define them. *A. atratoënsis* has a much more distinct arch at the nape and in general appearance is different from *magdalenæ*.

KEY TO THE SPECIES OF CHARAX.

a. Depth 3.1; head 4; A. 47–50; scales 106–126; nape sharply humped, the profile very concave, a medium-sized naked area on the cheek.....**atratoënsis** Eigenmann.

b. Depth 3–3.4; head 4.2–4.33; A. 50–57; scales 113–116; nape less sharply humped, the profile less concave; naked area on the cheek very small.....**magdalenæ** (Steindachner).

251. **Charax atratoënsis** Eigenmann. (Plate XXV, fig. 2.)

Charax atratoënsis EIGENMANN, Proc. U. S. Nat. Mus., XXXIII, 1907, p. 33, fig. 8 (Truando).

3848 *a–b*, C. M.; 15030, I. U. M., sixteen, 195–365 mm., 15031 I. U. M., four, 44–51 mm., Quibdo. Wilson.

5183, C. M., one, Rio Sucio, Atrato Basin. Eigenmann.

Habitat: Atrato Basin.

252. **Charax magdalenæ** (Steindachner).

"Juan viejo."

Anacyrtus (*Cynopotamus*), *argenteus* (*non* Valenciennes) STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 62 (Magdalena).

Anacyrtus magdalenæ STEINDACHNER, *loc. cit.*, p. 61, plate XII, figs. 2 and 2*a* (Rio Magdalena); ? PERUGIA, Ann. Mus. Civ. Stor. Nat. Genova, ser. 2*a*, X, 48, 1891 (Rio Paraguay at Asunción).

Anacyrtus (*Cynopotamus*) *magdalenæ* STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 80 (Cauca near Caceres).

Cynopotamus magdalenæ EIGENMANN and EIGENMANN, Proc. U. S. Nat. Mus., XIV, 1891, p. 58; STEINDACHNER, Denkschr. Akad. Wiss. Wien, LXXII, 1902, p. 144 (Barranquilla).

5184, C. M.; 12931, I. U. M., two, largest 275 mm., Soplaviento. Eigenmann.

5181 *a–e*, 5182 *a–d*, C. M.; 12929, 12930, I. U. M., nineteen, 115–365 mm., Calamar River and Cienega. Eigenmann.

13059, I. U. M., three, largest 300 mm., Cienega at Puerto Berrio. Gonzales.

5180 *a–d*, C. M.; 12928, I. U. M., eleven, 206–365 mm., Honda. Eigenmann.

Habitat: Magdalena Basin.

RŒBOIDES Günther.

One of the most widely distributed genera, ranging from Mexico to Argentina and from sea-level to an elevation of several thousand feet.

Specimens of the genus *Rœboides* are abundant in the Magdalena Basin from sea-level at least to Girardot and Cali, in both the San Juan and Atrato Rivers, in the Patia Basin, in northern Ecuador, and in Panama on both slopes. The

species of the Chagres ranges north into Mexico, which gives this genus the second farthest north of the *Characidæ*, only *Astyanax* reaching the United States. They vary greatly with the locality, and no locality has more than one species, or variety, unless it be Soplaviento. In some species there is no symptom of a shoulder-spot, in others it is large, nearly the size of the eye, rounded and very conspicuous; in others it is large and crescent-shaped; and between these there is every gradation. The spot is least developed in specimens from Soplaviento and most developed in specimens from the upper Cauca. The anal rays vary from forty-two to fifty-six, specimens from the San Juan and the Quito Rivers having the highest average, those from the upper Cauca the lowest. In the scales of the lateral line there is a variation of from fifty-one to eighty-nine, being highest (eighty to eighty-nine) in the Chagres specimens. I have attempted a definition of species. Some of these are statistical, *i.e.*, the difference becomes evident only on the statistical comparison of numbers of specimens. Possibly *R. occidentalis*, *hildebrandi*, *meeki*, and *dayi* should all be united under the oldest name, *dayi*. The species all look very much alike. In life the caudal is brilliant orange and the remaining fins are yellowish.

Key to the Species of Rœboides.

a. Shoulder in the adult without a conspicuous spot, spot varies in the young. Origin of dorsal a little nearer tip of adipose than snout; gill-rakers in lower arch, 7–9.

b. Origin of anal equidistant from tip of snout and base of second to eighth anal ray from the last; depth 2.5–2.8; scales 64–72; A. 42–50; a silvery lateral band, the young like the adult, or with a humeral spot, which may consist of but a few chromatophores or approach the size found in *R. dayi*. . . . . **magdalenæ** sp. nov.

bb. Origin of anal equidistant from tip of snout and base of ninth to thirteenth anal ray from the last; depth 2.9–3; scales 80–89; A. 47–52; a silvery lateral band, especially in the young, usually enclosing a dark streak in the anterior part just behind the location of the spot in other species. . . . . **guatemalensis** (Günther).

aa. Shoulder in the adult with a conspicuous spot.

c. Origin of anal equidistant from tip of snout and tip of last anal ray or base of caudal. Anal rays usually 43–45 (from 42–47); caudal peduncle longer than deep. . . . . **caucæ** sp. nov.

cc. Origin of anal nearer snout than base of last anal ray.

d. Lateral line 71–81.

e. A. 44–50, most frequently 47 and 48; pectoral in a specimen 86 mm. long just reaching anal; naked area of the cheek at its lower angle less than half the width of the suborbital. . . . . **occidentalis** Meek and Hildebrand.

ee. A. 46–54, most frequently 49 and 52; naked portion of cheek 2 (in larger), 1.5 (in smaller) in the width of the suborbital; pectoral in half-grown specimens reaching anal; nape more strongly arched. . . . . **hildebrandi** sp. nov.

dd. Lateral line 60–71, most frequently 66 or 67; anal rays 47–56, most frequently 50 to 51. **meeki** sp. nov.

ddd. Lateral line 57–65, most frequently 61–64; anal rays 46–52, most frequently 48 or 49. **dayi** Steindachner.

VARIATION IN THE NUMBER OF ANAL RAYS IN RŒBOIDES.

The numbers opposite the specific names indicate the number of specimens possessing the indicated number of anal rays.

Number of Anal Rays.	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
R. magdalenæ	4	1	4	8	11	3	1	3	2						
R. guatemalensis						5	1	2	4	6	1				
R. caucæ	4	13	8	8	3	1									
R. occidentalis			3	2	1	4	8	2	3						
R. hildebrandi					1	5	2	8	11	15	17	3	4		
R. meeki						1	2	3	6	7	2	1	1	2	1
R. dayi					1	4	8	7	4	1	1				

VARIATION IN THE PORES IN THE LATERAL LINE IN RŒBOIDES.

Number of Pores.	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82
R. magdalenæ								3	1	2	6	6	4	8	8	1										
R. guatemalensis																								X	X	X
R. caucæ								3	0	2	6	6	4	8	8	1										
R. occidentalis																X	X	X	X	X	X	X	X	X		
R. hildebrandi															1	2	6	10	4	4	1	1		1	1	
R. meeki				1	0	1	3	3	2	5	7	2	1	1	1											
R. dayi	1	3	0	2	3	3	3	4	1																	

253. **Rœboides magdalenæ** sp. nov.

SPECIMENS EXAMINED.

The distinguishing features of this species are given in the key.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5202 *a–x*, C. M.; 12950, I. U. M.	Over 200[17]	Largest 105	Soplaviento	Eigenmann
5207 *a*, C. M.	1	32	Calamar	"
5204 *a*, C. M.	1	45	El Banco	"
5209 *a–c*, C. M.; 12952, I. U. M.	7	Largest 60	Near Puerto Wilches	"
12949, I. U. M.	Many		Cienega near Puerto Wilches	"
5206 *a*, C. M.	1	50	Peñas Blancas	"
5205 *a*, C. M.	1	47	Below Buenavista	"
5203 *a–j*, C. M.; 12951, I. U. M.	19	Largest 83	Bernal Creek	"
5210 *a–e*, C. M.; 12954, I. U. M.	8	Largest 70	Girardot	"
12953, C. M.	12	Largest 78	Apulo	Gonzales

254. **Rœboides guatemalensis** (Günther).

Anacyrtus (*Rœboides*) *guatemalensis* GÜNTHER, Cat. Fishes Brit. Mus., V, 1864, p. 347 (Chagres, Huamuchal, Lake Nicaragua).

Rœboides guatemalensis MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs.,

[17] Type and paratypes.

Zoöl. Ser. X, 1916, p. 291, plate XXII (Atlantic slope of Panama from brackish water to mountain streams).

Habitat: Pacific slope of southern Mexico to the Rio Chagres.

255. **Rœboides caucæ** sp. nov.

This species differs from all other species in western Colombia in having the origin of the anal equidistant from tip of snout and some point between the tip of the last anal ray and the base of the middle caudal rays, except in very young.

Head 3.25–3.5; depth 2.7–2.8; D. 11; A. 42–47, most frequently 43 (50 in one); scales 64–72, most frequently 67–71; naked portion of cheek 1.5–2 in the width of the suborbital; caudal peduncle longer than deep; pectoral not reaching anal; caudal lobes not sharply pointed; lateral spot large, faint, or very conspicuous.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5201, C. M.; 12948, I. U. M.	Many	Largest 110	Piedra Moler	Eigenmann
12934, I. U. M.	Many	Largest 115, type and paratypes	Cartago	"
5191 *a–b*, C. M.; 12937, I. U. M.	4	Largest 96	Paila	"
5189 *a–i*, C. M.; 12935, I. U. M.	20	25–90	Cali	"
5190 *a–x*, C. M.; 12936, I. U. M.	Many	Largest 125	Juanita	"

256. **Rœboides occidentalis** Meek and Hildebrand.

Rœboides occidentalis Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 293, plate XXIII (Pacific slope of Panama, from the head of tide-water to the mountain streams).

Habitat: Pacific slope of Panama.

257. **Rœboides hildebrandi** sp. nov. (Plate XXV, fig. 3.)

Rœboides guatemalensis Regan (in part), Biol. Centr.-Amer. Pisces, 1906–1908, p. 174 (Western Ecuador).

This species, found in the Pacific slope streams, differs statistically from *R. occidentalis* of the Pacific slope of Panama. The two species evidently reach about the same size, *R. occidentalis* reaches 170 mm. and of *R. hildebrandi* the largest specimen caught in the San Juan was 160 mm., the largest in the Patia, 165 mm. I secured no specimens in the Rio Dagua, which empties into the Pacific between the San Juan and the Patia. It is very probable that the specimens collected by Rosenberg in western Ecuador and attributed to *guatemalensis* by Regan belong to this species.

The humeral spot in *R. occidentalis* is entirely above the lateral line in the specimens examined and is not half-way above and half-way below as depicted in Meek and Hildebrand's figure.

Head 4; depth 2.66; D. 11; A. 46–54 (for details see the table). A broad, silvery band from head to middle caudal rays; a large, conspicuous humeral spot; a large, but faint caudal spot.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5186, C. M.; 12933, I. U. M.	18, *type* and *paratypes*	62–160	Istmina	Eigenmann
12960, I. U. M.	22	Largest 119	Istmina	Wilson
12959, I. U. M.	3	Largest 112	Tado	"
5187, C. M.	1	80	Halfway between Puerto Negria and Istmina	Eigenmann
5185, C. M.; 12932, I. U. M.	25	38–136	Puerto Negria	"
13066, I. U. M.	1	102	Rio San Juan at mouth of Rio Cucurrupi	Henn
5373 *a–e*, C. M.; 13062, I. U. M.	23	Largest 103	Patia between Magui and Telembi	"
5375 *a–e*, C. M.; 13065, I. U. M.	30	Largest 111	Rio Magui, tributary of Patia	"
13063, I. U. M.	1	58	Patia at mouth of Rio Guaitara	"
5195–5198, 5374, C. M.; 12944–12947, 13064, I. U. M.	40	35–165	Rio Telembi between Barbacoas and 8 miles above	Henn and Wilson

258. **Rœboides meeki** sp. nov. (Plate XXV, fig. 4.)

5192 *a–g*, C. M.; 12938, I. U. M., thirty, 52–116 mm., Boca de Certegui. Eigenmann.

5372 *a–g*, C. M.; 13061, I. U. M., eighty-three, largest 117 mm., Truando. Wilson.

3840 *a–x*, C. M.; 15032, I. U. M., *type* (3840 *a*, C. M.) and *paratypes*, several hundred, largest 130 mm., Quibdo. Wilson.

This species confined, as far as known, to the Atrato Basin, is also a statistical species. It differs from *R. occidentalis* and *R. hildebrandi* in the larger scales, from *R. magdalenæ* and *R. caucæ* in the larger number of anal rays.

Head 3.75–4; depth 2.2–2.4; D. 11; A. 47–56, usually 49–51.

259. **Rœboides dayi** (Steindachner).

Anacyrtus (*Rhœboides*) *dayii* STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 61 (Rio Magdalena); *ibid.*, XLII, 1880, p. 80 (lower Cauca).

Habitat: Magdalena Basin.

5211 *a–x*, C. M.; 12955, I. U. M., many, largest 80 mm., Calamar Cienega. Eigenmann.

This is the largest scaled species of the genus *Rœboides* in Colombia. It is so far known only from cienegas near the mouth of the Magdalena. The specimens collected are all rather small. It is very close to *R. meeki* from the Atrato.

Head very little less than 4; depth 2.6–2.7; D. 11; A. 46–52, usually 48 or 49; scales 57–65, most frequently 61–64; naked area at lower angle of cheek 2–3 in the width of the interorbital; lateral spot conspicuous.

Gilbertolus Eigenmann.

Gilbertella (preoccupied) Eigenmann, Smithsonian Misc. Coll. Quart., 45, 1904, p. 147 (*alatus*).

Gilbertolus Eigenmann, Proc. U. S. Nat. Mus., XXXIII, 1907, p. 3, substituted for *Gilbertella* erroneously spelled *Gilbertollus* in Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 445.

Type: *Anacyrtus* (*Rœstes*) *alatus* Steindachner.

260. **Gilbertolus alatus** (Steindachner). (Plate XXVI, fig. 1.)

Anacyrtus (*Rœstes*) *alatus* Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 65 (Lower Magdalena).

Rœstes alatus Eigenmann and Eigenmann, Proc. U. S. Nat. Mus., XIV, 1891, p. 57.

Habitat: Magdalena and Atrato Basins.

Of this aberrant species, hitherto known from a specimen 120 mm. long, we have: 5380 *a–j*, C. M.; 13072, I. U. M., many, largest 145 mm., Quibdo. Wilson.

Head 4.5–4.8; depth about 3; D. 11; A. usually 49 or 50, more rarely 48 or 52; scales 15–68 to 72–12; eye .5–.6 in the snout, 2.5–2.66 in the head; interorbital a little less than the snout; gill-rakers 7 to 9 + 17; mouth very oblique; maxillary reaching to suture between second and third suborbitals; the distance from snout to end of maxillary equal to the distance from snout to posterior margin of the eye; one-half or two-fifths of the cheeks naked; lower jaw with two minute teeth in front, the first one withdrawn from the line, these followed by two canines of which the second is by far the larger, nine conical teeth on the sides, of which the first is much smaller than the next four, which diminish but little, the remaining four rapidly diminishing in size; presumably with a canine a little smaller than the anterior one in the lower jaw, followed by a series of nine conical teeth of which the first four diminish rapidly, the next four increase in size backward (the last

three of these sometimes nearly equal in size) and the last two again diminish; maxillary with teeth (42 in one) along its entire margin.

Profile depressed over the eyes, gently arched to the dorsal; ventral profile from chin to anal a section of a circle, the diameter of which is about equal to the distance between snout and dorsal; dorsal small, pointed, its height about equal to the length of the head less half an orbit, its origin equidistant between base of caudal and a point near posterior margin of the eye, equidistant with the eighth anal ray from the base of the caudal; adipose fin short and high; caudal forked, the lobes nearly equal to the distance between snout and pectoral; anal with a nearly straight margin, its highest rays three times as long as the last, equal to the head without the opercle, origin of the anal nearly equidistant between snout and middle caudal rays; ventrals small, one and a half times the length of the eye or less, reaching the origin of the anal; pectoral very large, reaching past origin of the anal, its margin meeting below the ventral surface, when depressed to a distance about equal to the head.

Scales thin, adherent, with a few divergent radials; a narrow sheath of scales at bases of caudal and anal.

Silvery, a large conspicuous spot on the end of the caudal peduncle, disappearing with age.

Subfamily ACESTRORHAMPHINÆ.

ACESTROCEPHALUS Eigenmann.

Acestrocephalus EIGENMANN, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 447.

Type: *Xiphorhamphus anomalus* Steindachner.

261. **Acestrocephalus anomalus** (Steindachner). (Plate XXVI, figs. 2 and 2*a*.)

Xiphorhamphus anomalus STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 84 (Cauca near Caceres); EIGENMANN, Indiana University Studies No. 16, Dec. 23, 1912, p. 21.

Of this species previously known only from the type, 185 mm. long, I secured only small specimens, which are as follows:

5043 *a–f*, C. M.; 12837, I. U. M., twenty-three, largest 110 mm., Girardot.

5044 *a–j*, C. M.; 12838, I. U. M., eleven, largest 70 mm., Peñas Blancas.

5045, C. M., one, 53 mm., Honda.

12839, I. U. M., forty, largest 100 mm., Apulo.

Habitat: Magdalena Basin.

Head 3.66; depth 4.2; D. 11; A. 35; scales about 11–75–9; eye a little less than snout, 3.6 in the head, 1 in the interorbital.

Long and slender, the snout pointed; no depressions or humps in the profile; postventral area more or less compressed, the preventral area broadly rounded; dorsal areas rounded; no distinct median series of scales on back or belly.

Lower jaw included, maxillary extending to below posterior margin of eye or further; fontanels well developed, narrow; third suborbital leaving a very wide naked area below, which gradually narrows upward. Many (thirty-three) flat, triangular, recurved teeth on the maxillary; premaxillary with four canines, the first and last in a line with the irregular series of conical teeth, the second and third within the outer series (forming a second series); four teeth between the first and second canines, three between the second and third, and two between the third and fourth, the first canine the largest; about nine small, conical teeth in the series behind the two anterior canines, twenty-five or more in the series following the third canine; three canines of the lower jaw about equal to the largest of the upper jaw, the third one in a line with a series of small, conical teeth, those in front of the canine separated from it by an interspace and smaller than those behind it which are retrorse; the two anterior canines form a second series in front of the second series of minute, inner teeth. All the teeth conical. Palatines with a sharp ridge, but without teeth. Gill-rakers very few, 2 + 4, no rakers on the upper three-fourths of the upper arch or the anterior half of the lower arch.

Dorsal pointed, equal to head less opercle, its origin a little in advance of the middle; caudal about as long as the head; anal basis long, its margin nearly straight, its origin equidistant from base of middle caudal rays and some part of the eye. Ventrals not reaching the anal, pectorals to the ventrals.

Scales regularly placed, their exposed surfaces with many spinules; fins naked, except a series of scales well separated from the scales of the sides along base of anterior half of the anal; axillary scale well developed. Lateral line but slightly decurved, complete.

A narrow silvery band ending in a dark spot on the base of the caudal.

Subfamily Hydrocyninæ.[18]

Ctenolucius Gill.

Ctenolucinus Gill, Senate Doc. 9, 2d sess., 36th Cong., VII, Pt. 1, 1861, p. 258 (*nomen nudum*).

[18] From Maracaibo is recorded *Hydrocynus hujeta* (*Xiphostoma hujeta* Cuvier and Valenciennes, Hist. Nat. Poiss., XXII, 1848, p. 358). Is this *C. insculptus?*

Ctenolucius GILL, Proc. Acad. Nat. Sci. Phila., XIII, 1861, Suppl. p. 8.

Luciocharax STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 67, plate XIII, fig. 2 and 2*b* (*insculptus*).

Belonocharax FOWLER, Proc. Acad. Nat. Sci. Phila., 1906, p. 464 (*beani*).

There are apparently two species of this genus in Colombia. One of them is found in the Magdalena Basin, the other occurs in the San Juan, Mamoni and Tuyra Basins, and in the Atrato Basin. Specimens of the species in the Magdalena Basin vary considerably and the difference between the two species is slight. They may be distinguished by the following characters:

KEY TO THE SPECIES OF CTENOLUCIUS.

a. Steel-blue above, a variable area white below, the two colors gradually shading into each other; sometimes, when the dark color extends far down on the sides, there is a light spot on each scale of the sides; lateral line 42–48; 17–28 scales with pores.....**insculptus** Steindachner.

aa. Steel-blue above, white below, sides with dark lateral bands between the rows of scales, becoming fainter downward, light bands along the middle of the rows of scales becoming fainter upward; lateral line 47–51; 27–39 scales with pores.....**beani** Fowler.

262. **Ctenolucius insculptus** (Steindachner). (Plate XXVI, fig. 5.)

Luciocharax insculptus STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 67, plate XIII, figs. 2 and 2*b* (Rio Magdalena); *ibid.*, XLII, 1880, p. 85 (Cauca near Caceres).

Habitat: A variable species, abundant in the Dique and extending for nearly eight hundred miles up the Magdalena to Girardot.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm. to Base of Caudal.	Locality.	Collector.
4876 *a–i*, C. M.; 12717 *a–i*, I. U. M.	83	Largest 211	Soplaviento	Eigenmann
4877 *a–d*, C. M.; 12718 *a–d*, I. U. M.	14	Largest 214	Calamar	"
4878 *a–e*, C. M.; 12719 *a–c*, I. U. M.	6	Largest 179	Bernal Creek	"
4879 *a–b*, C. M.; 12720 *a*, I. U. M.	3	Largest 137	Girardot	"
12721, I. U. M.	4		Apulo	Gonzales
51974, U. of Michigan	1	35	Marsh at Fundación	A. S. Pearse

Head 3; depth 6.2–6.8; eye 7.4–8; the ratio of the snout to the postorbital part of the head differs. In the specimens from Soplaviento and Calamar it is as 61 : 57; in those from Bernal Creek as 61 : 51. The interorbital in those from the lower Magdalena is one-fifth of the length of the head, in those from Honda and Girardot, one-sixth.

Number of Specimens, Having Given Number of Scales, from	Number of Scales.						
	42	43	44	45	46	47	48
Soplaviento	.....	.....	2	5	3		
Calamar	1	.....	.....	3	2		
Bernal Creek	.....	.....	.....	.....	.....	5	1
Girardot	.....	.....	.....	.....	1	1	1

263. **Ctenolucius beani** (Fowler). (Plate XXVI, figs. 3 and 4.)

Luciocharax insculptus Steindachner (part), Denkschr. Akad. Wiss. Wien, XLI, 1879, p. 169 (Mamoni).

Belonocharax beani Fowler, Proc. Acad. Nat. Sci. Phila., 1906, p. 464 (Truando, tributary of the Atrato).

Luciocharax beani Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 302 (Pacific slope of Panama).

Ctenolucius hujeta (*non* Valenciennes) Bean, Proc. U. S. Nat. Mus., XXXIII, 1908, p. 701 (Truando).

Luciocharax striatus Boulenger, Ann. & Mag. Nat. Hist. (8), VII, p. 212, Feb. 1911 (Boca de Calima, Choco).

Habitat: Pacific slope of Panama; Atrato and San Juan Basins.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm. to Base of Caudal.	Locality.	Collector.
4873 *a–c*, C. M.; 12715 *a–c*, I. U. M.	12	Largest 260	Puerto Negria, San Juan Basin	Eigenmann
4874, C. M.	1		Istmina, San Juan	"
13909, I. U. M.	2	220–231	Istmina, San Juan	Wilson
13052, I. U. M.	2	85–240	Managru, Atrato Basin	"
4875 *a*, C. M.; 12716 *a*, I. U. M.	2	327–260	Rio Sucio, Atrato	Eigenmann
13051, I. U. M.	Many	Largest (at I. U.) 335	Truando, Atrato	Wilson
14004, I. U. M.	3	220–320	Rio Calobre, Panama	Meek and Hildebrand

Head 3; depth 6.3; eye 7.3 in head on an average; snout to postorbital part of head as 61 : 55; of those examined two have 47 scales, one has 48, four have 49, five have 50, one has 51. The interorbital is on an average two-elevenths of the length of the head.

I am not able to detect differences which might be considered specific between specimens from the San Juan (*striatus*) and specimens from Rio Sucio (*beani*).

The specimen described by Fowler is one of those on which Gill in 1861 based the genus *Ctenolucius*.

Subfamily Erythrininæ.

Hoplias Gill.

Key to the Species of Hoplias.

a. Eleven series of scales across the back of the tail from one lateral line to the other. Lateral line 43–47; D. 13–15; A. 9.5–10.5; sides mottled with light and dark brown... **microlepis** (Günther).

aa. Nine series of scales across the back of the tail from one lateral line to the other. Lateral line 39–44; D. 12–15; A. 10–11. Sides plain or mottled; young usually with a dark lateral band. **malabaricus** (Bloch).

264. **Hoplias microlepis** (Günther).

"Juanchiche."

Macrodon microlepis Günther, Cat. Fishes Brit. Mus., V, 1864, p. 282 (Chagres River and Western Ecuador); Eigenmann and Eigenmann, Proc. Cal. Acad. Sci. (2), II, 1888, p. 102 (Obispo, Rio Chagres); Eigenmann, Ann. N. Y. Acad. Sci., 1889, p. 102; Boulenger, Boll. Mus. Zoöl. Anat. Comp. Torino, XIII, 1898, p. 1 (Rio Daule, and Rio Vinces, Western Ecuador).

Macrodon trahira microlepis Steindachner, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 101 (Guayaquil).

Hoplias microlepis Starks, Proc. U. S. Nat. Mus., XXX, 1906, p. 772 (Guayaquil); Regan, Biologia Centrali-Americana, Pisces, 1907, p. 167, plate XXVII, fig. 1; Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 303 (all streams on both slopes of Panama, except the Tuyra Basin).

Regan (Ann. & Mag. Nat. Hist. (8), XIV, 1914, p. 32) records this species from the Rio Condoto, San Juan Basin. I examined a large series of specimens of *Hoplias* from the San Juan Basin and all of these were *H. malabaricus*. Dr. Regan has kindly reëxamined his specimens and informs me that they should also be referred to *H. malabaricus*.

Habitat: This species has a unique distribution, being found on the Pacific slope of southern Ecuador and on both slopes of Central Panama, but not on the Pacific slope between these points.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length of Largest in mm.	Locality.	Collector.
5549, C. M.; 13446, I. U. M.	10	340	Vinces, Ecuador	Henn
5550, C. M.; 13447, I. U. M.	15	312	Colimes, Ecuador	"
13448, I. U. M.	3	194	Chone, Ecuador	"
5551, C. M.; 13449, I. U. M.	2	354	Rio Chanchan, Ecuador	"
5552, C. M.	19	270	Guayaquil Market, Ecuador	"
14002, I. U. M.	3		Rio Gatun at Gaun, Panama	Meek and Hildebrand

Lateral line 43/5, 44/12, 45/5, 47/2; D. 13/3, 14/19, 15/2;* A. $10\frac{1}{2}$.

In all specimens there are eleven scales from lateral line to lateral line across the back of the caudal peduncle.

265. **Hoplias malabaricus** (Bloch).

For a full account of the synonymy and bibliography of this species, *see* Eigenmann and Eigenmann, Proc. Cal. Acad. Sci., 2d Ser., 2, 1888, p. 102. The references to the area under consideration are:

Macrodon trahira Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 47 (Rio Magdalena); *ibid.*, XLII, 1880, p. 66 (Cauca near Caceres).

Hoplias malabaricus Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 305 (Tuyra Basin).

Hoplias microlepis (*non* Günther) Regan, Ann. & Mag. Nat. Hist. (8), XIV, 1914, p. 32 (Rio Condoto).

Habitat: Tuyra to Patia Rivers on the Pacific slope; and from the Atrato to Buenos Aires on the Atlantic slope.

Specimens Examined.

a. From the Magdalena Basin.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5174 *a–f*, C. M.; 12921, I. U. M.	13		Soplaviento	Eigenmann
5175 *a*, C. M.; 12922, I. U. M.	2		Calamar Cienega	"
5178 *a–b*, C. M.; 12924, I. U. M.	3		Calamar	"
12925, I. U. M.	1		Puerto del Rio	Gonzales
5177 *a*, C. M.	1		Bernal Creek, Honda	Eigenmann
12926 *a*, I. U. M.	1		Apulo	Gonzales

b. From the Atrato Basin.

5176 *a–c*, C. M.; 12923, I. U. M.	4		Rio Sucio	Eigenmann
5555, C. M.; 13471, I. U. M.	61	82–339	Truando	Wilson
5557, C. M.	1	146	Quibdo	"
5554, C. M.	3	96–154	Managru	"
5553, C. M.	2	36–119	Raspadura	"

c. From the San Juan Basin.

13975, I. U. M.	1[19]	head, 131	Mouth of R. Munguido	Henn
5179 *a*, C. M.	1		Istmina	Eigenmann
13452, I. U. M.	1	71	Tado	Wilson
5173 *a–c*, C. M.; 12920, I. U. M.	6		Puerto Negria	Eigenmann
13454, I. U. M.	2	167–225	Small creek near Rio Calima	Henn

* The denominators indicate the number of specimens examined.

[19] The stomach of this specimen contained a *Rhamdia*, the head of which was 72 mm. long.

d. From the Patia Basin.

5558, C. M.; 13455, I. U. M.....	5	222–266	Laguna of Rio Patia, near mouth of Magui	Henn
13456, I. U. M.....			Patia River between the mouths of the Magui and Telembi	"

e. From East of the Eastern Cordilleras.

13453, I. U. M.....	2	177 and head, 94	Barrigón, Rio Meta	Gonzales

Lateral line 39/3, 40/7, 41/7, 42/10, 43/6, 44/1; D. 12/1, 13/2, 14/27, 15/3 * The specimens of *Hoplias* from the Patia, San Juan, and Atrato Basins all have nine scales from lateral line to lateral line on the caudal peduncle and accordingly are *H. malabaricus*.

Family XI. GYMNOTIDÆ.

Ellis (Mem. Carnegie Mus., VI, 1913, pp. 109–195, plates XV–XXIII) gives a detailed account of the known distribution, synonomy, and bibliography of the *Gymnotidæ*. It appears that four species of this family, *Gymnotus carapo* Linnæus, *Sternopygus macrurus* (Bloch and Schneider), *Eigenmannia virescens* (Valenciennes), and *Hypopomus brevirostris* (Steindachner), have been recorded from the area under consideration and from Central America to the north of it. These four species are more widely distributed than any other Gymnotids. They are the only species found in the Rio São Francisco and they are all found in the Orinoco River, or in Guiana, in the Amazon, in Uruguay, or Southeastern Brazil, and in the La Plata Basin.

The *Gymnotidæ* of transandean Colombia and Ecuador were reported upon in a preliminary paper by Eigenmann and Fisher in the Indiana University Studies No. 25, 1914, pp. 235–237. The specimens there reported upon are again listed here.

266. **Gymnotus carapo** Linnæus.

Gymnotus carapo Regan, Ann. & Mag. Nat. Hist. (8), XII, 1914, p. 466 (Condoto); Eigenmann and Fisher, Indiana University Studies No. 25, 1914, p. 237; Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 307. (Not taken in Panama.)

5606 *a–b*, C. M.; 13385, I. U. M., four, 142–306 mm. Small creek near mouth of Rio Calima, San Juan Basin. Henn.

5607 *a–b*, C. M.; 13386, I. U. M., four, 75–184 mm., Truando, Atrato Basin. Wilson.

Habitat: Rivers and lakes of Guatemala on both slopes; Atrato and San Juan

* The denominators indicate the number of specimens examined.

Basins. East of the Andes this species extends to the Rio São Francisco and the Rio de la Plata. It is the most widely distributed Gymnotid and the one reaching furthest north. It has not been taken in Panama.

267. **Sternopygus macrurus** (Bloch and Schneider). (Plate XXXV, figs. 6–9.)

"Vio."

Sternopygus macrurus Ellis, Mem. Carnegie Mus., VI, 1913, p. 121, fig. 3 (Full synonymy and distribution); Regan, Ann. & Mag. Nat. Hist. (8), XIV, 1914 (Rio Condoto); Eigenmann and Fisher, Indiana University Studies No. 25, 1914, p. 237 (Magdalena, Atrato, San Juan, Dagua and Patia Basins).

Gymnotus æquilabiatus Humboldt, Rec. d'Obs. Zoöl. Anat. Comp., I, 1805, p. 46, plate X.

Sternopygus æquilabiatus Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 69, plate XIV, fig. 1 (Magdalena); *ibid.*, XLII, 1880, p. 88 (Cauca and Guayaquil); Boulenger, Boll. Mus. Zoöl. Anat. Comp. Torino, XIII, 1898 (Rio Guayas); Steindachner, Denkschr. Akad. Wiss. Wien, LXII, 1902, p. 59 (Rio Magdalena at Barranquilla); Starks, Proc. U. S. Nat. Mus., XXX, 1906, p. 777 (Guayaquil); Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 466 (Rio Condoto).

Habitat: Rios São Francisco and Paraguay to the Atrato and Guayaquil. The largest specimen from our area measures 700 mm., and is from the market at Guayaquil.

Specimens Examined.

Catalog Numbers	No. of Specimens.	Length in mm.	Locality.	Collector.
5619 *a*, C. M.	1	72	Villavicencio	Gonzales
13397, I. U. M.; 5614 *a–d*, C. M.	8	188–453	Soplaviento	Eigenmann
13391, I. U. M.; 5615 *a*, C. M.	2	443–471	Calamar	"
5621 *a–f*, C. M.	2	484–531	Puerto del Rio	Gonzales
5617 *a–b*, C. M.	2	271–311	Apulo	"
13398, I. U. M.; 5618 *a–c*, C. M.	6	121–399	Cartago	Eigenmann
5609 *a*, C. M.	1	111	Cauca at Cali	"
13393, I. U. M.	2	71– 74	Managru	Wilson
13395, I. U. M.	1	264	Raspadura	"
13387, I. U. M.; 5611 *a–c*, C. M.	6	59–306	Small creek near mouth of Rio Calima	Henn
13388, I. U. M.; 5612 *a–c*, C. M.	7	29–251	Rio Calima near Boca del Guineo	"
13389, I. U. M.; 5610 *a–c*, C. M.	11	143–266	Istmina	Eigenmann
13390, I. U. M.; 5613 *a–c*, C. M.	6	204–499	San Juan at mouth of Rio Munguido	Henn
5608 *a*, C. M.	1	191	Cordova	Eigenmann
13392, I. U. M.	1	288	Rio Magui	Henn
13396, I. U. M.	2	234–251	Rio Telembi	Henn and Wilson
13394, I. U. M.; 5614 *a–e*, C. M.	31	282–800	Guayaquil Market	Henn

This species, the only one found in western Ecuador, reaches such a large size at Guayaquil that this physiological variety might well be named *maximus*.

268. **Sternopygus dariensis** Meek and Hildebrand.

Sternopygus dariensis Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 309, plate XXVI (Marrigante, Rio Tuyra).

Differs from *S. macrurus* "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."

Mr. Hildebrand has kindly prepared the following comparison between *S. macrurus* and *S. dariensis*.

Sternopygus macrurus	*Sternopygus dariensis.*
Upper profile of head convex	Upper profile of head straight, or slightly concave; snout more slender.
Eye comparatively large, 3.5 in snout in a specimen 360 mm. in length	Eye smaller, 5.7 in snout in specimen of same length.
Tail beyond anal very slender, notably longer than head, only slightly compressed	Tail beyond anal rather robust, varying in length but rarely much longer than head, strongly compressed.
Interorbital 3 to 4 in head	Interorbital 4.85 to 6.66.
Vent one and one-half times to twice diameter of eye behind vertical from posterior margin of eye	Vent three or four times diameter of eye behind vertical from eye.

Eigenmannia Jordan and Evermann.

269. **Eigenmannia virescens** (Valenciennes).

Eigenmannia virescens Ellis, Mem. Carnegie Mus., VI, 1913, p. 127 (Full synonymy, bibliography, etc.); Eigenmann and Fisher, Indiana University Studies No. 25, 1914 (Magdalena Basin at Calamar, Soplaviento, Cartago, Puerto del Rio, Apulo); Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 311 (Marrigante, Rio Tuyra).

Sternopygus humboldtii Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 71, plate XIV (Magdalena); *ibid.*, XLI, 1879, p. 169 (Mamoni R. at Chepo); *ibid.*, XLII, 1880, p. 88 (Cauca near Caceres); *ibid.*, LXXII, 1902, p. 147 (Barranquilla on Magdalena).

Habitat: Rio Mamoni and R. Tuyra, Panama; Rio Magdalena to Buenos Aires and Rio São Francisco.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
13399, I. U. M.	2	242 & 414	Barbacoas	Henn and Wilson
13400, I. U. M.	2	219 & 385	Rio Magui	Henn
13401, I. U. M.	1	224	Boca del Certegui	Wilson
13402, I. U. M.	1	145	Managru	"
5620 *a–j*, C. M.; 13403, I. U. M.	87	76–270	Calamar	Eigenmann
5625 *a–g*, C. M.; 13404, I. U. M.	11	102–289	Puerto del Rio	Gonzales
5623 *a*, C. M.; 13405, I. U. M.	2	207 & 236	Apulo	"
5624 *a*, C. M.; 13406, I. U. M.	2	185 & 222	Girardot	Eigenmann
5622 *a–o*, C. M.; 13407, I. U. M.	136	46–277	Soplaviento	"
13408, I. U. M.	2	241 & 270	Patia between Magui and Telembi	Henn

HYPOPOMUS Gill.

270. **Hypopomus brevirostris** (Steindachner).

Rhamphichthys brevirostris STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 89 (Cauca near Caceres).

Hypopomus brevirostris ELLIS, Mem. Carnegie Mus., VI, 1913, p. 134 (full bibliography); EIGENMANN and FISHER, Indiana University Studies No. 25, 1914, p. 236 (Magdalena, Atrato and San Juan Basins); MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 310 (Rio Chagres Basin; Rio Bayano Basin).

Habitat: Atlantic and Pacific sides of Panama, Atrato, San Juan and Magdalena Basins, south to Paraguay.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5601 *a–e*, C. M.; 13380, I. U. M.	10	86–145	Soplaviento	Eigenmann
5599 *a–c*, C. M.; 13381, I. U. M.	6	83–162	Managru	Wilson
5600 *a–b*, C. M.; 13382, I. U. M.	5	82–128	Truando	"
5604 *a–b*, C. M.; 13383, I. U. M.	5	50–168	Small creek near mouth of Rio Calima	Henn
5602 *a–b*, C. M.	2	90 and 98	Raspadura	Wilson
5603 *a*, C. M.	1	91	Quibdo	"
5605 *a*, C. M.; 13384, I. U. M.	3	50–168	Rio Calima near Boca del Guineo	Henn

There is considerable variation in the specimens of *Hypopomus* and it is possible that different species or varieties should be recognized. The specimens from Soplaviento have short, more or less vermiculating, dark markings on the anterior abdominal part of the body; behind this area there are dark cross-bars, or only a few spots, which are most pronounced on the back.

In the specimens from Managru there are pronounced dark cross-bars, wider than the interspaces, on the upper half of the anterior third, sometimes broken along the sides with the lower halves of the bars shifted backward. These recall the markings of *H. artedi*.

The specimens from Truando are marked with narrower bars, which are broken up into spots below and on the tail.

In specimens from the Rio Calima the bars are replaced by small spots, sometimes irregularly placed, sometimes elongate and following the general trend of the bars, where these are developed. These probably represent the following species (No. 271).

271. **Hypopomus occidentalis** Regan.

Hypopomus occidentalis Regan, Ann. & Mag. Nat. Hist. (8), XIV, 1914, p. 32 (Rio Condoto).

This species is known only from the original description.

Sternarchus Bloch and Schneider.

Key to the Species of Sternarchus.

a. Eye in middle of head; head 5.16; depth 7.8; A. 158; anus nearer upper angle of pectoral than to angle of gape.....**leptorhynchus** Ellis.

aa. Eye in middle of head in adult, somewhat in advance of it in smaller specimens; head 5.3–6.5 in the length; A. 151–175; anus much nearer upper angle of pectoral than to snout in a large specimen (13377, I. U. M.).....**rostratus** Meek and Hildebrand.

aaa. Eye far in advance of the middle of the head; head 6.3–7.1 in the length to end of the anal; depth 6.33; A. 173–176; anus equidistant from snout and center of opercle (in 13375, I. U. M.).
mariæ Eigenmann.

aaaa. Eye far in advance of the middle of the head; head 6–6.5 in the length to end of the anal; depth 7–8; A. 164–178.....**spurrelli** Regan.

272. **Sternarchus leptorhynchus** Ellis. (Plate XXXV, fig. 1.)

Sternarchus leptorhynchus Ellis, Mem. Carnegie Mus., VI, 1913, p. 147, plate XXII, fig. 4 (Amatuk and Warraputa, British Guiana); Eigenmann and Fisher, Indiana University Studies No. 25, 1914, p. 236 (Mouth of Rio Calima, San Juan Basin; Cordova, Rio Dagua).

5593 *a*, C. M., one, 130 mm. Small creek near mouth of Rio Calima.

13374, I. U. M., one, 209 mm. Cordova. Eigenmann.

Center of eye in middle of head; snout long; gape very long; anus under vertical limb of preopercle.

In No. 13374 I. U. M., the depth of the head at the anus is about equal to half its length; the eye is in the center of the head, the snout being equal to the post-

orbital part of the head; the gape is long; the anus is nearer the upper angle of the pectoral than to the angle of the gape and is below the vertical edge of the preopercle.

273. **Sternarchus rostratus** Meek and Hildebrand. (Plate XXXIV, fig. 5; plate XXXV, figs. 3, 4 and 5.)

Sternarchus rostratus Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1913, p. 83 (Rio Grande near Cana, Tuyra Basin); *ibid.*, X, 1916, p. 312, plate XXVII; Eigenmann and Fisher, Indiana University Studies No. 25, 1914, p. 236 (Magdalena Basin).

Habitat: Magdalena and Tuyra Basins.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5595 *a–c*, C. M.; 13376, I. U. M.		179–218	Girardot	Eigenmann
5596 *a*, C. M.; 13377, I. U. M.	2	203 and 204	Apulo	Gonzales
5597 *a–d*, C. M.; 13378, I. U. M.	8	94–182	Cartago	Eigenmann
5598 *a–c*, C. M.; 13379, I. U. M.	5	119–155	Cauca at Cali	"

Head 5.3–6.5 in length to end of the anal; depth 1.1–1.3 in the length of the head; A. 151–175; snout 2.3–2.7 in the length of the head; eye 3–6.1 in the interorbital, 4–11.5 in the snout; 9–21 in the length of the head, depending on the age; width of head 2–2.7 in the depth.

Evenly dotted or marbled, somewhat darker dorsally, a narrow light stripe along the median dorsal line from the end of the snout, disappearing on the posterior fourth of the body.

In No. 13377, I. U. M., the depth of the head at the anus is a little more than half its length; the posterior margin of the eye is in the center of the head; the gape is long; the anus is much nearer the upper angle of the pectoral than the snout, or below a point about two and one half orbital diameters behind the eye.

274. **Sternarchus mariæ**[20] Eigenmann and Fisher. (Plate XXXIV, fig. 6; plate XXXV, fig. 2.)

Sternarchus mariæ Eigenmann and Fisher, Indiana University Studies No. 25, Sept. 5, 1914, p. 236.

5594 *a*, C. M., *type*, 201 mm., Girardot. Eigenmann.

13375, I. U. M., *paratype*, 273 mm., Apulo. Gonzales.

Head 7.1 in type (6.3 in paratype) in the length to the end of the anal; depth

[20] Named for Brother Apolinar Maria, Director of the Natural History Museum of Bogotá.

of head at the occiput 1.25 in its length in the paratype; depth 7 in the length, 6.33 to end of anal; anal rays one hundred and seventy-three in type (one hundred and seventy-six in paratype); snout 2.7 in type (2.6 in paratype) in the length of the head; eye far in advance of the middle of the head, 5.5 in type (5.7 in paratype) in the interorbital; width of head 2.4 in type (2.5 in paratype) in the depth.

Profile of snout sharply decurved; gape reaching to vertical from the eye; ground-color light buff, body closely pigmented with minute dark chromatophores which are much more abundant dorsally. An interrupted whitish streak along the median dorsal line from the end of the snout to the base of the caudal.

Easily recognized by the very short snout and gape.

In No. 13375, I. U. M., the depth of the head at the anus is much more than half its length; the center of the head falls an orbital diameter behind the eye; the gape is very short; the anus is equidistant from the snout and the middle of the opercle, and is below a point but little behind the middle of the head.

275. **Sternarchus spurrelli** Regan.

Sternarchus spurrellii Regan, Ann. & Mag. Nat. Hist. (8), XIV, 1914, p. 32 (Rio Condoto) four specimens, the largest 180 mm.

Habitat: Rio San Juan.

This species is known only from the original description. It seems to be similar to *S. mariæ* and may be identical with it, but without a specimen or a figure it is difficult to determine its direct relationships.

Order **SYMBRANCHIA.**

Family XII. SYMBRANCHIDÆ.

Symbranchus Bloch.

276. **Symbranchus marmoratus** Bloch.

Symbranchus marmoratus Regan, Ann. & Mag. Nat. Hist. (8), XII, 1914, p. 473 (Rio Condoto).

7526 *a–b*, C. M., three, 445, 470, and 620 mm., Soplaviento. Eigenmann.

I have also examined specimens in the collection of the University of Michigan as follows: two, 120–135 mm. long, from the Gaira River at Gaira, Colombia, collected by Dr. A. G. Ruthven; three, 67–98 mm. long, collected in the Tamocal River at San Lorenzo and the Manzanares River at Santa Marta and Mamatoco by Dr. A. S. Pearse.

This is the most widely distributed fresh-water fish of South America.

Order **APODES.**

Family XIII. ANGUILLIDÆ.

Anguilla Shaw.

277. **Anguilla chrysypa** Rafinesque.

51987, University of Michigan, one, 118 mm., Gaira River at Gaira, Colombia. A. G. Ruthven.

The common eel of North America has been known to enter various West Indian rivers. As far as I am aware, this is the first South American record. Meek and Hildebrand obtained a specimen in the Rio Chagres.

Order **ISOSPONDYLI.**

Family XIV. CLUPEIDÆ.

Lile Jordan and Evermann.

278. **Lile stolifera** (Jordan and Gilbert).

Lile stolifera Regan, Ann. & Mag. Nat. Hist. (8), XIX, 1917, p. 393.

7490 *a–f*, C. M.; 13874, I. U. M., thirteen, largest 100 mm., Mouth of Rio Dagua. Eigenmann.

7494 *a–f*, C. M.; 13879, I. U. M., many, largest 100 mm., Tumaco. Henn and Wilson.

This species was also recorded by Boulenger (Boll. Mus. Zoöl. Anat. Comp. Torino, XIV, 1899) from Guayaquil.

Family XV. ENGRAULIDÆ.

Stolephorus Lacépède.

279. **Stolephorus lucidus** Jordan and Gilbert.

7488 *a–j*, C. M.; 13872, I. U. M., many specimens, the largest 85 mm. Chone, Province Manabi, Ecuador. Henn.

7489 *a–o*, C. M.; 13873, I. U. M., thirty, largest 76 mm. Mouth of Rio Dagua. Eigenmann.

Head 3.75; depth 4.25 uniformly; D. 13 or 14; A. 28–30; scales about thirty-four; sixteen rakers on the upper part, twenty on the lower part of the first gill-arch; maxillary reaching a little beyond mandible, not to the gill-opening; margin of caudal dusky.

280. **Stolephorus branchiomelas** Eigenmann. (Plate XXVIII, fig. 1.)

Stolephorus branchiomelas EIGENMANN, Proc. Amer. Philos. Soc., LVI, p. 682 (Mouth of Rio Dagua, and Tumaco, Colombia).

The original description is supplemented by the figure appearing in this volume.

281. **Stolephorus poeyi** (Kner and Steindachner).

Engraulis poeyi KNER and STEINDACHNER, Abhandl. Bayer. Akad. Wiss., X, 1864, p. 23, plate III, fig. 3 (Rio Bayano).

ANCHOVIA Jordan and Evermann.

282. **Anchovia macrolepidota** (Kner and Steindachner).

Engraulis macrolepidotus KNER and STEINDACHNER, Abhandl. Bayer. Akad. Wiss., X, 1864, p. 21, plate III, fig. 2 (Rio Bayano, Panama).

Family XVI. ELOPIDÆ.

TARPON Jordan and Evermann.

283. **Tarpon atlanticus** (Cuvier and Valenciennes).

Megalops thrissoides STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 69 (Magdalena).

5016, C. M., about 500 mm., Soplaviento. Eigenmann.

5017, 5018, C. M.; 12817, I. U. M., three, the largest about 530 mm., Calamar Cienega. Eigenmann.

The tarpon ascends the Magdalena and probably other streams for many miles. While I was in the "Cienega" near Calamar, a fisherman threw in a few rocks at a certain spot to attract the fishes and then threw in his casting net, securing five tarpons in the one cast.

Order **MICROCYPRINI.**

Family XVII. PŒCILIIDÆ.

This family reaches its optimum north of the area under consideration and there are more species in Panama (nine) than at any point in Colombia. There are but four species in the San Juan Basin, only two closely related species in Ecuador, and only *Rivulus peruanus* and several species of *Orestias* in Peru.

Pseudopœcilia, *Diphyacanthus*, and *Neoheterandria* are genera peculiar to our area. Only *Rivulus*, distributed from Paraguay to the United States, connects this area with the south. The genera *Gambusia*, *Priapichthys*, *Pœciliopsis*, and *Mollienisia* find their southern limit in this area.

For a detailed account of the species of Panama including their bibliography, *see* Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, pp. 313–332.

Henn (Annals Carnegie Mus., X, 1916, pp. 93–142) likewise has given an account of the species from our expeditions to Colombia and Ecuador. The present account of the *Pœciliidæ* is in general limited to a list of the species with references to these papers, and figures of the species already described, but not heretofore figured.

GAMBUSIA Poey.

284. **Gambusia nicaraguensis** Günther.

Gambusia nicaraguensis MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 316, fig. 4 (Brackish water, Atlantic and Pacific Coasts of Panama).

Habitat: Southern Mexico to Panama.

285. **Gambusia episcopi** Steindachner.

Gambusia episcopi MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 317, fig. 5 (Panama north of the Rio Bayano, on both slopes).

Habitat: Central Panama on both slopes.

286. **Gambusia cascajalensis** Meek and Hildebrand.

Gambusia cascajalensis MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 318 (Rio Cascajal, Porto Bello, Panama).

Habitat: Panama north of the Rio Bayano, on both slopes.

287. **Gambusia caliensis** Eigenmann and Henn. (Plate XXVII, fig. 5.)

Gambusia caliensis EIGENMANN and HENN, Ann. Carnegie Mus., X, 1916, p. 113 (Cali).

Habitat: Cauca Basin.

PRIAPICHTHYS Regan.

288. **Priapichthys nigroventralis** (Eigenmann and Henn).

Gambusia nigroventralis EIGENMANN and HENN, Indiana University Studies No. 16, 1912, p. 26 (Rio San Juan at Istmina).

Priapichthys nigroventralis REGAN, Proc. Zoöl. Soc. London, 1913, p. 992; HENN, Ann. Carnegie Mus., X, 1916, p. 115, fig. 3 (Istmina, Tambo, Managru, Quibdo, Raspadura, Rio Calima).

Gambusia caudovittata REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 471 (Rio Condoto, San Juan Basin); Proc. Zoöl. Soc. London, 1913, p. 986.

Habitat: Atrato and San Juan Basins.

Head 4.5–4.8; depth at origin of dorsal 4.5–5; depth of caudal peduncle about 6 in length to base of caudal and about 1.3 in head. Eye 2.2–2.5 in head; equal to interorbital width. Snout short and blunt, lower jaw not extending beyond upper; snout 1.5 in eye. Body depressed, profile arched.

D. 9; A. 9; P. 7; V. 6; scales twenty-nine to thirty in lateral series; eight in transverse series.

Origin of dorsal slightly in advance of the middle of the entire length, slightly posterior to origin of anal. Ventral rays graduated, outer ones longest, barely reaching the vent. In males the anal is a pointed sword-shaped organ, arising at the anterior third of the entire length. Its length is about 2.45 in the entire length of the fish.

289. **Priapichthys tridentiger** (Garman).

Priapichthys tridentiger MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 320, fig. 6 (Panama).

Habitat: Both slopes of Panama, not in the Rio Tuyra.

290. **Priapichthys tridentiger canus** (Meek and Hildebrand).

Priapichthys tridentiger cana MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 321 (Rio Satiganti).

Habitat: Tuyra Basin of Panama.

291. **Priapichthys dariensis** (Meek and Hildebrand).

Priapichthys dariensis MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 321, fig. 7 (Rio Juan Diaz, Rio Bayano and Rio Tuyra).

Habitat: Panama.

292. **Priapichthys panamensis** Meek and Hildebrand.

Priapichthys panamensis MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 322, fig. 8 (Rio Chame and Chame Point).

Habitat: Pacific side of Panama.

PŒCILIOPSIS Regan.

293. **Pœciliopsis elongata** (Günther).

Pœciliopsis elongatus MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 324 (Brackish water near city of Panama).

Habitat: Pacific coast of Panama.

294. **Pœciliopsis colombiana** (Eigenmann and Henn).
(Plate XXVII, figs. 8 and 9.)

Heterandria colombianus Eigenmann and Henn, Indiana University Studies, No. 16, 1912, p. 27 (Rio Dagua); Regan, Proc. Zoöl. Soc. London, 1913, p. 996.
Pœciliopsis colombianus Henn, Ann. Carnegie Mus., X, 1916, p. 120.

Habitat: Rio Dagua, Colombia.

Head 4.25–4.5; depth at origin of anal 3.5; depth of caudal peduncle 5.1–5.6 in length to base of caudal; caudal peduncle 1.2 in head. Eye 3 in head, interorbital width 3.

D. 8; A. 9; V. 6; scales twenty-seven to twenty-nine in a longitudinal series; eight in transverse series.

Body slightly robust; snout broad and chin steep; profile oblique. Origin of the dorsal over last rays of the anal. In the single male, the anal fin is modified into a narrow sword-like organ, without hooks, 1.6 times the length of the head. The distance from the tip of the snout to the origin of the dorsal (in females) is equal to that from the origin of the anal to the end of the middle rays of the caudal. Pectorals reach over middle of ventrals; the latter do not quite reach the vent. Caudal subtruncate or slightly rounded.

General color in spirits olivaceous, belly yellowish. All fins are without color or pigment. Starting about the distance of the eye back of the origin of the pectoral is a series of six or seven vertical streaks or narrow dark bars.

Two series of narrow spike-like teeth. The anal of the male of this species exactly resembles that of *Heterandria pleurospilus* (Günther) of Guatemala and of *H. lutzi* Meek of Mexico. None of the females are pregnant.

295. **Pœciliopsis isthmensis** Regan.

Pœciliopsis isthmensis Regan, Proc. Zoöl. Soc. London, 1913, p. 997 (Colon); Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 325 (not taken).

Habitat: Atlantic side of Panama.

Mollienisia Le Sueur.

296. **Mollienisia sphenops** (Cuvier and Valenciennes).

Mollienisia sphenops Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 326, fig. 10 (both slopes of Panama); Henn, Ann. Carnegie Mus., X, 1916, p. 136 (Cartagena; Rio Manzanares; Santa Marta, Colombia).

Habitat: Both coasts of Panama north of the Rio Tuyra and northern Colombia.

297. **Mollienisia caucana** (Steindachner). (Plate XXVII, figs. 1, 2 and 3.)

Mollienisia caucana HENN, Ann. Carnegie Mus., X, 1916, p. 136, fig. 16 (Calamar and Fundación, Colombia); MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 329 (Aruza and Cituro, Tuyra Basin).

Habitat: Magdalena and Tuyrà Basins.

RIVULUS Poey.

298. **Rivulus peruanus** Regan.

Haplochilus peruanus REGAN, Ann. & Mag. Nat. Hist. (7), XII, 1903, p. 626 (Perim, Peru, 800 meters).

Rivulus peruanus REGAN, Ann. & Mag. Nat. Hist. (8), X, 1912, p. 496.

I do not know whether Perim is on the Pacific or on the Atlantic slope of Peru.

299. **Rivulus brunneus** Meek and Hildebrand.

Rivulus brunneus MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 331 (upper course of a small creek at Toro Point).

Habitat: Atlantic slope of Panama.

300. **Rivulus elegans** Steindachner. (Plate XXVII, fig. 4.)

Rivulus elegans HENN, Ann. Carnegie Mus., X, 1916, p. 108 (Rio Condoto; Rio Truando); MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 331 (Atlantic slope of Panama near Culebra).

Habitat: Magdalena, Atrato, San Juan, and upper Chagres Basins.

301. **Rivulus magdalenæ** Eigenmann and Henn. (Plate XXVII, fig. 10.)

Rivulus magdalenæ EIGENMANN and HENN, Ann. Carnegie Mus., X, 1916, p. 109 (Ibagué; Boquilla; Rio Guaduas; Rio Villeta; Quebrada de Chamisal).

Habitat: Magdalena Basin.

In addition to the specimens recorded above, I have since received two specimens (15030 I. U. M.), 45–73 mm., from Quebrada Cristalina, 28 km. above Puerto Berrio, alt. 1,000 feet, collected by Dr. E. B. Wilson.

302. **Rivulus brevis** Regan.

Rivulus brevis REGAN, Ann. & Mag. Nat. Hist. (8), X, 1912, p. 504 (Colombia without definite locality); HENN, Ann. Carnegie Mus., X, 1916, p. 112 (Fundación, near Santa Marta).

Habitat: Northern Colombia.

PSEUDOPŒCILIA Regan.

303. **Pseudopœcilia festæ** (Boulenger).

Pœcilia festæ BOULENGER, Bull. Mus. Zoöl. Anat. Comp. Torino, XIII, 1898, No. 329, p. 13 (San Vicente, near Santa Elena, Ecuador).

Pseudopœcilia festæ REGAN, Proc. Zoöl. Soc. London, 1913, p. 996.

Habitat: Ecuador, west of Guayaquil.

Scales 33–35, 12–13 transverse.

304. **Pseudopœcilia fria** (Eigenmann and Henn). (Plate XXVII, figs. 6 and 7.)

Pœcilia fria EIGENMANN and HENN, Indiana Univ. Studies No. 19, Jan. 16, 1914, p. 13 (Vinces, Ecuador); HENN, Ann. Carnegie Mus., X, 1916, p. 119, fig. 6.

Habitat: Western Ecuador.

Scales 3–29 or 30–4.

I have since received several specimens of this species (15151, I. U. M.), collected at Ventura, Ecuador, by Dr. J. N. Rose.

DIPHYACANTHA Henn.

305. **Diphyacantha chocoënsis** Henn.

Diphyacantha chocoënsis HENN, Ann. Carnegie Mus., X, 1916, p. 114, fig. 2, plate XIX, figs. 1, 2 (Rio Calima).

Habitat: San Juan Basin.

NEOHETERANDRIA Henn.

306. **Neoheterandria elegans** Henn.

Neoheterandria elegans HENN, Ann. Carnegie Mus., X, 1916, p. 117, fig. 5, plate XIX, figs. 4, 5 (Rio Truando).

Habitat: Atrato Basin.

ORESTIAS Valenciennes.

Members of this genus are distributed in lakes and quiet stretches of Andean rivers above 7,000 feet elevation, from Lake Junin to Latitude 21′ 30″. The species are especially numerous in Lake Titicaca. Large collections were made during the Irwin Expedition and a monograph of the genus will be prepared as soon as possible.

307. **Orestias elegans** Garman.

Orestias elegans GARMAN, Mem. Mus. Comp. Zoöl., XIX, 1895, p. 149 (Lakes of the Cordillera de la Ascension, sources of the river Santa Eulalia, which flows into the Rimac at 13,000 feet elevation).

15242, I. U. M., forty-six specimens, largest about 90 mm. to base of caudal. Small glacial Lake between 15,000 and 15,500 feet, about five miles from Casapalca, September, 1918.

These specimens were collected by a young man from Casapalca at the instance of Supt. Roper, after my own visit to one of these lakes had proved barren.

This is the only species of the genus *Orestias* hitherto recorded from the Pacific slope. There seem to be two species in the Montaro Basin of the Atlantic drainage just across the divide from the Rimac, of which one appears to be this species. Inasmuch as there is a great similarity between the young of the different species, their true relations may be left in abeyance until the entire genus can be reviewed.

308. **Orestias** sp.

15243, I. U. M., five, largest 70 mm., Crucero Alto, at the crest of the Southern Railway of Peru.

Along the railway at Crucero Alto (elevation 14,688 feet), there are small ditches with pools. I am not sure in which direction they drain, probably in both directions at different times. They contain many small specimens of an *Orestias* allied to *elegans* and *agassizi*, the exact determination of which must be left until later.

Order **SYNENTOGNATHI.**

Family XVIII. ESOCIDÆ.

Tylosurus Cocco.

309. **Tylosurus fluviatilis** (Regan).

Belone fluviatilis Regan, Ann. & Mag. Nat. Hist. (7), XII, 1903, p. 626 (N. W. Ecuador); *ibid.* (8), XII, 1913, p. 471 (Rio Condoto).

Habitat: From Manabi, Ecuador, to the Patia, San Juan and Atrato Basins.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
7521 *a–c*, C. M.; 13902, I. U. M.....	5		Manabi, Ecuador	Henn
7502 *a–d*, C. M.; 13885, I. U. M.	8	Largest 550	Patia River	"
7497 *a–f*, C. M.; 13882, I. U. M.....	11	238–425	Tumaco	Henn and Wilson
7495, C. M.; 15034, I. U. M.....	2	Largest 450	Barbacoas	Henn and Wilson
7499 *a*, C. M.; 13884, I. U. M.	11	Largest 200	Mouth of Rio Dagua	Eigenmann
7525 *a–d*, C. M.; 13905, I. U. M.	14	Largest 470	San Juan at mouth of R. Jujiado	Henn
7503, C. M.; 13887, I. U. M.....	5	About 90–450	Puerto Negria	Eigenmann
7501, C. M.....	1	470	Tado	Wilson
7498, C. M.; 13883, I. U. M.....	13	78–460	Istmina	Eigenmann and Wilson
7505, *a–c*, C. M.; 13888, I. U. M.	6	Largest 560	Boca de Certegui, Atrato Basin	Eigenmann
7496, C. M.; 13881, I. U. M.....	7	305–330	Truando	Wilson

Order **PERCESOCES.**

Family XIX. MUGILIDÆ.

The *Mugilidæ* are in part marine fishes, which enter the mouths of rivers (*Mugil* and *Querimana*), and in part freshwater fishes found in swift, clear streams, in rapids, and at the base of waterfalls (*Agonostomus* and *Joturus*).

Mugil Linnæus.

In addition to those listed below, species of *Mugil* which may enter freshwater inlets are *M. trichodon*, which may enter rivers of the Atlantic slope, and *M. hospes* and *M. thoburni*, which may occur in rivers draining into the Pacific.

310. **Mugil curema** Cuvier and Valenciennes.

5643 *a*, C. M.; 13429 *a–b*, I. U. M., Chone, Prov. of Manabi, Ecuador. Henn. Field Mus. Coll., four, largest 113 mm., Trujillo, Peru. W. H. Osgood.

311. **Mugil cephalus** Linnæus.

Mugil cephalus Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913 (Pacasmayo).
15294, I. U. M., six, largest 181 mm., Pisco, Peru. Eigenmann.
15295, I. U. M., four, largest 247 mm., Santiago (Market), Chile. Eigenmann.
15297, I. U. M., many, largest 267 mm., La Serena, Chile. Eigenmann.

312. **Mugil incilis** Günther.

Mugil incilis Günther, Trans. Zoöl. Soc. London, 1869, VI, p. 443 (Rio Chagres); Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 26 (Mouth of Magdalena).

313. **Mugil liza** Cuvier and Valenciennes.

Mugil liza Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 26 (Mouth of Magdalena).

314. **Mugil charlottæ** Steindachner.

Mugil charlottæ Steindachner, Denkschr. Akad. Wiss. Wien, LXXII, 1902, p. 129, plate IV, figs. 2, 2*a* (Guayaquil).

315. **Mugil brasiliensis** Agassiz.

Mugil brasiliensis Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 26 (Mouth of Magdalena).

QUERIMANA Jordan and Gilbert.

316. **Querimana harengus** Günther.

Querimana harengus, REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 279 (freshwater at Pacasmayo).

AGONOSTOMUS Bennett.

317. **Agonostomus monticola** (Bancroft).

Agonostomus monticola MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 334.

This species, occurring in Mexico and Central America, was taken by Meek and Hildebrand in the Chagres River and numerous other Atlantic streams. It was found everywhere on the Pacific slope except in the Tuyra Basin. It was not taken by us in Colombia.

318. **Agonostomus macracanthus** Regan.

Agonostomus macracanthus MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 335 (Rio Indio, upper Chagres).

I have examined specimens, 63 and 69 mm. long, from the Tamocal River at San Lorenzo, Colombia (800 feet), Dr. A. S. Pearse, collector, Nos. 51965 and 51966, University of Michigan.

319. **Agonostomus nasutus** Günther.

Agonostomus nasutus REGAN, Ann. & Mag. Nat. Hist. (8), XIV, 1914, p. 33 (Condoto, San Juan Basin).

It is possible that the specimen recorded by Regan from the Condoto really belongs to the species listed below as *Joturus daguæ*.

JOTURUS Poey.

320. **Joturus daguæ** Eigenmann. (Plate XXVIII, fig. 2.)

Joturus daguæ EIGENMANN, Proc. Amer. Philos. Soc., LVI, 1917, p. 681 (Caldas, Colombia).

Habitat: Rio Dagua. This is the southernmost record of any species of *Joturus* or *Agonostomus*.

This species greatly resembles *Agonostomus monticola*, which has a narrower and longer snout.

The figure on the plate will supplement the original description.

321. **Joturus pichardi** Poey.[21]

Joturus pichardi Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 336 (Rio Indio, and Gatun, Chagres Basin).

Habitat: Cuba; Mexico to Panama. It was not taken by us in Colombia.

Family XX. ATHERINIDÆ.

Thyrina Jordan and Culver.

Thyrina Jordan and Culver, Proc. Cal. Acad. Sci. (2), V, 1895, p. 419.
Type, *Thyrina evermanni* Jordan and Culver.

322. **Thyrina colombiensis** Hubbs.

Thyrina guatemalensis (*non* Günther) Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 472 (Rio Condoto).

Thyrina colombiensis Hubbs, Occ. Papers Mus. Zoöl., Univ. Michigan, 1920, No. 88, p. 4.

Habitat: San Juan and Patia Basins.

The specimens, on which Dr. Hubbs based his description, were collected by us at Barbacoas on the Rio Telembi of the Patia Basin, and at Condoto, Tado, and Istmina in the San Juan Basin.

Menidia Bonaparte.

323. **Menidia chagresi** Meek and Hildebrand.

Menidia chagresi Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1914, p. 119 (Gorgona, Canal Zone).

Habitat: Chagres Basin.

Basilichthys Girard.

324. **Basilichthys semotilus** (Cope).

Protistius semotilus Cope, Proc. Acad. Nat. Sci. Phila., 1874, p. 66 (Peruvian Andes, 12,000 ft.); Proc. Amer. Philos. Soc., XVII, 1878, p. 700; Fowler, Proc. Acad. Nat. Sci. Phila., 1903, p. 737, plate XLIV (reëxamination, with figure of type).

Gasteropterus archæus Cope, Proc. Amer. Philos. Soc., XVII, 1878, p. 700 (Are-

[21] *Polydactylus approximans* (Lay and Bennett) was recorded from fresh water at Pacasmayo by Regan (Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 279).

quipa); FOWLER, Proc. Acad. Nat. Sci. Phila., 1903, p. 738, plate XLIII (reëxamination of type).

Pisciregia beardsleei ABBOTT, Proc. Acad. Nat. Sci. Phila., 1899, p. 342.

Atherinopsis regius (*non* Humboldt) STEINDACHNER, Denkschr. Akad. Wiss. Wien, LXXII, 1902, p. 39 (Rio Tambo); EVERMANN and RADCLIFFE, Bull. U. S. Nat. Mus., 95, 1917, p. 45 (Rio Rimac near Lima).

Protistius semotilus was described and *Trichomycterus dispar* Cuvier and Valenciennes was listed by Cope, with the statement that they were derived from some portion of the Peruvian Andes at an elevation of twelve thousand feet. I question the correctness of the altitude. My own experience is that in Peru at 12,000 feet there are only *Orestias*, *Pygidium*, and possibly *Astroblepus*.

Fowler, who has reëxamined and figured the types of *P. semotilus* and of *G. archœus*, says that the latter "differs from *Protistius* chiefly in the presence of more than one dorsal spine." I have been able to examine a large number of specimens and find that the number of dorsal spines varies from none to four in specimens from the area between Vitor Valley and Arequipa and from three to five in those from the Rimac Valley. The number of dorsal spines therefore is not of generic value, and the genera *Protistius* and *Gasteropterus* are synonymous. From the variability in the number of dorsal spines in specimens from the Arequipa region, one may naturally question whether Cope's specimens might not have come from Arequipa (elevation 7,500 ft.). The objection to this surmise is that *Pygidium dispar* does not occur about Arequipa.

P. dispar has hitherto been recorded from the Atlantic side of Peru at an elevation of 14,000 feet, and from Callao, from Lake Titicaca, and from Eten, Peru, although I question the correctness of the identification of specimens from the last three localities.

Eliminating the number of dorsal spines, it becomes difficult to distinguish between *P. semotilus* and *P. archœus*. Fowler made out the following differences, respectively, in a specimen of *P. semotilus* five and one-half inches long, and a specimen of *P. archœus* six and one-half inches long. Depth 5 *vs.* 6; D. I–I, 10 *vs.* I–I, 11; A. 1.13 *vs.* 1.15; scales 75 *vs.* 86; width of head in its length 1.875 *vs.* 2; interorbital 2.66 *vs.* 2.875; least depth of caudal peduncle 2.60 *vs.* 2.875; anus, close in front of anal *vs.* midway between tip of ventrals and anal.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm. (Largest).	Locality.	Date.	Collector.
15180, I. U. M.	4	200	Arequipa Market.	Oct. 29, 1918	Eigenmann
7699 *a–e*, C. M.; 15181, I. U. M.	Many	172	Tiabaya, Rio Chili	Oct. 25, 1918	"
7700 *a–e*, C. M.; 15182, I. U. M.	"	170	Vitor Valley, Rio Vitor	Oct. 28, 1918	"
15183, I. U. M.	"	153	Lima, Rio Rimac	August, 1918	Allen
15184, I. U. M.	"	170	Chosica, Rio Rimac	Oct. 10, 1918	Eigenmann
7701 *a–f*, C. M.; 15186, I. U. M.	"	153	Chosica, Rio Rimac	Aug. 24, 1918	Allen
15185, I. U. M.	"		Matucana, Rio Rimac	Aug. 24, 1918	Eigenmann
15346, I. U. M.	"	201	Chucurapi, Rio Tambo	June, 1921	N. E. Pearson

Head 4.25 to 4.6; depth 4.66 to 5; D. 0 to V [22]–12 to 14; A. 15 to 17; snout

Specimens from	Number of Spines.					
	0	I	II	III	IV	V
Lima, Rio Rimac					3	2
Chosica, Rio Rimac				27	52	4
Vitor Valley, Rio Vitor			3	52	19	
Tiabaya, Rio Chili	2	8	6	23	4	
Arequipa, Rio Chili		1			3	
Chucurapi, Rio Tambo				9	20	1

3 in the head, eye 4.5 to 5, interorbital 2.75 to 3; scales 83 to 95.

Vomer with a patch of teeth on its tip; distance from tip of snout to end of maxillary equal at least to distance between snout and eye; depth of caudal peduncle 2.5 to less than 3 in the distance between base of last anal ray and base of middle caudal ray; pectorals reach half-way to tip of ventrals or half-way to anus. Color as in *B. microlepidotus*.

Order **ACANTHOPTERI.**

Family XXI. CENTROPOMIDÆ

Centropomus Lacépède.

A number of other species of this genus, which probably enter the mouths of the rivers, were taken on the coasts of Colombia and Ecuador. They are listed by Wilson, Ann. Carnegie Mus., 1916, X, pp. 63–64.

[22] Number of dorsal spines in *Basilichthys semotilus*.

325. **Centropomus grandoculatus** Jenkins and Evermann.

Centropomus grandoculatus WILSON, *loc. cit.*, p. 63 (Mouth of Rio Dagua).

326. **Centropomus armatus** Gill.

Centropomus atridorsalis REGAN, Ann. & Mag. Nat. Hist. (7), XII, 1903, p. 627 (Rio Vauqueria, Ecuador).

5243, C. M.; 13226, I. U. M., five, Mouth of Rio Dagua. Eigenmann.

5248, C. M.; 13227, I. U. M., three, Puerto Negria, San Juan. Eigenmann.

5249, C. M.; 13228, I. U. M., three, Rio Rosario, near Tumaco. Henn and Wilson.

327. **Centropomus unionensis** (Bocourt).

Centropomus unionensis STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 94 (Guayaquil).

328. **Centropomus undecimalis** (Bloch).

Centropomus undecimalis GÜNTHER, Cat. Fishes Brit. Mus., I, 1859, p. 79 (Rio Chagres); STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 21 (Cienega near Caiman, Magdalena); *ibid.*, XLII, 1880, p. 94 (Guayaquil).

329. **Centropomus ensiferus** Poey.

Centropomus ensiferus STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 21 (near mouth of Magdalena).

330. **Centropomus pedimacula** Poey.

Centropomus pedimacula STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 22 (Barranquilla).

331. **Centropomus parallelus** Poey.

Centropomus parallelus GÜNTHER, Trans. Zoöl. Soc. London, VI, 1868, p. 407 (Rio Chagres).

Family XXII. HÆMULIDÆ.

POMADASYS Lacépède.

Various species of this marine genus enter fresh water, and some of them are possibly confined to it.

332. **Pomadasys bayanus** Jordan and Evermann.

Pomadasys bayanus JORDAN and EVERMANN, Bull. U. S. Nat. Mus., 47, 1898, p. 1331 (Rio Bayano); REGAN, Ann. & Mag. Nat. Hist. (8), XIV, 1914, p. 33 (Rio Condoto).

Pristipoma labraciforme Boulenger, Boll. Mus. Zoöl. Anat. Comp. Torino, XIV, 1899, p. 3 (St. Elena Bay, Ecuador).

7509 *a–c*, C. M.; 13893, I. U. M., five, 158–337 mm. Cordova, Rio Dagua. Eigenmann.

7517 *a*, C. M., 430 mm. Half-way between Puerto Negria and Istmina. Eigenmann.

Head 3; depth 3.5; D. XIII, 12; A. III, 7. The smaller specimens along the sides, have interrupted streaks which on the sides of the caudal peduncle merge into two longitudinal bands. The anterior part of the anal is dark, the posterior hyaline.

333. **Pomadasys macracanthus** (Günther).

5751 *a*, C. M.; 13242, I. U. M., two, mouth of Rio Dagua. Eigenmann.

7524 *a*, C. M.; 13904, I. U. M., three, Guayaquil Market. Henn.

334. **Pomadasys branicki** (Steindachner).

Pristipoma branicki Steindachner, Denkschr. Akad. Wiss. Wien, XLI, 1879, p. 28 (Tumbez).

5266 *a–b*, C. M.; 13241, I. U. M., three, mouth of Rio Dagua. Eigenmann.

No. 13241, I. U. M., has the following formula: Head 3; depth 2.5; D. XIII, 12; A. III, 7; pores 47 + 10; eye 4 in head, preorbital 5, snout 3, maxillary 3.5, pectoral 1.16, fourth dorsal spine 1.9, second anal spine 1.25; soft dorsal 2.66 in the spinous; anterior part of anal black.

335. **Pomadasys sinuosus** Eigenmann. (Plate XXXIV, fig. 4.)

Pomadasys sinuosus Eigenmann, Proc. Amer. Philos. Soc., 1917, p. 683 (Patia between Magui and Telembi Rivers).

Head 3; depth 3.3; D. XIII, 12; A. III, 8; fifty-one pores in the lateral line to the base of the caudal, twelve pores on the caudal; eye 4.4 in the head, snout 3.1, bony interorbital 7, interocular 5, preorbital 7.3.

Additional descriptive details will be found in the original description.

336. **Pomadasys andrei** (Sauvage).

Pristipoma andrei Sauvage, Bull. Soc. Philom. Paris (7), III, 1879, p. 204 (Rio Guayas, Ecuador).

337. **Pomadasys schyri** Steindachner.

Pomadasys schyri Steindachner, Denkschr. Akad. Wiss. Wien, LXXII, 1902, p. 32 (Guayaquil).

Family XXIII. SCIÆNIDÆ.[23]

338. **Plagioscion surinamensis** (Bleeker).

Pseudosciæna surinamensis BLEEKER, Arch. Neërl. Sci. Exact. et Nat., VIII, 1873, p. 458 (Surinam).

Sciæna magdalenæ STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 22, plate I, fig. 1.

[23] Several marine species of this family, not recorded by Wilson in Annals Carnegie Museum, X, 1916, pp. 57–70, are the following:

Cynoscion xanthulus Jordan and Gilbert.

7519 *a*, C. M.; one, 160 mm., Tumaco. Henn and Wilson.

Bairdiella ensifera (Jordan and Gilbert).

7508 *a*, C. M.; 13891, I. U. M., three, largest 200 mm., market at Guayaquil. Henn.
7518 *a*, C. M., one, 185 mm., Buenaventura. Eigenmann.

Bairdiella chrysoleuca (Günther).

13895, I. U. M., one, Guayaquil market. Henn.

Bairdiella ronchus (Cuvier and Valenciennes).

7510, C. M.; 13894, I. U. M., two, Cartagena. Eigenmann.

Ophioscion typicus Gill.

7511, C. M., one, 192 mm., Rio Dagua.
7512 *a–c*, C. M.; 13896, I. U. M., ten, largest 145 mm., Guayaquil. Eye 4.5 in the head, snout 3.75.

Odontoscion dentex (Cuvier and Valenciennes).

7514 *a–e*, C. M.; 13898, I. U. M., nine, 87–135 mm., Cartagena. Eigenmann.

Micropogon altipinnis Günther.

Micropogon altipinnis Steindachner, Denkschr. Akad. Wiss. Wien, LXXII, 1902, p. 121 (Guayaquil).

Stellifer melanocheir sp. nov. (Plate XXVIII, fig. 3.)

7520, C. M., *type*, 120 mm., Tumaco. Henn and Wilson.

This species is evidently closely allied to *S. oscitans* (Jordan and Gilbert), from which it differs, among other things, in the much longer pectorals and in coloration. In *S. oscitans* the pectoral reaches almost to the vent, in the present species it reaches to above the first anal spine.

Head 3.44; depth 3.1; D. XI, 23; A. II, 8; seven scales from middle of back in front of dorsal to lateral line, ten scales from lateral line to vent; fifty pores to origin of caudal rays; eye about four times in the head, interorbital 2.5, snout 4.5; maxillary-premaxillary border 1.8.

Mouth oblique, lower jaw included; the premaxillary on a level with the lower edge of the pupil; interorbital slightly convex; chin with a small knob, the pores evident; teeth in two irregular series, the outer series of the upper jaw and the inner series of the lower jaw enlarged. Gill-rakers fifteen or sixteen in upper, twenty-five or twenty-six in lower arch (twenty-one + twenty-seven in *S. oscitans*), preopercular spines strong, the upper directed backward, the lower downward and backward; first and second dorsal spines strong, pungent; second dorsal spine nearly half the length of the head; tenth dorsal spine shortest, the third to the seventh spines weak, flexible, the rest becoming strong, pungent, third dorsal spine higher than any of the rays; second anal spine 1.17 in head, its tip reaching tip of fourth anal ray; caudal

Sciæna surinamensis STEINDACHNER, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 77; *ibid.*, XLII, 1880, p. 56 (Cauca near Caceres).

Plagioscion surinamensis magdalenæ STEINDACHNER, Denkschr. Akad. Wiss. Wien, LXII, 1902, p. 32 (Barranquilla).

Habitat: Magdalena Basin.

7506 *a–b*, C. M.; 13889, I. U. M., four, 188–278 mm., Soplaviento. Eigenmann.

7507 *a–j*, C. M.; 13890, I. U. M., twenty-five, largest 420 mm., Cienega, at Puerto del Rio. Gonzales.

Family XXIV. CICHLIDÆ.

The members of this family are distributed from the United States to Buenos Aires on the Atlantic side and to Pacasmayo on the Pacific side. The distribution of the genus *Cichlasoma* is coextensive with that of the family. There are a number of genera north of Panama, while others flourish south of it. *Neetroplus*, one of the northern genera, reaches as far south as the Canal Zone, while the genera *Geophagus* and *Æquidens*, universally distributed from Buenos Aires northward, reach the Canal Zone. Central Panama is thus in a small measure the outpost both of the southern and the northern elements of the family. This fact is emphasized by the members of the genus *Cichlasoma* found in our area. Three of the species belong to the genus *Theraps*, which is not found south of Panama, two belong to the genus *Parapetenia*, which is also essentially a northern group, and the others are members of the subgenus *Astatheros*, which, while essentially a northern group, extends south on the Pacific slope to Guayaquil. It also extends over into the Atlantic side in the Atrato Basin.

Key to the Genera.

a. First gill-arch with a downward projecting lobe on its upper part..... **Geophagus.**

aa. First gill-arch normal.

c. Anal with three spines..... **Æquidens.**

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narrowly rounded, its middle rays equal to the length of the head; pectorals reaching to above the first anal spine, the ventrals to the vent; caudal, soft dorsal, and anal scaled to near the tip; a row of scales along the back of the dorsal spines to near the tip. Caudal, soft dorsal, and all but part of last three anal rays densely punctate; upper surface of first two ventral rays less densely punctate; spinous dorsal and all but lowest rays of the pectorals nearly black, much darker than the other fins. Scales of sides and back with punctulations forming faint streaks, oblique between the lateral line and the spinous dorsal, horizontal elsewhere. We give the measurements below.

Table of Measurements of Type.

Length to base of caudal 93 mm.; length of head 27 mm.; pectoral 31 mm.; ventral 23 mm.; second anal spine 23 mm.; caudal 28 mm.; second dorsal spine 13 mm.; third dorsal spine 15 mm.; base of spinous dorsal 21 mm.; base of soft dorsal 32 mm.; base of anal 12 mm.

cc. Anal with more than three spines.

d. Outer series of teeth incisor-like.....**Neetroplus.**

dd. Teeth all conical.....**Cichlasoma.**

GEOPHAGUS Heckel.

KEY TO THE SPECIES OF GEOPHAGUS.

a. Caudal and soft dorsal spotted.

b. D. XV or XVI, rarely XVII. One scale between lateral line and soft dorsal. No dark bar below eye, even in youngest.....**steindachneri** Eigenmann and Hildebrand.

aa. Caudal and soft dorsal uniform.

c. D. XV or XVI; two scales between lateral line and soft dorsal..**crassilabris** Steindachner.

cc. D. generally XVII, sometimes XVIII; one scale between lateral line and soft dorsal; a dusky shade from eye to angle of preopercle, well marked in young; some of the lateral bands of the male continued on the spinous dorsal, especially in specimens from the Atrato Basin.....**pellegrini** Regan.

339. **Geophagus steindachneri** Eigenmann and Hildebrand.

(Plate XXXII, fig. 3.)

Geophagus brasiliensis (*non* Quoy and Gaimard) STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 56 (Cauca near Caceres).

Geophagus steindachneri EIGENMANN and HILDEBRAND, Reports Princeton Univ. Exped. Patagonia, III, 1910, p. 478.

Geophagus hondæ REGAN, Ann. & Mag. Nat. Hist. (8), 1912, p. 506 (Honda).

Habitat: Magdalena Basin from the coast to Girardot.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
7605, C. M.; 14134, I. U. M.....	60	Largest 133	Soplaviento	Eigenmann
7606, C. M.; 14135, I. U. M.....	68	Largest 111	Bernal Creek	"
7607 *a*, C. M.; 14136, I. U. M.....	2	93–98	Rio Seco	Gonzales
14137, I. U. M.....	2	Largest 58	Apulo	"
51975, 51976, U. of Michigan	2	37–62	River at Fundación	Pearse and Gaige

340. **Geophagus crassilabris** Steindachner. (Plate XXXII, fig. 4.)

Geophagus (*Satanoperca*) *crassilabris*, STEINDACHNER, Sitzungsb. Akad. Wiss. Wien, LXXIV, 1876, p. 65, plate VII (Candelaria, Panama); MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 340 (both slopes of Panama).

Habitat: Both slopes of Panama.

D. XV, 11 in one; XVI, 11 in two; A. III, 8.

341. **Geophagus pellegrini** Regan. (Plate XXXII, fig. 2.)

Geophagus pellegrini Regan, Ann. & Mag. Nat. Hist. (8), 1912, p. 505 (Tado, Rio San Juan); *ibid.* (8), XII, 1913, p. 472 (Rio San Juan and Rio Condoto).

Habitat: Atrato and San Juan Basins.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length of Largest in mm.	Locality.	Collector.
14138, I. U. M.	5	187	Truando, Atrato Basin	Wilson
7608, C. M.; 14139, I. U. M.	Many	193	Quibdo, Atrato Basin	Eigenmann, also Wilson
7616, C. M.; 14140, I. U. M.	30	220	Tado, Atrato Basin	Wilson
7609, C. M.	9	57	Managru, Atrato Basin	Eigenmann
7610, C. M.; 14141, I. U. M.	18	147	Boca de Certegui, Atrato Basin	"
7611, C. M.; 14142, I. U. M.	60	95	Boca de Raspadura, Atrato Basin	"
7612, C. M.; 14143, I. U. M.	19	125	Raspadura, Atrato Basin	Wilson
7613, C. M.	1	35	Tambo, Atrato Basin	"
7614, C. M.; 14144, I. U. M.	24	200 to end of upper caudal filament	Puerto Negria, San Juan	Eigenmann
7617, C. M.; 14146, I. U. M.	Many	202	Istmina, San Juan	"

This species, first recorded from the San Juan, is even more abundant in the Atrato Basin of the Atlantic drainage.

The young have a dusky band extending from eye to middle of base of caudal, a curved bar from a point some distance in front of dorsal to the eye and from the eye to the angle of the preopercle; six bars crossing sides between the opercle and the caudal spot; a spot in the bar crossing the sides at the tip of the pectoral. These markings fade irregularly with age, the spot on the side usually remains most prominent, sometimes there are inky blotches on the sides and the fins of the male.

The male develops an excessive nuchal knob and very thick lips. A female 188 mm. long from the Truando is carrying young in its mouth.

Æquidens Eigenmann and Bray.

Key to the Species of Æquidens.

a. Gill-rakers 5 or 6.

b. Caudal emarginate, subtruncate, or rounded; dorsal without a spot.

c. Usually three, rarely four, bars behind the lateral spots; dorsal spines usually XV, rarely XIV; center of lateral spot equidistant from center of caudal spot and a point between the edge of the operculum and its anterior third.

cœruleopunctatus (Kner and Steindachner).

d. Usually four bars, tending to divide, behind the lateral spot; center of lateral spot equidistant between the center of the caudal spot and a point between the eye and

the second third of the operculum; dorsal spines usually XIV, rarely XV; lateral spot below the scales of the lateral line..... **latifrons** (Steindachner).

dd. Four bars behind the lateral spot, bars not tending to divide, the interspaces broad; center of lateral spot equidistant from center of caudal spot and a point in the posterior half of the eye; dorsal spines usually XV, rarely XIV; depth 2.33–2.43. Centers of scales sometimes light; caudal emarginate, the outer rays sometimes prolonged..... **sapayensis** (Regan).

bb. Caudal lanceolate in adult; a black spot on the spinous dorsal over the lateral spot; a lateral spot on the lateral line, sometimes extending on the dorsal fin, about equidistant from center of caudal spot and the upper angle of the operculum; dark lines along the rows of scales, a dark band from eye to upper edge of caudal peduncle, four bars behind the lateral spot. **biseriatus** Regan.

aa. Gill-rakers 7–9, usually 8; dorsal spines XIII–XV; three, rarely four, bars behind the lateral spot, the interspaces narrow, becoming obscure with age; lateral stripes along rows of scales becoming prominent with age, the bands sometimes double in the young..... **rivulatus** Günther.

342. **Æquidens cœruleopunctatus** (Kner and Steindachner).

Acara cœruleopunctata Kner and Steindachner, Sitzb. Bayer. Akad. Wiss. München, 1863, 222; Abhandl. Bayer. Akad. Wiss. München, X, 1864, p. 16, plate II, fig. 3 (Chagres).

Æquidens cœruleopunctatus Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 339 (Panama).

Habitat: Both slopes of Panama; (?) N. W. Ecuador.

Gill-rakers 6; D. XV in five, XVI in one; bands 4 in two, 3 in four. Center of lateral spot equidistant between center of caudal spot and a point between edge of operculum and its anterior third.

343. **Æquidens latifrons** (Steindachner). (Plate XXXIII, fig. 1.)

Acara cœruleopunctata latifrons Steindachner, Denkschr. Akad. Wiss. Wien, XXXIX, 1878, p. 27 (Lower Magdalena); *ibid.*, XLII, 1880, p. 56 (Cauca near Caceres).

Acara cœruleopunctata brevirostris Steindachner, *ibid.*, XLII, 1880, p. 56 (substitute name).

Acara pulchra (part) Pellegrin, Mém. Soc. Zoöl. France, XVI, 1903, p. 176; Regan, Ann. & Mag. Nat. Hist. (7), XV, 1905, p. 335 (Barranquilla).

Cichlasoma cœruleopunctatum Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 471 (R. Condoto, R. Tamana).

Habitat: Panama; Magdalena, Atrato and San Juan Basins.

Number of Individuals Possessing Number of Spines Following:	Number of Spines in Dorsal Fin.		
	XIII.	XIV.	XV.
Specimens from Soplaviento		18	1
" " Calamar		15	2
" " Truando		19	2
" " Quibdo		7	3
" " Raspadura		8	3
" " Puerto Negria	1	15	4

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
[23] 7654 *a–j*, C. M.; 14187, I. U. M	Forty-five	32–89	Soplaviento	Eigenmann
[24] 7655 *a*, C. M.	One	70	Peñas Blancas	"
[24] 7656 *a–j*, C. M.; 14188, I. U. M.	Thirty-nine	24–77	Calamar Cienega	"
[25] 7650 *a–j*, C. M.; 14183, I. U. M.	Many	27–148	Truando	Wilson
[25] 7647 *a–j*, C. M.; 14180, I. U. M.	Nineteen	Largest 101	Quibdo	Eigenmann
[25] 7651 *a–f*, C. M.; 14184, I. U. M.	Fourteen	25–100	Raspadura	Wilson
[26] 7649 *a–n*, C. M.	Fourteen	53–125	Puerto Negria	Eigenmann
[26] 14182, I. U. M.	Twenty-three	18–145	Puerto Negria	Wilson
[24] 51970, U. Michigan	Two	About 54	Irrigation ditch at Santa Marta	A. S. Pearse
[24] 51971, " "	One	78	Marsh at Mamatoco, Santa Marta	A. G. Ruthven
[24] 51969, " "	Two	52–74	Pond near river at Fundación	A. S. Pearse
[24] 51968, " "	Three	42–70	Marsh at Fundación	"
[24] 51971, " "	Three	44–49	Manzanares River, Mamatoco, Santa Marta	"

344. **Æquidens sapayensis** (Regan). (Plate XXXI, fig. 1.)

Acara sapayensis Regan, Ann. & Mag. Nat. Hist. (7), XII, 1903, p. 628; *ibid.* (7), XV, 1905, p. 340 (Rio Sapayo).

Acara rivulata (part) Pellegrin, Mém. Soc. Zoöl. France, XVI, 1903, p. 177.

Habitat: Rio Patia and Rio Sapayo.

7659 *a*, C. M.; 14186, I. U. M., two, 75 and 116 mm., Rio Telembi near Barbacoas, Jan. 17, 1913. Henn and Wilson.

14197, I. U. M., one, 68 mm., Rio Magui, Patia Basin, April 4–5, 1913. Henn. Head 2.8–3; depth 2.33–2.43; D. XIV/1 or XV/3, 10 or 11; A. III, 9; eye 3–3.75;

[24] Magdalena Basin, including the Santa Marta Mountains.

[25] Atrato Basin.

[26] San Juan Basin.

interorbital 2.5 to 3; twenty-four or twenty-five scales along the series of the lower lateral line. Center of lateral spot equidistant from center of caudal spot and a point in posterior half of the eye. Lateral bars without tendency to divide into two bars.

Caudal rounded in the two smaller specimens, emarginate, and the outer rays prolonged in the larger specimen from the Telembi.

345. **Æquidens biseriatus** (Regan). (Plate XXX, fig. 4.)

Cichlasoma (*Æquidens*) *biseriatum* Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 471 (Condoto).

Habitat: Atrato and San Juan Basins.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
7653, C. M.; 14186, I. U. M.	29	23–127	Managru, Atrato Basin	Wilson
7662 *a*, C. M.; 14181, I. U. M.	2	60–68	Condoto, San Juan Basin	"
14189, I. U. M.	2	51–71	Istmina, San Juan River	"
7652 *a–c*, C. M.; 14185, I. U. M.	6	35–54	Tambo, Atrato Basin	"
7661, C. M.	1	90	Boca de Raspadura, Atrato Basin	Eigenmann
7660 *a–c*, C. M.; 14198, I. U. M.	18	43–148	Rio Calima, small creek near Boca del Guineo, San Juan	Henn

D. XIV/1, XV/17, XVI/6, 9/1, 10/16;* A. III, 8; 22 to 25 scales in a median series.

346. **Æquidens rivulatus** (Günther). (Plate XXX, fig. 3; plate XXXIII, fig. 2.)

Chromis rivulata Günther, Proc. Zoöl. Soc. London, 1859, p. 418 (Western Ecuador).

Acara rivulata Boulenger, Boll. Mus. Zoöl. Anat. Comp. Torino, XIV, 1899, No. 335, p. 5 (Rio Vinces; Rio Peripa); Pellegrin, Mém. Soc. Zoöl. France, XVI, 1903, p. 177; Regan, Ann. & Mag. Nat. Hist. (7), XV, 1905, p. 338 (Western Ecuador; Rio Peripa).

Acara pulchra (*non* Gill) Günther, Cat. Fishes Brit. Mus., IV, 1862, p. 280 (Western Ecuador).

Acara æquinoctialis Regan, Ann. & Mag. Nat. Hist. (7), XV, 1905, p. 337 (W. Ecuador; Rio Vinces).

Æquidens azurifera Fowler, Proc. Acad. Nat. Sci. Phila., 1911, p. 515, fig. 7 (tributary of the Chimbo, near Bucay, Prov. Guayas, Ecuador).

* The denominators indicate the number of specimens.

Habitat: Ecuador south to Pacasmayo, Peru.

Günther based *Chromis rivulata* on the type, a specimen 136 mm. in length, and four other specimens 52–92 mm. all in Fraser's collections from Western Ecuador. Boulenger received two specimens, 55–76 mm. long, from the Rio Vinces and three, 113–126 mm. long, from the Rio Peripa, all collected by Festa. All of these he referred to *A. rivulata.* Pellegrin examined the same material and in addition a specimen 114 mm. long from the Sapayo in northwestern Ecuador, collected by Rosenberg. All of this material he referred to *A. rivulata.* Lastly Regan referred Günther's four smaller specimens and Boulenger's specimens from Vinces to *A. æquinoctialis;* Günther's type and Boulenger's specimens from the Rio Peripa, he referred to *A. rivulata;* and the specimen from the Sapayo, he made the type of a new species, *A. sapayensis.* The latter is a valid species.

	A. æquinoctialis.	*A. rivulata.*	*A. azurifer.*
Length	52–96 mm.	113–136 mm.	133 mm.
Depth in the length	2–2.2	2.2–2.4	2.33
Head in the length	2.66–2.8	3	2.8
Snout in posterior part of head	shorter than	equal to	equal to
Eye in length of head	2.8–3.6	3.66–4	3.6–5.1
Interorbital in length of head	2.5–3	3–3.25	2.7
Preorbital	equals eye or less	1–1.25 in eye	.75 in eye
Maxillary reaching to	ant. margin of eye	not to ant. margin of eye	not to eye
Jaws	equal	equal	equal
Fold of lower lip	not continuous	not continuous	
No. of series of scales on cheek	3	3–4	3
Gill-rakers on lower arch	8–9	7–8	8
Scales	25–26	27–28	24
Scales between 1.1. and soft dorsal	1.5	1.5	1.5
Dorsal spines	XIII–XV	XIV–XV	XIII–XV
Dorsal rays	10–12	10–12	10–11
Dorsal spines	subequal from 5th	graduate to last	subequal
Fourth or fifth spine in head	2.5	3	2.75
Soft dorsal extending to	middle of caudal	nearly to middle of caudal or beyond	middle of caudal
A.	III, 8–9	III, 8–9	III, 8 or 9
Pectoral	at least equal to head	nearly equal to head	nearly equal to head
Ventral	to origin of A. or further	nearly to origin of A.	to origin of A.
Cadual	subtruncate or rounded	rounded	rounded
Caudal peduncle	.6–.75 as long as deep	as long, or nearly as long, as deep	as long as deep
Coloration	dark cross-bars; sometimes a dark bar below eye	four or five bars; a dark stripe below eye	six bars; a dark stripe below eye

Fowler described *A. azurifer* based on four specimens from the Rio Chimbo. I have examined a large series of specimens, and *A. rivulata*, *A. æquinoctialis*, and *A. azurifer* seem to me but different forms of the same species.

The differences between the three nominal species from Western Ecuador, using the diagnoses of Regan and Fowler, are as follows:

Specimens Examined.

Specimens from Ecuador.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
7604 *a–j*, C. M.; 14190, I. U. M.	Many	Largest 207	Colimes, Rio Daule	Henn
7657 *a–c*, C. M.; 14191, I. U. M.	26	Largest 204	Chone, Prov. Manabi	"
14192, I. U. M.	1	123	Portoviejo, Prov. Manabi	"
14193, I. U. M.	2	125–172	Naranjito	"
14194, I. U. M.	Several	Largest 143	Vinces	"
7658 *a–c*, C. M.; 14195, I. U. M.	50	Largest 195	Guayaquil Market	"
4697 *a*, C. M. (Paratype of *A. azurifer*)	1	102	Affluent of Chimbo River near Bucay	S. N. Rhoads

Specimens from Peru.

Field Mus.	7	50–113	Pacasmayo	Osgood and Anderson
7681 *a–j*, C. M.; 15157, I. U. M.	Many	38–175	Cultambo, near Pacasmayo	Eigenmann
15154, I. U. M.	1	230	Laguna near Pacasmayo	"
15155, I. U. M.	10	56–191	Llallan, Rio Jequetepeque	"
7683 *a–c*, C. M.; 15156, I. U. M.	Many	Largest 84	Piura	"

Neetroplus Günther.

Distributed southward from Mexico to the Chagres River in Panama.

347. **Neetroplus panamensis** Meek and Hildebrand.

Neetroplus panamensis Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1913, p. 90 (Rio Mandingo, Bas Obispo, Canal Zone); *ibid.*, 1916, p. 348, plate XXXI.

Habitat: Chagres Basin.

Cichlasoma Swainson.

Distribution: Southern Mexico, Cuba, Barbados, Trinidad, and South America south to Guayaquil on the Pacific slope, and Buenos Aires on the Atlantic slope.

There are at least three groups or subgenera of *Cichlasoma* in the area under consideration: *C. kraussii* and *C. umbriferum* form one of the groups (*Parapetenia*); *C. maculicauda*, *C. tuyrense* and *C. sieboldi* form another (*Theraps*); and *C. festæ* from Guayaquil, *C. ornatum* from the Patia, *C. gephyrum* from the Dagua and

San Juan, *C. atromaculatum* from the San Juan and Atrato, *C. calobrense* from the Tuyra and Bayano, and possibly *C. altifrons* from northern Panama form a third group (*Astatheros*). The species composing the last group are found in successive basins from Guayaquil to northern Panama, only the Rio San Juan harboring two species.

KEY TO THE SPECIES OF CICHLASOMA.

a. Premaxillary process not extending past middle of eye.

b. Teeth of the upper and lower jaws similar, none of them enlarged canines; an ill-defined dark blotch at the middle of the base of the caudal; depth 1.75–2.33 in the length. (*Theraps* Günther.)

c. Anal with six or seven spines.

d. Depth 1.75–2 in the length; two series of scales between the two branches of the lateral line; no cross-bands; a large blotch, or band, on caudal peduncle; scales 31–33; D. XVII or XVIII, 11 or 12; A. VI, 9 or 10.....**maculicauda** Regan.

dd. Depth about twice in the length; four rows of scales between the two branches of the lateral line; six cross-bars, intensified along the middle or reduced to a series of spots along the middle of the sides; series of dots along the rows of scales; scales 34–41; D. XVI–XVIII, usually XVII, 11 or 12; A. VI or rarely VII, 8 or 9. **tuyrense** Meek and Hildebrand.

cc. Anal with five spines.

e. Depth 2.33 in the length; two rows of scales between the two branches of the lateral line; five or six cross-bars, intensified below the middle and along the back, rows of dots along the rows of scales; snout rounded; scales 30–32; last dorsal spines twice as long as eye; D. XVII, 11; A. V, 8.....**sieboldi** (Kner and Steindachner).

bb. Teeth of the middle of the upper jaw larger than those in the front of the lower jaw. (*Astatheros* Pellegrin.)

ee. An ocellus at the base of the upper half of the caudal; a black spot at the bases of the last dorsal and anal rays; lateral bars sometimes continued on the spinous and soft dorsals.

f. Young with cross-bars, a dark band from eye to near caudal ocellus in the adult, black spots, or a black band, under the pectoral below the lateral band; upper parts of the bands sometimes remaining and continued on the bases of the dorsal, sometimes the bands intensified with age, the spinous dorsal nearly black; a dark spot on base of pectoral; depth 2.5 in the length; two series of scales between the two branches of the lateral line; D. XVII, 11; A. VI, 8 or 9.....**atromaculatum** Regan.

ff. Sides of head and each scale of the sides with a pearl-gray or blue spot; sides with cross-bands (remaining in the adult), most prominent between the tip of the pectoral and the soft dorsal; depth 2.5 in the length; two scales between the two branches of the lateral line; D. XVI, 12; A. V, 9...**ornatum** Regan.

fff. Similar to *ornatum*, the gray spots of the head smaller; D. XVI or XVII; A. V, 7, or VI, 6.....**ornatum gephyrum** subsp. nov.

ffff. Sides with black cross-bars, without blue spots; depth 2.25–2.6; two scales between the two branches of the lateral line; scales 30, pores 19 + 12; D. XVI or XVII, 11 or 12; A. V, 9.....**festæ** (Boulenger).

eee. A small black spot at the base, middle, or upper half of the caudal; lateral bands not continued on the dorsal; last rays, soft dorsal, and anal without a spot.

g. Sides with a dark spot on middle, under posterior part of spinous portion of dorsal; cross-bands in young; cheeks, opercle, and anterior portion of sides often with small rusty spots; depth 2.13–2.7; two rows of scales between the branches of the lateral line; scales 28–31; D. XVII, 10–12; A. VI, 7 or 8; scales 28–31. **calobrense** Meek and Hildebrand.

gg. Depth 2.3; pearl-colored spots over entire body; three rows of scales between the two branches of the lateral line; about five cross-bars; snout pointed; scales about 30; last dorsal spine less than twice the length of the eye; D. XVI, 11; A. V, 8–9..... **altifrons** (Kner and Steindachner).

aa. Premaxillary process extending to beyond the eye; maxillary usually reaching beyond the anterior margin of the eye; anterior teeth in both jaws canines; snout pointed, the lower jaw prominent; an ocellus at base of upper caudal lobe; two scales between the upper and lower branches of the lateral line (*Parapetenia* Regan).

h. A spot on the lower angle of the opercle, another above the gill-opening, a third near middle of sides, and a fourth at base of upper half of caudal; scales of the sides with a dark spot or margin; more or less distinct cross-bands; scales 29–30; D. XV or XVI, 10 or 11; A. VI, 8 or 9..... **kraussi** (Steindachner).

hh. A dark lateral band, an ocellus near its middle and another at its end on the base of the upper half of the caudal; scales of sides with a light vertical streak; no cross-bars, except in very young; scales 30–32; D. XVI or XVII, 11 or 12; A. VI, 8 or 9. **umbriferum** Meek and Hildebrand.

348. **Cichlasoma maculicauda** Regan.

Cichlasoma maculicauda Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 343 (lower Chagres and its tributaries).

Habitat: Guatemala to Panama. This species finds its southern limit in the Chagres Basin.

349. **Cichlasoma tuyrense** Meek and Hildebrand.

Cichlasoma tuyrense Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1913, p. 89 (Boca de Cupe, Rio Tuyra); *ibid.*, 1916, p. 344, plate XXVIII (Bayano and Tuyra Basins).

Habitat: Pacific slope of Panama from the Bayano to the Tuyra.

This species evidently related to *C. maculicauda* and *C. sieboldi* can be readily distinguished by its small scales.

350. **Cichlasoma sieboldi** (Kner and Steindachner).

Cichlasoma sieboldi Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 345.

Habitat: Pacific slope of Panama.

This species is known only from the types, not having been taken by Meek and Hildebrand.

351. **Cichlasoma atromaculatum** Regan. (Plate XXXIII, figs. 3 and 4.)

Cichlasoma (*Parapetenia*) *atromaculatum* Regan, Ann. & Mag. Nat. Hist. (8), IX, 1912, p. 507 (Tado, Rio San Juan; Rio Condoto); *ibid.*, XII, 1914, p. 472.

Habitat: Atrato and San Juan Basins.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
7625 *a–f*, C. M.; 14155, I. U. M.	12	54–140	Istmina, R. San Juan	Eigenmann
7626 *a–b*, C. M.; 14156, I. U. M.	11	36– 87	Condoto, San Juan Basin	Wilson
7629 *a–b*, C. M.; 14159, I. U. M.		44–152	R. Calima, San Juan Basin	Henn
14085 *a*, I. U. M.		71	Tado, San Juan	Rosenberg
7627 *a–c*, C. M.; 14157, I. U. M.	5	27– 65	Tambo, Atrato Basin	Wilson
7628 *a–b*, C. M.; 14158, I. U. M.	8	22–115	Raspadura, Atrato Basin	"
7630 *a–b*, C. M.; 14160, I. U. M.	4	31– 63	Managru, Atrato Basin	"
14162, I. U. M.	5	47–257	Truando, Atrato Basin	"
7631 *a–b*, C. M.; 14161, I. U. M.	5	34–122	Quibdo, Atrato Basin	Eigenmann

Head about 2.8; average depth 2.39; D. equifrequently XVI or XVII, 11, rarely 10 or 12; A. VI, 8; scales in a median series 27 or 28 + about two on the caudal with pores.

352. **Cichlasoma ornatum** Regan. (Plate XXXI, fig. 2.)

Cichlasoma ornatum Regan, Ann. & Mag. Nat. Hist. (7), XVI, 1905, p. 330 (Rio Durango, St. Javier).

Habitat: Patia Basin in southwestern Colombia, and Durango, and St. Javier in northwestern Ecuador.

7632–7636, C. M.; 14164–14168, I. U. M., twenty-nine, 42–256 mm., Rio Telembi, creeks between Barbacoas and eight miles above, January 14–17, 1913. Henn and Wilson.

14169, I. U. M., sixteen, 106–237 mm., Rio Magui, Patia Basin, Apr. 4–5, 1913. Henn.

Head (average) 2.9; depth (average) 2.43; D. normally XVI, 12; A. V, 9. In the specimens from the Patia Basin, there are twenty-two with sixteen dorsal spines, one with but fifteen, and one with seventeen. The number of anal spines is uniformly five.

Mr. Henn recorded the living colors of a specimen from near Pambana, Rio Telembi, as follows: "general coloration olive-green, lighter on operculum below eye; three yellow streaks from anterior corner of eye to gape; silvery yellow spots

on operculum; dark green vertical streaks. Pectorals and ventrals clear light yellow; dorsal tipped with deep crimson; transverse streaks or dots of clear light blue mixed with colorless patches. Caudal and anal similar, latter with considerable orange or deep yellow. Caudal ocellus black."

353. **Cichlasoma ornatum gephyrum** subsp. nov. (Plate XXXI, figs. 3 and 4.)

7638 *a–d*, C. M.; 14170, I. U. M., eight, largest 136 mm., Istmina, Rio San Juan. Eigenmann.

7637 *a*, C. M.; 14166, I. U. M., two, 68–70 mm., Cisnero, Rio Dagua. Eigenmann.

7639 *a–b*, C. M., *type* and *paratype*, 240 and 78 mm.; 14171, I. U. M., one paratype, Cordova, Rio Dagua. Eigenmann.

Habitat: Rios Dagua and San Juan.

The type has seventeen dorsal and five anal spines. Its coloration is so peculiar (see figure) that it might well be a hybrid between *C. atromaculatum* and *C. ornatum*. The other two paratypes from Cordova have sixteen dorsal spines (the normal number); one has six anal spines, and the other five (the normal number).

Of six specimens from Istmina, two have sixteen and four have seventeen dorsal spines; two have five and four have six anal spines. The smaller specimens might be considered as belonging to *C. atromaculatum*, if there were not a number of specimens of the latter species of equal size from the same place with the perfectly characteristic color of *C. atromaculatum*.

Description of the Type. (7639 *a*, C. M. figured.)

Head very rarely 3; depth 2.4; D. XVII, 12; A. V, 9; eye 5.5, snout equals half the length of the head; interorbital 2.6; preorbital 1.5 times the eye. Five series of scales on the cheeks; 3.5 scales between the upper lateral line and the soft dorsal; two scales between the two branches of the lateral line; scales twenty-nine in a median series to base of caudal; sixth to fourteenth dorsal spines of nearly equal height, 1.25 the diameter of the eye; last spine three times in the head; soft dorsal and anal pointed, not reaching middle of caudal; pectoral less than head without opercle, not reaching to above anus.

Remains of cross-bands occur especially along back and middle of sides, many of the scales of the bands below the middle have black bases; axil black, centers of scales otherwise largely light; soft dorsal, caudal, and posterior half of soft anal with translucent spots; anterior parts of soft dorsal and anal and outer parts of ventrals black, the inner rays of ventrals and the entire pectoral light; small

(blue?) spots on cheeks and opercles; a black spot on base of upper half of caudal, a black spot on bases of soft dorsal and anal near the ends of these fins.

The dorsal spines are relatively higher in the young and the lateral bars are complete from dorsal to anal. In the larger specimen from Istmina the centers of all the scales over the abdominal cavity and a little beyond it are pearl-gray, the dark spot on base of pectoral is lacking, the caudal spot is less conspicuous, and the bands do not encroach on the base of the dorsal spine. Otherwise this specimen is very similar to one of *ornatum* of the same size from the Telembi.

354. **Cichlasoma festæ** (Boulenger). (Plate XXXII, fig. 1.)

Heros festæ Boulenger, Boll. Mus. Zoöl. Anat. Comp. Torino, XIV, 1899, No. 335, p. 6 (Rio Guayas); Pellegrin, Mem. Soc. Zoöl. France, XVI, 1903, p. 230.

Habitat: Guayas Basin of Ecuador.

14177, I. U. M., one, 174 mm., Rio Chanchan, Ecuador. Henn.

14178, I. U. M., one, about 185 mm., Guayaquil Market. Henn.

Head 2.6–2.75; depth 2.25–2.6; D. XVI or XVII, 11 or 12; A. V, 9; thirty scales in a median series, pores 19 + 12; eye 4.5 in the length of the head, interorbital 3–3.25; preorbital greater than eye; teeth of the lower jaw increasing forward, the middle pair of the upper jaw canine-like; last dorsal spine about three times in the head; nine gill-rakers on the lower arch. Five series of scales on the cheeks; two and a half scales between the lateral line and the soft dorsal; two scales between the lines.

Nine conspicuous black bands, alternating with red bars; a black spot at the base of the upper caudal lobe, continued as a bar across the base of the fin. Spinous dorsal black, except just above the light spaces between the bars; soft dorsal, caudal, and soft anal having the color of the light interspaces of the body, no spots; spinous portion of the anal and the ventrals dark; pectorals like the caudal, the axil dark.

355. **Cichlasoma calobrense** Meek and Hildebrand.

Cichlasoma calobrense Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1913, p. 90 (Rio Calobre); *ibid.*, 1916, p. 346, plate XXIX (Bayano and Tuyra Basins).

Habitat: Pacific slope of Panama from the Bayano to the Tuyra.

This species is related to the *atromaculatum-ornatum* group of *Cichlasoma*.

356. **Cichlasoma altifrons** (Kner and Steindachner).

Heros altifrons KNER and STEINDACHNER, Abhandl. Bayer. Akad. Wiss. München 1864, X, p. 11, plate II, fig. 1 (New Granada).

Habitat: Panama.

This species may have come from the Pacific rivers of Chiriqui (Western, Veragua) as stated by Günther and thus be beyond the limits of this paper. It was not taken by Meek and Hildebrand.

357. **Cichlasoma kraussii** (Steindachner).

Petenia kraussii STEINDACHNER, Denkschr. Akad. Wiss. Wien, 1879, XXXIX, p. 28, plate II (Magdalena); *ibid.*, 1880, XLII, p. 56 (Cauca near Caceres); EIGENMANN and BRAY, Ann. N. Y. Acad. Sci., VII, 1894, p. 615; PELLEGRIN, Mém. Soc. Zool. France, XVI, 1903, p. 244 (Lake Maracaibo).

Cichlasoma kraussii REGAN, Ann. & Mag. Nat. Hist. (7), XVI, 1905, p. 339 (Barranquilla).

Chromis dentatus Guichenot MS. Pellegrin, *loc. cit.*

Habitat: Magdalena and Atrato Basins.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
7640 *a*, C. M.; 14172, I. U. M.	2	235–256	Rio Sucio, Atrato Basin	Eigenmann
7645 *a*, C. M.	1	157	Truando, Atrato Basin	Wilson
7642 *a–b*, C. M.; 14174, I. U. M.	3	118–175	Quibdo, Atrato	"
7641 *a*, C. M.; 14173, I. U. M.	2	218–230	Cienega, Puerto Berrio, Magdalena Basin	Gonzales
7643 *a–x*, C. M.; 14175, I. U. M.	Over 100	Largest 215	Calamar Cienega, Magdalena Basin	Eigenmann
7644 *a–x*, C. M.; 14176, I. U. M.	Over 100	Largest 230	Soplaviento, Magdalena Basin	"

358. **Cichlasoma umbriferum** Meek and Hildebrand.

Cichlasoma umbriferum MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1913, p. 88 (Rio Cupe, Cituro, Panama); *ibid.*, 1916, p. 347, plate XXX (Tuyra Basin).

Habitat: Chepo, Tuyra, Atrato, and Magdalena Basins.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
14063, I. U. M.	1	81	Rio Cupe, Darien, Panama	Meek and Hildebrand
14150, I. U. M.	7	50–116	Truando, Atrato Basin	Wilson
7619 *a–f*, C. M.; 14148, I. U. M.	11	56–293	Quibdo, Atrato	Eigenmann
7621, C. M.	1	71	Certegui, Atrato Basin	Wilson
7618 *a*, C. M.; 14147, I. U. M.	3	73–211	Raspadura, Atrato Basin	"
7622 *a–b*, C. M.; 14151, I. U. M.	3	39– 75	Soplaviento, Magdalena Basin	Eigenmann
7620 *a–d*, C. M.; 14149, I. U. M.	7	82–117	Rio Seco, Magdalena Basin	Gonzales
14152, I. U. M.	2	41 and 42	Apulo, Magdalena Basin	"

Head 2.7; depth 2.4; D. XVII, rarely XVI, 11 or 12; A. VI, 8 or 9.

Family XXV. GOBIIDÆ.

The members of the *Gobiidæ* and *Pæciliidæ* help to bridge the gap between the truly fresh-water fishes and the truly marine fishes. Some are confined to salt water, some to fresh water, while others seem to be at home in either place. Many of the genera occurring in fresh water like *Philypnus, Dormitator, Eleotris, Guavina Awaous,* and *Sicydium* have long been well known. They are defined in "The Fishes of North and Middle America," by Jordan and Evermann (Bull. U. S. Nat. Mus., No. 47, III, 1898); in the "Biologia Centrali-Americanâ," by Regan, 1906–08; and in "The Fishes of the Fresh Waters of Panama," by Meek and Hildebrand (Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, pp. 349–370).

The new species of this family from Colombia and Ecuador have been described by me (Proc. Amer. Philos. Soc., LVI, 1917, pp. 684–687) and while in the present account sufficient details have been given in the keys to permit identification, it has not been considered necessary to repeat the original descriptions.

The genera of the area under consideration may be distinguished as follows:

Key to the Transandean Genera of Gobiidæ.

a. Ventrals separate.

b. Gill-arches with two series of long, blade-like, slender gill-rakers (over one hundred on first arch), the tips of the lower ones in the inner row, bifid, those of the anterior and posterior series divergent, leaving a broad groove between them, those of the posterior series of one arch interlacing with those of the anterior series of the following arch to form an elaborate straining apparatus; buccal cavity short; head short and very broad between the eyes; each jaw with several series of incisors, those of the two anterior series much the larger, several series of minute, conical teeth behind them; head scaled to the snout.... **Dormitator** Gill.

bb. Gill-arches with a single series of rakers or none.

c. Preopercle with a downward projecting spine at its angle; first gill-arch with two series of cushions or with a few low, fleshy rakers in place of the anterior cushions of the first arch. **Eleotris** Bloch and Schneider.

cc. Preopercle unarmed.

d. Head scaled; first gill-arch with an anterior series of slender, wide-set rakers in front, and a series of low cushions or knobs behind, succeeding arches with cushions only; lower jaw projecting.

e. Vomer with slender conical teeth; gill-openings extending forward to below the eyes, opercular scales ctenoid; buccal cavity long; teeth conical, those of the upper jaw increasing in size backward; head scaled to the snout; snout long. **Philypnus** Cuvier and Valenciennes.

ee. Vomer without teeth; outer teeth of the upper jaw slightly larger.

f. Scales large; opercular scales ctenoid....**Hemieleotris** Meek and Hildebrand.

ff. Scales very small, over one hundred in a lateral series, scales of the head small, imbedded, all of them, including those of the opercular, cycloid. **Guavina** Bleeker.

dd. Head, breast, and nape naked; first arch without rakers, all of the arches with cushions or low knobs; head naked.

g. Head narrow, articular of the lower jaw expanded below, meeting or nearly meeting its fellow of the opposite side; teeth in bands; general appearance of *Philypnus*. **Leptophilypnus** Meek and Hildebrand.

gg. Head wider, articular of the lower jaw not expanded; slit between first gill-arch and the sides of the buccal cavity very short, the upper limb of the arch with a membrane connecting it with the lower arch, the anterior part of the lower arch adnate; mouth large, the lower jaw projecting; head broad, depressed. **Microëleotris** Meek and Hildebrand.

aa. Ventrals united; head naked.

h. Ventral disk short, adnate to belly; no dermal flaps on shoulder-girdle; buccal cavity very short; no gill-rakers; upper jaw with a series of many small, close-set incisors, lower jaw with fewer, stronger, recurved, thorn-like teeth.....**Sicydium** Cuvier and Valenciennes.

hh. Ventral disk free from belly; interorbital area not elevated in front; dorsal spines four to eight; teeth pointed; maxillary not greatly prolonged; body scaly.

i. Inner edge of shoulder-girdle without papillæ.....**Gobius** Linnæus.

ii. Inner edge of shoulder-girdle with two or three dermal flaps.....**Awaous** Steindachner.

Dormitator Gill.

359. **Dormitator maculatus** (Bloch).

Dormitator maculatus Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 354 (Stagnant and brackish streams of Panama).

Habitat: Atlantic coastal streams from North Carolina to Pará, and West Indies.

5679 *a*, C. M., one, Cartagena. Eigenmann.

360. **Dormitator latifrons** (Richardson).

Dormitator latifrons Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 355 (Panama, not in Tuyra).

Habitat: Pacific slope from Lower California to Ecuador.

5676 *a–d*, C. M.; 13515 *a–d*, I. U. M., fifteen, Market of Guayaquil, Ecuador. Henn.

5677 *a–d*, C. M.; 13516 *a–d*, I. U. M., eight, Chone, Province of Manabi, Ecuador. Henn.

5678 *a–b*, C. M.; 13517 *a–b*, I. U. M., four, Mouth of Rio Dagua. Eigenmann.

This species is the Pacific coast representative of *D. maculatus*.

ELEOTRIS Bloch and Schneider.

361. **Eleotris picta** Kner and Steindachner.

Eleotris picta REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 472 (Rio San Juan); MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 357 (Panama).

Habitat: Pacific coastal streams from Lower California to Ecuador.

5681 *a–b*, C. M.; 13520 *a–b*, I. U. M., Market of Guayaquil, Ecuador. Henn.

5682 *a*, C. M.; 13521 *a–b*, I. U. M., Chone, Province of Manabi, Ecuador. Henn.

362. **Eleotris pisonis** (Gmelin).

Eleotris pisonis MEEK and HILDEBRAND Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 358 (Lower Chagres, Porto Bello, and upper Rio Trinidad, Panama).

Habitat: Atlantic coastal streams from Florida to Brazil, and West Indies.

51977, Univ. of Michigan, two, 65 mm., Gaira River at Gaira, Colombia. A. G. Ruthven.

363. **Eleotris isthmensis** Meek and Hildebrand.

Eleotris isthmensis MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 359 (Mindi, Chagres Basin).

PHILYPNUS Cuvier and Valenciennes.

364. **Philypnus dormitor** (Lacépède).

Philypnus dormitor MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 350 (Chagres system).

Habitat: Atlantic coastal streams from Texas to Brazil, and West Indies.

365. **Philypnus maculatus** (Günther).

Philypnus maculatus REGAN, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 472 (Rio San Juan); MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 352 (Panama).

Habitat: Pacific coastal streams from Lower California to Ecuador.

The most elevated and most inland locality at which it was secured by us is Istmina.

SPECIMENS EXAMINED.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
15293, I. U. M.	5	largest 260 mm.	Cultambo, Rio Jequetepeque	Eigenmann
5680 *a–c*, C. M.; 13518, I. U. M.	6		Market at Guayaquil, Ecuador	Henn
7474 *a–e*, C. M.; 13853, I. U. M.			Rio Chanchan, Naranjito, Ecuador	"
7473 *a–e*, C. M.; 13857, I. U. M.	30		Colimes, Rio Daule, Ecuador	"
7467 *a*, C. M.	1		Barbacoas	Henn and Wilson
7469 *a–g*, C. M.; 13855, I. U. M.	13		Mouth of Rio Dagua	Eigenmann
7470 *a*, C. M.	1		Cordova	"
13856, I. U. M.	3		Small creek near mouth of Rio Calima	Henn
13519, I. U. M.	1		Rio San Juan at mouth of Rio Cucurrupi	"
7468 *a–c*, C. M.	3		Rio Rosario, near the rapids	Henn and Wilson
7472, C. M.	6		Puerto Negria	Eigenmann
7471 *a–c*, C. M.; 13854, I. U. M.	6		Istmina	"
3927, I. U. M.	1	159 mm.	Tado	Wilson

HEMIELEOTRIS Meek and Hildebrand.

Hemieleotris MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 364. Type, *Eleotris latifasciatus*.

KEY TO THE SPECIES OF HEMIELEOTRIS.

a. Dorsals truncate, some of the anterior spines and rays longest, tip of the first or second spine reaching beyond the tip of the last, tip of the first dorsal ray reaching the middle of the last ray; ventrals reaching to, or beyond, the vent; a conspicuous lateral band from the snout to the caudal, a more intensely black spot at the base of the caudal, narrowed on the base of the middle caudal rays; dorsals with horizontal streaks; D. VI–I, 9; head scaled to behind the eyes; scales of opercle and a few on upper part of cheek, ctenoid; head elongate, interorbital much less than the eye; gill-rakers 2 + 9. . . . . **latifasciatus** (Meek and Hildebrand).

aa. Dorsals rounded, first and second spines not reaching the middle of the last spine; tip of first dorsal ray not reaching beyond base of last, usually much shorter; ventrals not reaching the vent; lateral band, if present, very faint; sides with cross-shades; a dark humeral spot; dorsals uniform; D. VII–I, 10; head scaled to the snout; scales of opercles and cheek all cycloid; head broad; interorbital a little larger than the eye; gill-rakers 5 + 15. . . . . **levis** Eigenmann

366. **Hemieleotris latifasciatus** Meek and Hildebrand.

Hemieleotris latifasciatus MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 365 (between Rios Chorrera and Bayano, Panama).

Habitat: Rivers of Pacific slope from Costa Rica to southern Colombia.

7475 *a–e*, C. M.; 13858, I. U. M., twenty-two, largest 45 mm., creek near mouth of Rio Calima, San Juan Basin. Henn.

13859, I. U. M., three, largest 57 mm., Rio Calima near Boca del Guineo, San Juan Basin. Henn.

7476 *a–c*, C. M., three, largest 32 mm., Puerto Negria, San Juan Basin. Eigenmann.

7477 *a–c*, C. M.; 13860, I. U. M., twelve, largest 23 mm., Rio Rosario, small coastal stream near Tumaco. Henn and Wilson.

367. **Hemieleotris levis** Eigenmann. (Plate XXIX, fig. 1.)

Hemieleotris levis Eigenmann, Proc. Amer. Philos. Soc., LVI, 1917, p. 684 (Rio Calima; and warm, stagnant pools in Buenaventura).

Head 3.5; depth 4.5; D. VII–I, 10; A. 10 or 11; scales 34 or 35–11; eye once in snout, four times in head; interorbital a little greater than the eye; teeth in narrow bands, outer series considerably enlarged.

Guavina Bleeker.

368. **Guavina guavina** (Cuvier and Valenciennes).

Guavina guavina Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 360 (Colon, and Toro Point, Panama).

Habitat: Atlantic coastal streams from Mexico to Brazil, and West Indies.

Leptophilypnus Meek and Hildebrand.

369. **Leptophilypnus fluviatilis** Meek and Hildebrand.

Leptophilypnus fluviatilis Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 361.

This species has been taken only at Mindi, Atlantic slope of Panama.

Microëleotris Meek and Hildebrand.

Key to the Species of Microëleotris.

a Scales in lateral series, 33 to 36; second dorsal I, 8; anal I, 8.....**panamensis** Meek and Hildebrand

aa. Scales in lateral series, 30 to 32; second dorsal I, 9; anal I, 9.....**mindii** Meek and Hildebrand.

370. **Microëleotris panamensis** Meek and Hildebrand.

Microëleotris panamensis Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 363.

Known only from the Rio Juan Diaz, and Rio Chorrera, Pacific slope of Central Panama.

371. **Microëleotris mindii** Meek and Hildebrand.

Microëleotris mindii Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 364.

Known only from brackish water at Mindi, near the Atlantic coast of the Canal Zone.

Sicydium Cuvier and Valenciennes.

Key to the Species of Sicydium.

a. Occipital region scaled; caudal plain.

b. Belly scaled in the adult, with a naked area in specimens 63 mm. in length.

c. Third or fourth dorsal ray projecting far beyond the rest; second dorsal ray almost reaching caudal, the penultimate ray shorter than the head; pectorals about equal to head; dorsals minutely and nearly uniformly punctate, the points aggregated in the soft dorsal into a dark marginal and a submarginal line; anal with a more intense submarginal line.

salvini Grant.

cc. Second, third, and fourth dorsal spines produced, and of nearly equal extent; penultimate dorsal ray reaching caudal, longer than head; dorsals with numerous hyaline spots; anal with a dusky border. . . . . **hildebrandi** Eigenmann.

bb. Belly with a median naked area; rays of first dorsal in the male nearly reaching end of base of second dorsal, the longest ray of which is a little longer than the head; pectorals longer than head; eye 5.5–6; dorsal with dark vermiculations; anal with a dark edge.

pittieri Regan (extralimital).

aa. Nape, an area behind ventrals, and a vertical strip connecting these, naked; second dorsal and anal highest anteriorly, last ray not nearly reaching caudal; pectoral as long as head, eye four times in the head; caudal with two dark cross-bars; soft dorsal with a series of small dark spots on the rays.

condotense Regan.

372. **Sicydium salvini** Grant.

Sicydium salvini Grant, Proc. Zoöl. Soc. London, 1884, p. 159, plate XII, fig. 2 (Panama); Regan, Biologia Centrali-Americana (Pisces), 1905, p. 10 (Panama; Western Ecuador); Meek and Hildebrand, Field Mus. Nat. Hist Pubs., Zoöl. Ser. X, 1916, p. 369 (Paraiso on Rio Grande, Pacific slope of Panama; Chagres Basin).

Sicyopterus salvini Jordan and Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, p. 485.

Cotylopus salvini Jordan and Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, p. 2208.

Oreogobius rosenbergii Boulenger, Ann. & Mag. Nat. Hist. (7), IV, 1899, p. 126 (Paramba, Western Ecuador, 3,500 ft.).

Habitat: Eastern and western slopes of Panama; Magdalena Basin; and western Ecuador.

51991, Univ. of Michigan, one, 63 mm., Tamocal River at San Lorenzo, Colombia (800 ft.). A. S. Pearse.

In the specimen from San Lorenzo and in the smallest specimen from the Rio Indio, collected by Meek and Hildebrand, the belly is naked and the nape is scaled.

373. **Sicydium hildebrandi** Eigenmann. (Plate XXVIII, fig. 4.)

Sicydium hildebrandi Eigenmann, Proc. Amer. Philos. Soc., LVI, 1917, p. 685 (Cisnero, Rio Dagua).

Head 5.25; depth 5.5; D. VI–11; A. 11; about seventy scales between pectoral and caudal, about twenty between dorsal and anal; eye six times in the head; interocular 2.5; horizontal teeth of the lower jaw entirely concealed, teeth of the upper jaw truncate.

374. **Sicydium pittieri** Regan.

Sicydium pittieri Regan, Ann. & Mag. Nat. Hist. (7), XIX, 1907, p. 260 (Rio Grande de Terraba, Costa Rica).

Meek and Hildebrand (p. 369) state that this species has been recorded from Panama, but they secured no specimens.

375. **Sicydium condotense** Regan.

Sicydium condotense Regan, Ann. & Mag. Nat. Hist. (8), XIV, 1914, p. 33 (Rio Condoto).

This species is known only from the original description based on a single specimen, 60 mm. in total length.

Gobius Artedi.

Subgenus Ctenogobius Gill.

376. **Gobius daguæ** Eigenmann. (Plate XXXI, fig. 2.)

Gobius (*Ctenogobius*) *daguæ* Eigenmann, Proc. Amer. Philos. Soc., LVI, 1917, p. 685 (Mouth of Rio Dagua).

Allied to *Gobius boleosoma* and *G. encæomus*.

Head 4–4.2; depth 5.25–6; D. VI–I, 12; A. I, 12; scales 31–34; eye four times in the head, interocular six times, preorbital very little wider than the eye; head as well as body compressed, heaviest at the ventrals, tapering regularly to the caudal; snout very blunt, narrow; width of the head but little, if any, more than half its length; depth of the head 1.5 in its length; mouth low, terminal, horizontal; lips very thin; upper jaw with an outer series of fixed teeth and a few

teeth within these near the symphysis; lower jaw with a similar series of slightly smaller teeth and several irregular series behind this and near the symphysis.

Subgenus GOBIONELLUS Girard.

377. **Gobius sagittula** (Günther).

7483 *a–b*, C. M.; 13864, I. U. M., four, 45–85 mm., mouth of Rio Dagua. Eigenmann.

Head 4; depth 6 or 7; D. VI, 13; A. I, 13; scales 55; eye 1 in snout, a trifle over 4 in the head; interorbital very narrow, less than one fourth of the eye.

Heaviest at the head, tapering to the caudal, very little compressed; head blunt, wide, flat below, arched from its ventral surface; eye high, looking upward and outward; lips thin, mouth wider than long, upper jaw readily protractile; upper jaw with an outer series of heavy, straight, blunt teeth and an inner series of smaller, recurved teeth; teeth of the lower jaw like those of the upper, with a few strong recurved teeth near the symphysis within the inner series; preorbital narrower than the eye. Nape naked, scales crowded about the pectorals, becoming larger toward the caudal.

AWAOUS Steindachner.

To the following key, as published by Meek and Hildebrand, the characters of *A. decemlineatus* since described have been added.

KEY TO THE SPECIES OF AWAOUS.

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** (Lichtenstein).

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** (Günther).

aaa. Scales about 57 in a lateral series; about 14 rows between dorsal and anal; maxillary reaching to below middle of eye; fifth dorsal spine reaching the fourth ray, the last rays reaching caudal; sides with about ten cross-lines..... **decemlineatus** Eigenmann.

378. **Awaous taiasica** (Lichtenstein).

Gobius taiasica LICHTENSTEIN, Berl. Abhandl., 1822, 273 (Brazil).

Awaous taiasica MEEK and HILDEBRAND, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 366 (Chagres Basin).

379. **Awaous transandeanus** (Günther). (Plate XXIX, fig. 3.)

Gobius transandeanus Günther, Cat. Fishes Brit. Mus., III, 1861, p. 62 (Western Ecuador).

Awaous transandeanus Regan, Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 473 (Rio Condoto); Meek and Hildebrand, Field Mus. Nat. Hist. Pubs., Zoöl. Ser. X, 1916, p. 368 (Pacific slope streams between Rio Chame and Rio Tuyra).

Habitat: Rio Chame in Panama to the Rio Chanchan in Ecuador.

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
13847, I. U. M.	1	156	Rio Chanchan, Ecuador	Henn
7460 *a–b*, C. M.	2	Larger 165	Rio Telembi, Patia Basin	Henn and Wilson
13848, I. U. M.	1	130	San Lorenzo, Rio Telembi	"
7461 *a–b*, C. M.	2	Larger 118	Barbacoas, Rio Telembi	"
7462 *a*, C. M.	1		Patia, between Magui and Telembi	Henn
13876, I. U. M.	6	Largest 86	Creek near mouth of Rio Calima	"
7464 *a–b*, C. M.	2	Larger 137	Puerto Negria, Rio San Juan	Eigenmann
7465 *a–f*, C. M.; 13851, I. U. M.	12	Largest 33	Puerto Negria, Rio San Juan	Eigenmann
13850, I. U. M.	1	78	Tado, San Juan Basin	Wilson
7463 *a–b*, C. M.; 13849, I. U. M.	5	Largest 234	Istmina, Rio San Juan	Eigenmann

380. **Awaous decemlineatus** Eigenmann. (Plate XXIX, fig. 4.)

Awaous decemlineatus Eigenmann, Proc. Amer. Philos. Soc., LVI, 1917, p. 686 (Quibdo, Atrato Basin; cienegas at Puerto del Rio, and Calamar, Magdalena Basin).

Head 3.33; depth 5.25; D. VI–I, 9 or 10; A. I, 10; scales 57–14; eye a little over 5 in the head and equal to the interocular; snout nearly 3 in the head; mouth wide, its width equal to the postorbital part of the head; lower jaw (in the type) with a series of small, more or less movable teeth in an outer row, and four strong, recurved, fixed teeth in an inner series near the symphysis, which is not parallel with the outer series, and on the side of the jaw remote from the rest of the inner series and opposite the end of the outer series, one or two similar teeth; upper jaw with a series of about seven strong, widely spaced, recurved teeth (16 in the young). Easily distinguished from the other species of *Awaous* by its narrow cross-lines.

GOBIOIDES Lacépède.

381. **Gobioides peruanus** (Steindachner).

Amblyopus (*Gobioides*) *peruanus* STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 94, plate II, figs. 2, 2*a*.

Habitat: Ecuador.

7522 *a–c*, C. M.; 13903, I. U. M., twelve, 189–583 mm., Prov. of Manabi, Ecuador. Henn.

Family XXVI. BATRACHOIDIDÆ.

THALASSOPHRYNE Günther.

382. **Thalassophryne quadrizonatus** sp. nov. (Plate XXIX, fig. 5.)

3921 *a*, C. M., type, 35 mm., Rio Truando, Atrato Basin. Wilson.

This species is evidently allied to *T. maculosa* Günther from the Caribbean Sea.

Head about as wide as long, 3 in the length; D. II, 22; membrane of the last ray just reaching caudal; A. 23, the last ray adnate to the caudal; dorsal spines broad and not very acute; pectoral rather acute, reaching to the sixth anal ray; gill-opening extending from the upper angle of the pectoral to near the anterior margin of the ventrals; very short tentacles along the lower jaw.

A short bar across the back at the second dorsal spine; another across the anterior part of the soft dorsal, another a little behind its middle, and another at its end; several large spots along the sides and many smaller ones on the back and the head; pectoral and caudal with dark spots.

BATRACHOIDES Lacépède.

383. **Batrachoides pacifici** Günther.

Batrachoides pacifici STEINDACHNER, Denkschr. Akad. Wiss. Wien, XLI, 1879, p. 160 (Mamoni at Chepo); *ibid.*, LXXII, 1902, p. 123 (Guayaquil).

Family XXVII. PLEURONECTIDÆ.

CITHARICHTHYS Bleeker.

384. **Citharichthys gilberti** Jenkins and Evermann.

Citharichthys gilberti JENKINS and EVERMANN, Proc. U. S. Nat. Mus., 1888, p. 157 (Guaymas, Mexico); JORDAN and EVERMANN, Bull. U. S. Nat. Mus., 47, 1898, p. 2686; STEINDACHNER, Denkschr. Akad. Wiss. Wien, LXXII, 1902, p. 133 (Guayaquil).

Habitat: Pacific coast from Mexico to Peru, entering rivers.

15008, I. U. M., one, 85 mm., Chone, Prov. of Manabi, Ecuador. Henn.
One, I. U. M., 132 mm., Sullana, Peru. Eigenmann.

Family XXVIII. SOLEIDÆ.

Achirus Lacépède.

385. **Achirus klunzingeri** (Steindachner.)

Solea klunzingeri Steindachner, Denkschr. Akad. Wiss. Wien, XLII, 1880, p. 96. plate IX, fig. 3 (Guayaquil).

Habitat: Panama to Guayaquil, marine, but entering rivers.

15005, I. U. M., five, 31–77 mm., Vinces, Prov. Rios, Ecuador. Henn.
15006, I. U. M., two, 29 and 63 mm., Colimes, Rio Daule, Ecuador. Henn.
15007, I. U. M., one, 40 mm., Chone, Prov. of Manabi, Ecuador. Henn.

All of these specimens are young and it is quite possible that the adult enter rivers only at spawning time.

386. **Achirus fischeri** (Steindachner).

Solea fischeri Steindachner, Denkschr. Akad. Wiss. Wien, XLI, 1879, p. 161, plate II, fig. 8 (Mamoni).

387. **Achirus panamensis** (Steindachner).

Achirus panamensis Regan, Ann. & Mag. Nat. Hist. (8), XIV, 1914, p. 33.

APPENDIX I.

THE FISHES OF THE META RIVER BASIN OF EASTERN COLOMBIA.

By C. H. Eigenmann.

The following pages deal with the fishes from the streams of the eastern slopes of the Eastern Cordillera, and the llanos or plains, at the base of the Andes east of Bogotá. These streams drain into the Rio Meta, which is one of the larger tributaries of the Orinoco. Little has been previously known of the fishes from this region and nearly half of the species have proven to be new. These have been described by me in the "Annals of the Carnegie Museum," in the "Proceedings of the American Philosophical Society," and especially in the "Indiana University Studies." A number are described in the present paper.

After my return from Colombia in 1912, my assistant Manuel Gonzales continued collecting. He made a number of very valuable collections from along three routes, (1) along the road from Factativa west to Honda; (2) from Bogota north through Santander; and (3) from Bogota east to Barrigón. We are concerned here with only the last of these, since the others have been considered in the preceding memoir.

Brother Apolinar Maria, Director of the Museum of the Instituto de la Salle of Bogotá, has sent me valuable collections from this region. One such collection came from Cumaral, another from Caño Carneceria, which is reached by two days' travel northeast from Villavicencio. These localities and those of Gonzales are indicated on the accompanying map of this area. Their collections are in the Museum of Indiana University and in the Carnegie Museum.

Fourteen of the species listed here, or nearly one-fourth, are widely distributed forms, which have been recorded in the preceding pages from the Magdalena or other streams west of the Eastern Andes. Of particular interest is the fact that the genus *Stevardia*, supposed to be peculiar to the island of Trinidad, has a representative at the base of the Cordilleras. However, through a study of this fauna and that of Lake Valencia in Venezuela, Trinidad has lost its supposed isolation and proves faunistically to have much in common with the Orinoco Basin.

Dr. C. T. Regan (Ann. & Mag. Nat. Hist., (8) Vol. 10, 1912, pp. 218, 391, *et al.*) has recorded several species presented to the British Museum by Sir Bryan Leighton and presumably collected at Honda in the Magdalena Basin. In the same papers he records several specimens from Bogotá, collected by Cutter. During my short

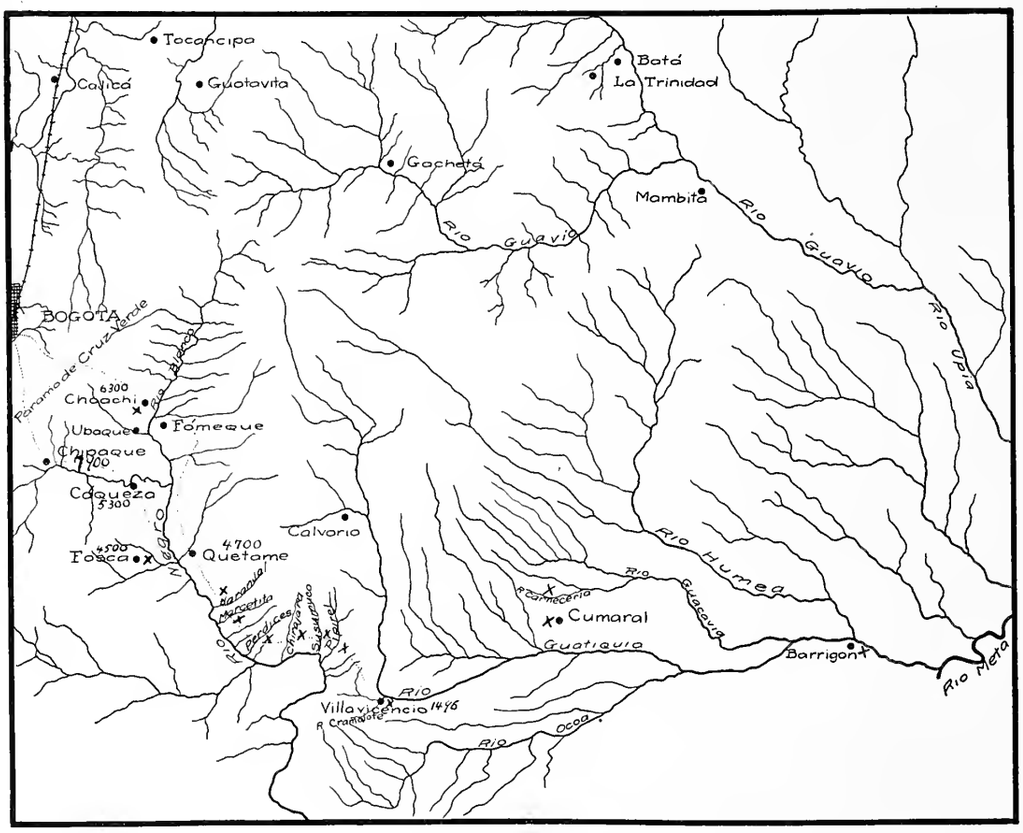


Fig. 21. Sketch map of the upper drainage area of the Rio Meta. Localities where collections were made are marked ×.

stay at Honda, I did not secure the species mentioned, which, however, are abundant in the Rio Meta. Likewise the species recorded from Bogotá certainly did not come from that locality and it is more than probable that in both instances the recorded specimens actually came from the Meta Basin and were shipped from Honda and Bogotá.

Chasmocranus Eigenmann.

1. **Chasmocranus rosæ** sp. nov. (Plate I, fig. 4.)

3841, C. M., *type*, 65 mm.; 3842, C. M.; 15019, I. U. M., *paratypes*, four, 35–78 mm., Rio Negro, Villavicencio. Gonzales.

15020, I. U. M., two, 49 and 57 mm., Quebrada Cramalote, Villavicencio. Gonzales.

Head 5; depth 6–6.33; D. 7; A. 9 or 10; adipose 4–4.25 in the length; eye 2 in snout, 7 in the length of the head, nearly 2 in the interorbital; maxillary barbels reaching to, or but little beyond, the middle of the pectorals; premaxillary teeth in two separate patches, each patch about twice as wide as deep and without backward projecting angle; dorsal truncate, the second ray highest and nearly coterminous with the subsequent rays when depressed, the first ray a little shorter, not spinous; caudal slightly forked; anal rounded, the middle ray highest, those following it coterminous with it, those in front of it rapidly graduate; pectorals and ventrals large, rounded, first pectoral ray not spinous; fontanels narrow, from in front of eye to base of occipital crest.

Top of head dusky; six bands on body, well marked on the back, faint or absent on the sides; the first from pectoral to pectoral, widest; the second under first half of the dorsal; the third between the dorsals; the fourth and fifth under the ends of the adipose; the last across end of caudal peduncle; distal half of caudal dusky.

Imparfinis Eigenmann and Norris.

Imparfinis Eigenmann and Norris, Revista Museu Paulista, 1900, p. 352. Type, *Imparfinis piperatus* Eigenmann and Norris.

Eye without a free orbital margin except in the old of *I. piperatus;* no teeth on the palatines or vomer; snout broad; jaws subequal; premaxillary band of teeth without a backward projecting angle. Pectoral spine, short, strong, or scarcely spinous; first dorsal ray not spinous; skull covered by skin, not granular; occipital process very short. Upper caudal lobe the longer; origin of ventrals in front of origin of dorsal; anal short. Fontanels narrow, continued to near base of occipital process; a narrow bridge behind the eyes.

2. **Imparfinis microps** Eigenmann and Fisher, sp. nov. (Plate IV, figs. 2 and 3.)

6776 *a*, C. M., *type*, 75 mm.; 6777 *a–e*, C. M.; 13546, I. U. M., paratypes, 19–43 mm., Rio Negro, Villavicencio. Gonzales.

D. 7; A. 12; P. 8; head 5.5, depth 7; width 8.7; snout in head 2.6; interorbital 1.5 in the snout; adipose 4.4 in length.

Body slender, compressed toward caudal. Head short, flat, its depth equal to one-half its width. Eye very small, five in the snout, twelve in the head. Mouth rather wide; its width at rictus equal to length of snout. Jaws equal; premaxillary band of teeth moderate, of equal width throughout. All barbels extending to gill-opening when laid straight back. Dorsal rounded; its base slightly longer than longest ray; its origin behind origin of ventrals.

Anal rounded, the length of its base slightly less than length of head; caudal forked, the upper lobe the longer, longer than the head; ventrals short, in front of dorsal, equal to the postorbital portion of the head. Pectoral short, reaching only half way to origin of ventrals.

With numerous brown chromatophores which are more abundant dorsally and anteriorly. Fins all hyaline.

3. **Pimelodella metæ** Eigenmann.

Pimelodella metæ Eigenmann, Mem. Carnegie Mus., VII, 1917, p. 244, plate XXXI, fig. 1.

Catalog Numbers.	Length in mm.	Locality.	Collector.
7441, C. M.	77	Rio Negro, Villavicencio	Gonzales
7442, C. M.; 13769, I. U. M.		Barrigón	"
13768, I. U. M.		Quebrada Cramalote, Villavicencio	"
15088, I. U. M.	Largest 100	Lake Valencia Basin	Pearse

4. **Pimelodella chagresi** (Steindachner).

Pimelodella chagresi Eigenmann, Mem. Carnegie Mus., VII, 1917, p. 253, plate XXXIII, fig. 3.

6766, C. M., 51 mm., Villavicencio. Gonzales.

I am not sure of the identification of this small specimen. The species has not previously been found east of the Cordilleras.

5. **Pimelodus clarias** (Bloch).

6663 *a–d*, C. M.; 13492, I. U. M., 53–181 mm., Villavicencio. Gonzales.

13798, I. U. M., one, 137 mm., Cumaral. Maria.

This is a widely distributed species, occurring also in the Atrato and Magdalena Basins, west of the Andes. (See Preceding Memoir, No. 28, p. 44).

6. **Rhamdia sebæ** (Cuvier and Valenciennes).

3922, C. M., two, 111 and 116 mm., Rio Negro, Villavicencio. Gonzales.

13567, I. U. M., one, 154 mm., Rio Meta. Gonzales.

15009, I. U. M., three, 103–155 mm., Barrigón. Gonzales.

This species also occurs in the Magdalena River.

SCIADES Müller and Troschel

7. **Sciades marmoratus** Gill.

Sciades marmoratus Gill, Proc. Acad. Nat. Sci. Phila., 1870, p. 95 (Upper Amazon); Eigenmann and Eigenmann, Proc. Cal. Acad. Sci. (2), I, 1888, p. 136 (Tabatinga).

15024, I. U. M., a head, 135 mm. to tip of opercle. Barrigón. Gonzales.

It is quite possible that the specimens recorded by Gill and by Eigenmann and Eigenmann represent two distinct species. Gill's specimen has the patches of vomerine teeth transversely ovate. The specimens in the Museum of Comparative Zoölogy, respectively 500 and 580 mm. long, have them longitudinally ovate. The present specimen, which on the basis of the length being about 5.2 times the length of the head must have been nearly 700 mm. long, has them transversely ovate as in Gill's specimen.

I add a few measurements of the specimen before me. Length of head to tip of long opercle, 135 mm.; snout 67 mm.; eye 13 mm.; greatest width of head 120 mm.; interocular 59 mm.; width at rictus 84 mm.; maxillary barbels 425 and 440 mm., mental barbels 95 mm., postmentals 180 mm., reaching to near tip of pectoral rays; pectoral 113 mm., pectoral spines 95 mm. +, being broken off near tip; 58 fine teeth on one of the pectoral spines (several broken off with the tip), largest at the end of the first third of the spine where they equal one third of the width of the body of the spine.

Distance between eyes and posterior nares 29 mm., between eyes and anterior nares 46 mm.; distance between ends of premaxillary band of teeth 45 mm., depth of the band greatest near middle, 6 mm.; distance between outer edges of the two patches of vomerine teeth 17 mm., distance between vomerine and palatine patches 16 mm.

Color of the barbels similar to that of the head, not annulated.

8. **Plecostomus plecostomus** Linnæus.

7571 *a–e*, C. M.; 13924, I. U. M., ten specimens, largest 140 mm., Barrigón, March 24, 1914. Gonzales.

7572 *a*, C. M., 138 mm., Rio Negro, Villavicencio. Gonzales.

13925 *a*, I. U. M., 22 mm., Quebrada Cramalote, Villavicencio. Gonzales.

A number of specimens were collected by Dr. A. S. Pearse in Lake Valencia and in the Rio Tuy, in Venezuela.

9. **Pseudancistrus daguæ** (Eigenmann).

Hemiancistrus daguæ EIGENMANN, Indiana University Studies No. 16, Sept. (Dec. 23) 1912, p. 11.

13661, I. U. M., one, 69 mm., Rio del Fosca, 4,500 feet. Gonzales.

Described originally from the Rio Dagua in the San Juan Basin of western Colombia. This is the only record from east of the Andes. (For other records, see Preceding Memoir, No. 98, p. 78).

10. **Pseudancistrus pediculatus** Eigenmann. (Plate X, fig. 4; plate XII, fig. 3.)
Pseudancistrus pediculatus EIGENMANN, Proc. Amer. Philos. Soc., LVI, 1917, p. 679.

SPECIMENS COLLECTED BY GONZALES.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.
13664, I. U. M.; 7348, C. M., *paratype* and *type*	2	60 and 118	Rio Negro, Villavicencio
13927, I. U. M.; 7586, C. M., *paratypes*	6	Largest 95	Villavicencio
13928 and 13663, I. U. M., *paratypes*	10	Largest 120	Quebrada Cramalote, Villavicencio
13929, I. U. M., *paratypes*	3	Largest 103	Barrigón, Rio Meta
13932, I. U. M.; 7587, C. M., *paratypes*	7	Largest 95	Tengavita
13930, I. U. M.	3	Largest 78	Villavicencio
13934, I. U. M.	7	Largest 55	Quebrada Blanca
13939, I. U. M.	5	Largest 33	Rio Roncador
13931, I. U. M.	2	Largest 73	Rio Negro, Villavicencio
13945, I. U. M.	6	Largest 46	Quebrada Sumuco

A specimen purchased from W. F. H. Rosenberg, the London dealer, as *P. setosus* from the Tamana River of the San Juan Basin of western Colombia, proves to be this species. This is probably one of the specimens recorded by Regan (Ann. & Mag. Nat. Hist. (8), XII, 1913, p. 469). If the locality is correct, then the present species occurs west of the Andes on the Pacific slope.

Head 2.7–3; depth 6.5–7; D. I, 7 in five, I, 8 in forty-six, I, 9 in two; A. I, 4; scutes usually 25, rarely 24 or 26; eye about 6 in snout, 10 in head, a little over 3 in the interorbital; ramus of lower jaw about equal to the interorbital; interopercle with two principal spines, the longer .6 of the head, extending much beyond the head; sometimes 4 or 5 graduated spines follow each other, besides which there is, with age, an increasing number of smaller spines about the edge or below the hispid portion of the interopercle; snout with many bristles in the male, short spines from the eyes forward, around the nares and forward along the middle to the snout; dorsal spine equal to the snout or shorter, the last ray reaching the adipose spine or the second scute in front of it; caudal very obliquely emarginate, the lower ray 3.33 in the length; pectoral reaching tip or middle of ventrals.

Back and sides with faint spots; dorsal and caudal with numerous spots on the rays, more rarely uniform; ventrals and pectorals more faintly spotted.

11. **Ancistrus triradiatus** Eigenmann. (Plate XII, fig. 8; plate XIII, figs. 3 and 4.)

Ancistrus triradiatus EIGENMANN, Proc. Amer. Philos. Soc., LVI, 1917, p. 680 (recording the following specimens).

Specimens Examined.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
13935 *a*, I. U. M., *type*	1♂	113	Quebrada Cramalote, Villavicencio	Gonzales
13935 *b–e*, I. U. M., *paratypes*	4	61–85	" " "	"
7591, C. M.	2	78 and 81	" " "	"
13937 *a*, I. U. M.	1♂	77	Barrigón	"
13937 *b–c*, I. U. M.	2♀	43 and 70	"	"
7578, C. M.	1	52	Villavicencio	"

Closely related to this species is *A. brevifilis* Eigenmann, from El Concejo in the Rio Tuy Basin, west of Caracas, Venezuela.

Cochliodon Heckel.

Type, *Hypostomus cochliodon* Kner. The genus *Cochliodon* is a *Plecostomus* with large unipointed teeth, as *Panaque* is a *Hemiancistrus* with large teeth. The teeth have one lobe only. The species of this genus are found east of the Andes.

Key to the Species of Cochliodon.

a. Lower caudal ray longer than upper; nine teeth in each side of each jaw; marginal spines of the opercle and interopercle larger than those of the side of the head. Base of dorsal equal to its distance from the second or third scute behind the spine of the adipose; caudal peduncle equal to the length of the head and the first scute behind the occipital or shorter than the head; 24–26 + 1 scutes..... **cochliodon** (Kner).

aa. Upper caudal ray longer than lower, teeth without lateral notch, eleven or twelve teeth in each side of each jaw; marginal spines of opercle and interopercle not enlarged; base of dorsal equals its distance from second to the fourth scute behind the adipose spine; caudal peduncle equal to the head measured along the dorsal line and the two scutes behind the occipital; depth of the head at the occipital equals the snout; 28–29 + 1 scutes..... **plecostomoides** n. sp

12. **Cochliodon plecostomoides** sp. nov. (Plate XI, figs. 1, 2, and 3.)

15043, I. U. M., *type*, 256 mm. over all. Quebrada Cramalote, Villavicencio. Gonzales.

15084, I. U. M., Rio Bue at Maracai, Valencia Basin. Pearse.

Head 3.1; depth 4.5; D. I, 7; A. I, 4; scales 26 or 27 + 1; 6 scutes between dorsal and fulcrum in front of the adipose spine; 16 scutes and fulcra between the anal and the lower caudal ray; eye 5.5 in snout, 4 in the interorbital, 8.5 in the head; ramus of lower jaw 8 in the head, 4 in the interorbital; interopercle without enlarged spines, plecostomoid; occipital bluntly keeled, its tip entering the scute following it; teeth large, without a lateral notch, spoon-shaped (when new?) or truncate (when worn?), 12 on each side of each jaw; belly entirely covered with scutes, lateral scutes all strongly keeled, finely granulate; dorsal truncate, the last

ray almost reaching the adipose spine, the first ray reaching the tips of the second to fourth rays, not those of the last three rays; base of dorsal equal to its distance from the fourth scute behind the adipose spine or its distance from a point a little in front of the middle of the snout; caudal deeply emarginate, the upper ray is longer than the lower, the length of the upper ray in the type is 83 mm., that of the shortest middle ray is 40 mm., and that of the lowest ray is 72 mm.; outer ventral ray (52 mm.) reaching to about middle of anal; the pectoral spine (59 mm.) reaches to the second third of the ventrals.

Covered everywhere with numerous spots, smallest and most numerous on the head, in size not equal to the pupil, about ten irregular series in the interorbital space, those of the body larger, most prominent on anterior parts, fading out toward the base of the caudal; those of the ventral surface equal in size to those of the sides. One or two series of spots in each dorsal membrane, prominent at the base but fading toward the tip. Well formed spots at the base of the caudal fin, the margin of the fin uniformly dark; pectorals, ventrals, and anal spotted; length of caudal peduncle about equal to the distance between the snout and the posterior margin of the second scute following the occipital.

13. **Chætostomus anomalus** Regan.*

Chætostomus anomalus Regan, Ann. & Mag. Nat. Hist. (7), XI, 1903, p. 599 (*Partim*).

13946, I. U. M., one, 58 mm., Villavicencio. Gonzales.

13940, I. U. M., three, largest, the type, 88 mm., Quebrada Cramalote, Villavicencio. Gonzales.

Head 2.75–3; depth 6; D. I, 9; A. I, 4; scales 25; eye 2.5 in the interorbital width which is 3.33–3.5 in the head; width of head equals its length, depth of head about 2.25 in its length; the naked portion of snout one-fourth the length of the head, measuring from snout to end of occipital. Interopercle with from 7 to 11 straight spines in three groups, none of them folding under the opercle, about 8 shorter spines on the upper part of the interopercle; dorsal spine equal to the snout or shorter; base of dorsal equal to its distance from the caudal the last ray reaching to adipose; adipose well developed; depth of caudal peduncle 2.25 in its length.

* *Chætostomus dorsalis* sp. nov. (extralimital).

Chætostomus anomalus Regan, Ann. & Mag. Nat. Hist. (7) XI, 1903, p. 599 (*partim*); Trans. Zoöl. Soc. Lond., XVII, 1904, p. 250, Pl. XIII, fig. 2 (Merida and mountain streams above it).

Of this species I have examined the following:

13656, I. U. M., 126 and 160 mm., Rios Albirregas and Millo, near Merida, purchased from Rosenberg, and two specimens collected by E. B. Williamson in northwestern Venezuela, now in the Museum of the University of Michigan.

Back with dark cross-shades, dorsal rays with small white spots; caudal dark, its tips rusty; upper surfaces of pectorals and ventrals more or less distinctly barred.

OTOCINCLUS Cope.

14. **Otocinclus spectabilis** Eigenmann.

Otocinclus spectabilis EIGENMANN, Indiana University Studies No. 23, 1914, p. 229; Ann. Carnegie Mus., X, 1916, p. 78, plate XIV, figs. 2 and 3.

13253, I. U. M., ten, largest 38 mm., Quebrada Cramalote, Villavicencio. Gonzales.

15. **Farlowella acus** (Kner).

13200, I. U. M., 2, 77 and 84 mm., Quebrada Cramalote, Villavicencio. Gonzales.
13199, I. U. M., 6, largest 158 mm., Barrigón, Rio Meta. Gonzales.
13252, I. U. M., 1, 44 mm., Rio del Fosca, 4,500 ft. elevation. Gonzales.
15081, I. U. M., 7, El Concejo, Rio Tiguirito. Pearse.

16. **Sturisoma leightoni** (Regan).

Oxyloricaria leightoni REGAN, Proc. Zoöl. Soc. London, 1912, p. 669, plate LXVII, fig. 2 (Honda).

13796, I. U. M., 2, 97–100 mm., Cumaral. Maria.

This species is common west of the Cordilleras, having been taken in the upper Magdalena Basin and in the Rio San Juan of western Colombia. The above specimens from Cumaral differ slightly in having the fins and the spines in the male slightly shorter than in the western specimens. See No. 125.

17. **Sturisoma aureum** (Steindachner).

Loricaria aurea STEINDACHNER, Denkschr. Akad. Wiss. Wien, LXXII, 1902, p. 138, plate V, fig. 2 (Bodega Central on the Rio Magdalena, and Rio Meta).

I did not receive any specimens of this species, which is known from a specimen 169 mm. in length from the Rio Magdalena and a smaller one from the Rio Meta. It has been identified by Regan as *S. panamense*. This identification of the latter, however, may be left in doubt until direct comparisons can be made.

18. **Corydoras metæ** Eigenmann. (Plate VIII, fig. 5.)

Corydoras metæ EIGENMANN, Indiana University Studies No. 23, 1914, p. 230; Ann. Carnegie Mus., X, 1916, p. 78, plate XIV, fig. 1.

13451, I. U. M., *type*, 54 mm., Barrigón, Rio Meta. Gonzales.

19. **Corydoras melanotænia** Regan. (Plate VIII, fig. 1.)

Corydoras melanotænia Regan, Ann. & Mag. Nat. Hist. (8), X, 1912, p. 217 (Honda).

13971 and 13972, I. U. M., eleven, 37–57 mm., Cumaral. Maria.

3928, C. M., Villavicencio. Gonzales.

15038, I. U. M., one, 52 mm., Quebrada Cramalote, Villavicencio. Gonzales.

15039, I. U. M., one, 43 mm., Barrigón. Gonzales.

This species was originally described from two specimens about 50 mm. in length, said to have come from Honda on the Rio Magdalena. I did not succeed in securing this species during my short stay at Honda. It is probable that the specimens really came from the Meta Basin and were shipped from Honda. The species is evidently abundant about Villavicencio.

20. **Astroblepus longifilis** (Steindachner).

Arges longifilis Steindachner, Denkschr. Akad. Wiss. Wien, XLVI, 1882, p. 19, plate V, figs. 3, 3*a*, 3*b* (Rio Huambo, and Rio Totora of northern Peru).

The following specimens were collected by Gonzales in mountain streams in the Cordilleras, east of Bogotá.

7404, C. M.; 13703, I. U. M., Caqueza; 7405, C. M., Quebrada Hirajara; 13714, I. U. M., Marutiba; 7406, C. M.; 13715, I. U. M., Rio del Fosca (4,500 feet); 7417, C. M., Quebrada Sumuco.

This species has an extensive distribution, ranging in the Andean streams from Peru to the Tuyra Basin in Panama, to Mogotes in Santander, and to the headwaters of the Rio Meta.

21. **Astroblepus latidens** Eigenmann. (Plate VI, fig. 3.)

Astroblepus latidens Eigenmann, Proc. Amer. Philos. Soc., LVI, 1917, p. 674.

This species, as far as known, is found only on the eastern slope of the Eastern Andes of Colombia. All the specimens recorded below are from along the route between Bogotá and Villavicencio and Barrigón, and were collected by Manuel Gonzales or under his direction.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.
7362, C. M., *type*	1 ♀	57	Piperel.
13677, I. U. M.; 7363, C. M.	10	28–58	Piperel.
13678, I. U. M.; 7364, C. M., *paratypes*	5	48–73	Caqueza.
13679, I. U. M.; 6365, C. M., *paratypes*	18	27–60	Quebrada Hirajara.
13680, I. U. M.; 6366, C. M.	33	Largest 79	Quebrada Perdizes.
13681, I. U. M.; 7367, C. M.	12	20–18	Rio del Fosca.
13727, I. U. M.		26–57	Quebrada Cramalote, Villavicencio.

Catalogue Numbers.	No. of Specimens.	Length in mm.	Locality.
7411 *a–i*, C. M.		23–55	Quebrada at Villavicencio.
7412 *a*, C. M.		26	Rio Negro, Villavicencio.
7413 *a–d*, C. M.; 13728, I. U. M.	9	32–50	Quebrada Sumuco.
7414 *a–b*, C. M.; 13729, I. U. M.	4	45–53.5	Quebrada Naranjal.
7415 *a–d*, C. M.; 13730, I. U. M.	7	37–54	Quebrada Marutiba.
7416 *a–c*, C. M.	3	34–41	Rio Blanco, Villavicencio.
13744, I. U. M.	4	25–35	Rio Roncador.
7432 *a–b*, C. M.; 13745, I. U. M.	4	36–60	Tengavita.

This species is similar to *A. trifasciatus* from the Rio Dagua. It ranges through the same gamut of color as *A. trifasciatus*, some specimens having conspicuous cross-bands, others being uniform in color. The adults are readily distinguishable from *A. trifasciatus* by the very broad teeth in the outer row of the premaxillary, a difference not evident in the young. It is very closely related to *A. chapmani*.

22. **Astroblepus grixalvii** Humboldt.

Astroblepus grixalvii Humboldt, Obs. Zool., I, 1805, p. 19, plate VII (Popayan).

13954, I. U. M., many, largest 85 mm., Choachi. Maria.

13955, I. U. M., one, 86 mm., Caño Carniceria. Maria.

This species occurs throughout the Andes of Ecuador, and the Eastern and Central Andes of Colombia, reaching the highest elevations attained by fishes in these regions.

23. **Astroblepus micrescens** Eigenmann.

Astroblepus grixalvii micrescens Eigenmann, Proc. Amer. Philos. Soc., LVI, 1917, p. 677.

This species occurs on the eastern slopes of the Eastern Cordillera of Colombia.

24. **Pygidium metæ** Eigenmann.

Pygidium metæ Eigenmann, Proc. Amer. Philos. Soc., LVI, 1917, p. 694; Mem. Carnegie Mus., VII, 1918, p. 312, plate XLVII, fig. 5.

13770, I. U. M., *type*, 78 mm., Barrigón, March, 1914. Manuel Gonzales.

25. **Pygidium kneri** (Steindachner).

Pygidium kneri Eigenmann, Mem. Carnegie Mus., VII, 1918, p. 314, plate XLVI, figs. 1 and 2.

13907, I. U. M., one, 155 mm., Barrigón, Rio Meta. Gonzales.

26. **Pygidium dorsostriatum** Eigenmann.

Pygidium dorsostriatum EIGENMANN, Proc. Amer. Philos. Soc., LVI, 1917, p. 695; Mem. Carnegie Mus., VII, 1918, p. 320, plate XLVIII, fig. 3.

7093, C. M.; 13810, I. U. M., four, 18–76 mm., Villavicencio. Gonzales.

ERYTHRINUS Gronow.

27. **Erythrinus erythrinus** (Bloch and Schneider).

13787, I. U. M., one, Cumaral. Apolinar Maria.

28. **Hoplias malabaricus** (Bloch).

13789, I. U. M., twenty, Cumaral. Apolinar Maria.

15044, I. U. M., a head, 90 mm. long, Quebrada Cramalote, Villavicencio. Gonzales.

29. **Curimatus argenteus** Gill.

Curimatus argenteus GILL, Ann. Lyc. Nat. Hist. N. Y., VI, 1858, p. 62; LÜTKEN, Vidensk. Medd. Nat. For., Kiöbenhavn, 1874, p. 225 (Trinidad); EIGENMANN and EIGENMANN, Ann. N. Y. Acad. Sci., IV, p. 13; REGAN, Proc. Zoöl. Soc. London, 1906, I, p. 385, plate XXI, fig. 3 (plentiful in the ravines of the Streatham Lodge Estate, Dominica).

This species, hitherto known from Trinidad, was found by Gonzales at Barrigón and Villavicencio.

15021, I. U. M., six, 83–100 mm., Barrigón. Gonzales.

3843, C. M., one, 109 mm., Rio Negro, Villavicencio. Gonzales.

15110, I. U. M., El Concejo, Rio Tiquirito, near Caracas, Venezuela. Pearse.

15111, I. U. M., Maracay, Rio Bue. Pearse.

Head 3.75–4; depth 2.75–3; D. 11; A. 9; scales 5–34 to 38–5; interorbital equals postorbital portion of the head, but little more than 2–2.4 in the length of the head; depth of caudal peduncle equal to its length, or to the postorbital portion of the head; less than 2 in the head. Highest anal rays reach the caudal. Dorsal spot large and usually very prominent, middle caudal rays but faintly tinged.

30. **Curimatus metæ** sp. nov. (Plate XVII, fig. 1.)

3844, C. M., *type*, 119 mm.; 3845 *a–b*, C. M.; 15023, I. U. M., 68–118 mm., *paratypes*; Quebrada Cramalote, Villavicencio. Gonzales.

15022, I. U. M., forty-seven, 70–148 mm., Barrigón. Gonzales.

Head 3.5–4; depth 2.66–3.25; D. 11; A. 9; scales 5–36 to 39–5; eye 3 in the head; depth of caudal peduncle equal to its length; interorbital 2.25–2.5 in

the head; origin of dorsal equidistant from tip of snout and some part of the adipose, the highest ray equal to the head behind the nares, all the rays nearly coterminous when depressed; caudal deeply forked, the lobes longer or shorter than the head; anal emarginate, the anterior rays extending beyond the posterior, not reaching the caudal; pectorals not reaching ventrals, the ventrals half-way to the last anal ray.

Scales increasing in size to the ventrals.

A variable dark spot near base of middle dorsal rays; a dark band on middle of caudal peduncle (in formalin specimens), fading out forward and continued to very near the end of the middle caudal rays; lower caudal lobe partly or entirely dusky.

This species is very similar to *C. argenteus*, differing in the shape of the caudal peduncle and in coloration.

31. **Prochilodus mariæ** sp. nov. (Plate XX, fig. 2.)

15150, I. U. M., 296 and 302 mm., the smaller is the *type*. Barrigón, Rio Meta. Received March 1914. Gonzales.

Allied to *Prochilodus laticeps* Steindachner.

Head 3.8–3.9 in the length to end of lateral line; depth very little more than 3; D. 11, not counting the short fulcrum or the last filament; A. 11. Scales 10–53–8 in one, 10–58–8 in the other. Eye 2.3 to 2.5 in the snout, 5 to 5.5 in the head, 3 to 3.25 in interorbital; gape extending slightly beyond nostrils, not to eye; origin of dorsal about equidistant from snout and the last half of the base of the adipose; anal emarginate, the second ray extending beyond the tip of the last rays; pectorals not reaching the ventrals by one or two scales. Postventral region trenchant.

About 8 obscure dark cross-bands under the dorsal and the region in front of it. Sides with zigzag lines between the rows of scales, most conspicuous above the anal. Dorsal obscure in front, hyaline behind; small dots in rows across the rays, most sharply defined in the upper posterior half; round spots on the adipose; caudal with about seven rows of spots, most sharply defined on the middle rays, running into wavy bands on the inner parts of the lobes, the margin of the lobes uniform.

32. **Pyrrhulina lugubris** sp. nov. (Plate XXI, fig. 1.)

? *Pyrrhulina semifasciata* Regan, Ann. & Mag. Nat. Hist. (8), X, 1912, p. 390 ("Bogotá"!).

15041 *a*, I. U. M., *type*, a male, 53 mm.; 12 *paratypes*, 21–54 mm., Barrigón. Gonzales.

15042 *a–b*, I. U. M., 52–53 mm., Quebrada Cramalote, Villavicencio. Gonzales.
3868, C. M., 2, 62 mm., Rio Negro, Villavicencio. Gonzales.
13791, I. U. M., 4, 36–60 mm., Cumaral. Maria.

Allied to *P. brevis*.

Head 4–4.33; depth 4–4.25; D. 10; A. 10 or 11; 5–5.5 scales between dorsal and ventral, 21 or 22 + 2 along the median series; eye 3 in the head, equals snout and part of eye in front of pupil; interorbital equals snout and half the eye, a little less than eye and postorbital portion of the head; caudal peduncle equals snout and eye.

Origin of dorsal equidistant from base of middle caudal rays and preopercle or opercle, much behind origin of ventrals, height of dorsal less than length of head; caudal large, the lobes rounded, the upper lobe longer, longer than head; lower fins larger in the male, the anal reaches the caudal, the ventrals reach the anal and the pectorals reach nearly to the ventrals.

A narrow dark stripe extends from the eye around the chin, and from the eye to the edge of the opercle and sometimes along a few scales behind it. These stripes are sharper in the female. A series of light spots extends along the rows of scales. The dorsal in the female has a black spot near its center or somewhere in the space between the second and fifth rays. In males, the black spot reaches to the tip of these rays, the anterior margin of the fin being white. The margins of the pectorals, ventrals, and anal are black in the male, with an obscure dark area above the posterior halves of the pectorals.

Although extra-limital, the following species may conveniently be described here:

COPEINA Fowler.

33. **Copeina osgoodi** sp. nov.

Type, 53 mm. in length from chin to end of scales on middle caudal rays. *Paratypes*, six, 45–54 mm., measured between the same points. Type in Field Museum of Natural History. Nazareth, Peru. Sept. 10, 1912, W. H. Osgood. Closely allied to *C. argyrops* Cope.

Head 4; depth 4; D. 10; A. 11; scales 6 in transverse series between dorsal and ventral; 24 or 25 + 2 along the middle line; eye 3 or a little more in the head; snout 4.25–4.5; interorbital about 2.4; caudal peduncle a little less than eye and postorbital portion of the head.

Origin of dorsal nearly directly over origin of ventrals, equidistant from tip of snout and end of scales on middle of caudal; height of dorsal equals eye and

postorbital part of head; caudal longer than head, the lobes subequal; pectorals not reaching ventrals, ventrals not reaching anal.

Iridescent, steel blue above with small, pearly spots along the rows of scales in some specimens. No stripe on head; dorsal spot mostly below the middle of the fin.

I take pleasure in naming this species for its collector, Dr. Wilfred H. Osgood of the Field Museum of Natural History, of Chicago.

34. **Copeina metæ** Eigenmann. (Plate XX, fig. 3.)

Copeina eigenmanni Regan (*in part*), Ann. & Mag. Nat. Hist. (8), X, 1912, p. 393 ("Bogotá"!).

Copeina metæ Eigenmann, Indiana University Studies No. 23, 1914, p. 229.

13251 *a*, I. U. M., *type*, 35 mm., and 34 *paratypes*, largest 43 mm., Barrigón, Rio Meta. Gonzales.

15040, I. U. M., 6, largest 49 mm., Barrigón. Gonzales.

The specimens recorded from Bogotá by Regan, as given above, very probably really came from the Meta Basin, as has been previously mentioned.

35. **Characidium fasciatum** Reinhardt.

15322, I. U. M., 1, 30 mm., Barrigón. Gonzales.

15323, I. U. M., 14, largest 50 mm., Villavicencio. Gonzales.

36. **Leporinus Y-ophorus** sp. nov. (Plate XX, fig. 4.)

15025, I. U. M., *type*, 167 mm. to end of scales on caudal. Barrigón. Gonzales.

Head 5; depth 4.66; D. 12; A. 11; scales 6–42–5; eye 2 in snout, 4.5 in the head, 2 in the interorbital; isthmus 3.5 in the head; depth of caudal peduncle 2.4 in the head.

Elongate, subcylindrical; snout subconical; preventral region rounded, with a median series of scales extending to opposite the anterior margin of the pectoral; predorsal area narrowly rounded, without a regular median series of scales.

Mouth small, the maxillary reaching to the vertical from behind the anterior nares; interorbital convex. Scales regularly imbricate, without notable differences in size except on the ventral surface in front of the pectorals. Origin of dorsal equidistant between snout and middle of adipose; its margin rounded, the third to ninth rays nearly coterminous when depressed; the third nearly equal to the length of the head; anal truncate when open, the longest rays just reaching the caudal fulcra when depressed.

A series of seven bars from the middle of the back to the ventral edge; the second bar Y-shaped, the three limbs of the Y nearly equal in size. Maxillary dark like the bars.

37. **Hemigrammus barrigonæ** Eigenmann and Henn.

Hemigrammus barrigonæ Eigenmann and Henn, Indiana University Studies No. 24, 1914, p. 232; Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, p. 161, plate 93, fig. 2.

13423 and 13424, I. U. M., 66 specimens, largest 43 mm., Barrigón, Rio Meta. Gonzales.

38. **Hyphessobrycon metæ** Eigenmann and Henn.

Hyphessobrycon metæ Eigenmann and Henn, Indiana University Studies No. 24, 1914, p. 233; Eigenmann, Mem. Mus. Comp. Zoöl., XLIII, p. 203, plate 93, fig. 3.

13421 and 13422, I. U. M., 67 mm., largest 35 mm., Barrigón, Rio Meta. Gonzales.

39. **Mœnkhausia metæ** sp. nov. (Plate XXXIV, fig. 3.)

15026, I. U. M., *type*, and *paratypes*, twenty, 52–74 mm., Barrigón, Rio Meta. Gonzales.

3926 *a–d*, C. M., and 13951, I. U. M., ten, *paratypes*, 52–63 mm., Villavicencio. Gonzales.

Head 4 or nearly 4; average depth 2.5 in the length; D. 11; A. 20–22; scales 6 (more rarely 7)–34 to 36–5 (more rarely 4); eye 2.7–3; interorbital about equal to the eye; maxillary with 2 or 3 teeth; 4 to 6 teeth in the front row of the premaxillary.

Shaped like *M. barbouri*; preventral area rounded, postventral area narrowly so; predorsal area narrowly rounded, with a median series of nine scales; occipital process 4–4.5 in the distance from its base to the dorsal, bordered by three scales on the side; interorbital convex; second suborbital leaving one-fifth or more of the cheek naked; maxillary 2.8–3 in the head; equal to the distance from the snout to the pupil; usually four or five teeth in the front series of the premaxillary, five teeth in the second series; maxillary usually with two, less frequently with three, teeth; mandible with four large teeth, about nine abruptly smaller teeth on the sides; gill-rakers about 5 + 9 to 11. Scales of the sides with four or more slightly diverging striæ; anal sheath consisting of five or six scales along the bases of the anterior rays; scales of caudal largely lost.

Origin of dorsal equidistant from tip of snout and caudal, the longest rays

longer than the head, 3.5 in the length, equal to the caudal lobes; anal lobe almost equal to the length of the head without the opercle, reaching to or very nearly to the base of the last ray; origin of ventrals nearer to base of last anal ray than to tip of snout; pectorals reaching base or two scales beyond base of outer ventral rays.

A dark median lateral line; anal dark at margin. One or two faint humeral spots or none.

40. **Mœnkhausia oligolepis** (Günther).

13773, 13774 and 13778, I. U. M., four specimens from Caño Carniceria. Apolinar Maria.

41. **Astyanax abramis** (Jenyns).

13777, 13781, 15310 to 15313, I. U. M., eight, largest 130 mm., Caño Carniceria, two days northeast of Villavicencio. Apolinar Maria.

The predorsal line is almost entirely naked, the scales are 47 to 49, the anal 27 to 32.

The humeral spots are faint. No. 15310, a male 130 mm. long, has a brilliant black band on the caudal peduncle; the pectorals being long and extending past the origin of the ventrals. A female of the same size entirely lacks the black band on the caudal peduncle, and has the pectorals not reaching to the ventrals, and the maxillary shorter than in the male.

42. **Astyanax metæ** Eigenmann.

Astyanax metæ EIGENMANN, Indiana University Studies No. 19, 1914, p. 11; Mem. Mus. Comp. Zoöl., XLIII, 1921, p. 287, plate 87, fig. 4.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.	Collector.
5457, C. M., *type*, 130 mm; 5458, C. M.; 13156, I. U. M., *paratypes*	6	103–130	Rio Negro, Villavicencio	Gonzales
13371, I. U. M.	1	141	Barrigón	"
13264, I. U. M.	19	Largest 146	"	"
7319, C. M.	4	Largest 104	Rio Guatigua	"
13153, I. U. M.	4	Largest 132	Rio Negro, Villavicencio	"
13265, I. U. M.	3	Largest 135	Quebrada Cramalote, Villavicencio	"
13790, I. U. M.	1	83	Cumaral	Maria
13782, I. U. M.	1	112 to base of caudal	Caño Carniceria	"

This species is also abundant in Lake Valencia and the Rio Tuy Basin in Venezuela.

43. **Bryconamericus cismontanus** Eigenmann.

Bryconamericus cismontanus EIGENMANN, Indiana University Studies No. 19, 1914, p. 5; Mem. Mus. Comp. Zoöl., XLIII, 1921, plate 91, fig. 4.

5459, C. M., *type*, 60 mm., Villavicencio. Gonzales.

? 5460, C. M., 13155, I. U. M., 2, 43 and 50 mm., Rio Orquiza. Gonzales.

44. **Bryconamericus deuterodonoides** Eigenmann.

Bryconamericus deuterodonoides EIGENMANN, Indiana University Studies No. 19, 1914, p. 5; Mem. Mus. Comp. Zoöl., XLIII, 1921, plate 91, fig. 3.

5461, C. M., *type*, 43 mm.; 5462 *a–f*, C. M.; 13156, I. U. M., *paratypes* 13, largest 48 mm., Rio Negro, Villavicencio. Gonzales.

45. **Bryconamericus alpha** Eigenmann.

Bryconamericus alpha EIGENMANN, Indiana University Studies No. 19, 1914, p. 7; Mem. Mus. Comp. Zoöl., XLIII, 1921, plate 91, fig. 1.

5463 *a*, C. M., *type*, 59 mm.; 5464 *a–c*, C. M.; 13157, I. U. M., *paratypes* six, largest 64 mm., Villavicencio. Gonzales.

7066 *a–i*, C. M.; 13258, I. U. M., many, largest 76 mm. Rio Meta at Barrigón. Gonzales.

13259, I. U. M., 16, 35–62 mm., Quebrada Cramalote, Gonzales.

Habitat: Base of Andes, east of Bogotá.

Allied to *B. caucanus*, differing among other things in the shorter maxillary.

Head 4–4.25; depth 2.75–3; D. 10; A. 23/7, 24/4, 25/1, 26/4, 27/1; scales 6 or 7–39 or 40–4 or 5; eye 2.66 in head, a little greater than interorbital.

Maxillary considerably less than the eye; mandible with four or five large teeth and smaller ones on the side; maxillary with 2/3, 3/4, 4/2 teeth (the denominator represents the number of specimens).

A vertical humeral spot; a broad lateral band (black in formalin specimens). possibly slightly broader on the caudal peduncle, continued as a dusky band to the end of the middle caudal rays. Base of anal hyaline, shading to a dark margin,

This species may prove to be *B. caucanus* from across the Andes. The two species are certainly very closely related.

46. **Bryconamericus beta** Eigenmann.

Bryconamericus beta EIGENMANN, Indiana University Studies No. 19, 1913, p. 7; Mem. Mus. Comp. Zoöl., XLIII, 1921, plate 91, fig. 2.

5465 *a*, C. M., *type*, 57 mm.; 5466 *a–d*, C. M.; 13158, I. U. M., nine *paratypes*, largest 75 mm., Villavicencio. Gonzales.

13257, I. U. M., thirteen, largest 58 mm., Villavicencio, Quebrada Cramalote. Gonzales.

15140, I. U. M., El Concejo, Tuy Basin near Caracas. Pearse.

Habitat: Base of Andes east of Bogotá and northern Venezuela.

Head 4–4.25; depth 2.65–2.8; D. usually 10, rarely 9; A. 25/1, 26/2, 27/6, 28/2, 29/4, 30/1; scales 5 or 6–36/2, 37/4, 38/1, 39/1–2 or 4 to ventrals. Eye 2.8–3, equal to or slightly less than interorbital; maxillary teeth 4/1, 3/2, 2/6, length of maxillary about two-thirds of the eye. (In the above fractions, the denominator represents the number of individuals having the given character).

Base of upper caudal lobe scaled for one-fourth, that of the lower for one-third, of its length.

Ventrals reaching to or not quite to the anal; pectorals about to ventrals; sometimes falling a little short or extending a little beyond origin of ventrals.

Color much faded, a black line in the dark lateral band, which extends to the end of the middle caudal rays. A transverse humeral band; an obscure caudal spot.

7065 *a–e*, C. M., 13256, I. U. M., thirty-three, largest 68 mm., Rio Meta at Barrigón. Gonzales.

These specimens are better preserved than the types. The pectorals extend to the second scale beyond the origin of the ventrals, rarely to the end of the third scale or only to the origin of the ventrals. D. 9/2, 10/18; A. 26/1, 28/7, 29/5, 30/5, 31/1, 32/1; head 4.25–4.66; scales 37/1, 38/6, 39/1. The humeral spot is frequently well marked, crossing the second and third scales of the lateral line; the lateral band overlying the black line is very faint except on the caudal peduncle where it widens and becomes darker. Anal with basal or subbasal part dusky, the entire fin sometimes uniformly dusky, the margin very rarely darker than the rest of the fin.

CREATOCHANES Günther.

47. **Creatochanes affinis** Günther.

13775, I. U. M., two, Caño Carniceria. Apolinar Maria.

The general characters are those of *C. affinis*. The upper caudal lobe is very much darker, its basal spot as prominent as in *C. caudomaculatus;* maxillary reaching to end of second premaxillary. Scales 7–48; A. 29.

48. **Creatochanes caudomaculatus** Günther.

13974, I. U. M., three, locality and collector in doubt.

49. **Creagrutus beni** Eigenmann.

Creagrutus beni EIGENMANN, Mem. Mus. Comp. Zoöl., XLIII, 1921, plate 56, fig. 3; plate 93, figs. 4, 5, 7.

SPECIMENS COLLECTED BY MANUEL GONZALES.

Catalog Numbers.	No. of Specimens.	Length in mm.	Locality.
5480 *a*, C. M.; 13173, I. U. M.	3	78–84	Rio San Gil, Santander
5481 *a–c*, C. M.; 13174, I. U. M.	6	54–80	Rio Guadrigua
5482 *a–g*, C. M.; 13175, I. U. M.	18	47–84	Rio Negro, Villavicencio
5488 *a*, C. M.; 13179, I. U. M.			Rio Roncador
13372, I. U. M.	12	54–73	Quebrada Cramalote, Villavicencio
13373, I. U. M.		42–80	Barrigón, Rio Meta

STEVARDIA Gill.

50. **Stevardia aliata** Eigenmann.

Stevardia aliata EIGENMANN, Indiana University Studies No. 20, 1914, p. 37; Mem. Mus. Comp. Zoöl., XLIII, 1921, plate 83, fig. 4.

5215, C. M., *type*, a male 75 mm.; 5489, C. M.; 13180, I. U. M., twenty-one *paratypes*, largest 77 mm., Rio Negro, Villavicencio. Gonzales.

5490, C. M.; 13181, I. U. M., three *paratypes*, largest 51 mm., Rio Guadrigua. Gonzales.

51. **Charax metæ** sp. nov. (Plate XXV, fig. 1.)

15027, I. U. M., *type* and *paratypes*, thirty-five, 47–149 mm., the largest the type, Barrigón. Gonzales.

3846 *a–j*, C. M., *paratypes*, twenty-one, 63–130 mm., Quebrada Cramalote, Villavicencio. Gonzales.

Closely allied to *C. pauciradiatus* of the Amazon.

Head 3.6–3.8; depth 2.7–3 (2.66 in *C. pauciradiatus*); D. 11; A. 42/6, 43/2, 44/1, 45/5, 46/1 (45–49 in *C. pauciradiatus*); scales 50/1, 51/1, 52/2, 53/2, 54/6, 56/2 (55–57 in *C. pauciradiatus*); eye equals interorbital or snout, 3.5 in the head.

Elongate, the back less humped than in *C. gibbosus;* breast flat without a regular median series of scales; postventral area compressed; dorsal profile from base of occipital process to dorsal formning a arc of a circle, the radius of which is equal to the distance between the snout and the dorsal; profile of head concave, maxillary extending beyond the posterior edge of the preorbital; premaxillary-maxillary border a little more than two-thirds of the length of the head; distance from the eye to the lower angle of the cheek about equal to snout and half the eye. Gill-rakers 5 + 8 or 9, the longest about half the length of the eye. Origin of

dorsal about equidistant between snout and caudal, its height about 3.5 in the length; caudal lobes about 4 in the length; origin of anal about equidistant from tip of snout and base of caudal, its margin very slightly concave; ventrals reaching to or a little beyond origin of anal; pectorals to middle of ventrals.

Scales regularly imbricate, without radials, largest over abdominal cavity, smallest on predorsal area. Lateral line nearly straight; fins naked.

Reticulate, a dark streak from eye obliquely down and back to the preopercle; a large spot on end of caudal peduncle continued on the middle caudal rays. Anal with numerous chromatophores, frequently those on different levels of the rays differently expanded, giving rise to a dark margin or a submarginal streak.

52. **Acestrorhynchus falcatus** (Bloch).

13786, I. U. M., one, 99 mm., Cumaral. Maria.
15308, I. U. M., one, 163 mm. to end of middle caudal rays. Maria.

53. **Gymnotus carapo** Linnæus.

13795, I. U. M., Cumaral. Maria.

This is the most widely distributed Gymnotid and the one reaching furthest north. It occurs from Guatemala south and east of the Andes to the Rio de la Plata. It was taken in the San Juan and the Atrato, but not in Panama.

54. **Sternopygus macrurus** (Bloch and Schneider).

5619 *a*, C. M., 72 mm., Villavicencio. Gonzales.
13788, I. U. M., Cumaral. Maria.

This widely distributed species occurs from the Rio Paraguay on the south, throughout northwestern South America, including the Atrato and Magdalena Basins. It occurs also in Pacific slope streams such as the San Juan, Patia, and Guayas Basins.

55. **Rivulus hartii** (Boulenger).

Rivulus hartii Henn, Ann. Carnegie Mus., X, 1916, p. 108.
13608, I. U. M., 3, 25–46 mm., Quebrada Cramalote, Villavicencio. Gonzales.
13609, I. U. M., 2, 23–47 mm., Barrigón, Rio Meta. Gonzales.

Apistogrammus Regan.

56. **Apistogrammus tæniatum** (Günther).

3930, C. M., 50 mm., Rio Negro, Villavicencio. Gonzales.

57. **Apistogrammus corumbæ** (Eigenmann).

15018, I. U. M., 37–43 mm., Barrigón. Gonzales.

CRENICICHLA Heckel.

58. **Crenicichla geayi** Pellegrin.

3866 *a*, C. M., 59 mm., Villavicencio. Gonzales.
13780, I. U. M., one specimen, 105 mm., locality doubtful. Maria.
13784, 13785, 13792, 13793, I. U. M., six specimens, 65–96 mm., Cumaral. Maria.
Also one specimen, 200 mm., Barrigón. Gonzales.

59. **Æquidens mariæ** sp. nov. (Plate XXX, fig. 1.)

Catalog Number.	No. of Specimens.	Length in mm.	Locality.	Collector.
15011, I. U. M.	11	60–110, the largest the *type*	Barrigón	Gonzales
13794, I. U. M.	2	61 and 82, *paratypes*	Cumaral	Maria
13776, I. U. M.	1	54 to base of caudal	Caño Carniceria	"
13968, I. U. M.	5	35–72	Rio Negro, Villavicencio	Gonzales
14154, I. U. M.	1	118	East of Bogotá	"
15012, I. U. M.	1	88	Quebrada Cramalote, Villavicencio	"

Head 2.8–3; depth 2.33–2.4; D. XIV (or rarely XIII), 9 or 10; A. III, 8 or 9; scales 26 in the median line to the base of the caudal, pores 16 + 12, + 2 scales with pores on the base of the caudal; two scales between the branches of the lateral line, 1.25 scales between the lateral line and the soft dorsal; eye 2.66–3.25 in the length of the head; interorbital 2.5–2.75 in the head; the sixth dorsal spine 2.66–3 in the head.

Center of eye in center of head or nearer snout than end of opercle by diameter of pupil or less; preorbital from two-thirds to exactly diameter of eye; soft dorsal and anal pointed, the former not quite reaching middle of caudal; caudal emarginate (sometimes rounded), the outer rays prolonged, equal to the length of the head; anal shorter than dorsal; ventrals reaching beyond origin of anal; pectorals about equal to the length of the head; six gill-rakers ; three series of scales on the cheeks, preopercle naked; dorsal and anal naked.

A dark band across the nape and along the upper part of the sides around the end of the soft dorsal, or to the base of the last rays; a narrow dark edge to the hinder orbital border, continued as a broader dark stripe from below the middle of the eye to the angle, or just below the angle of the preopercle; a faint dark bar between the anterior parts of the eyes; five or six dark shades entirely across the sides, sometimes forming spots where they cross the longitudinal band; dusky

longitudinal stripes between the rows of scales, wider or narrower than the light stripes along the middle of the scales; a small dark spot above the middle of the base of the caudal; the edges of the soft dorsal, anal, and the upper and lower margins of the caudal, dark; the soft dorsal and the caudal and sometimes the last anal membranes with hyaline spots; tips of membranes between the dorsal spines without color, a dark, oblique line below these; cheeks with spots and lines.

60. **Æquidens metæ** sp. nov. (Plate XXX, fig. 2.)

13967, I. U. M., *type*, 155 mm., *paratype*, 168 mm., Barrigón. Gonzales.
13779, I. U. M., 1, 110 mm., Caño Carniceria. Maria.
13797, I. U. M., 2, 51–59 mm., Cumaral. Maria.
15017, I. U. M., 8, 22–46 mm., Barrigón. Gonzales.

Head 3; depth 2.25; D. XIV or XV, 12; A. III, 8 to 10; scales 24; pores 16 + 12; eye nearly 4 in the length of the head; interorbital 2.2–2.3; last dorsal spine nearly half as long as the head, the sixth dorsal spine 3.5 in the head, 2.75 in the young.

Eye slightly behind the middle of the head, nearer the snout in the young; preorbital a little wider than the eye, much narrower than the eye in the young; jaws equal, dorsal spines but slightly graduate; soft dorsal pointed, extending beyond the middle of the caudal; caudal rounded, longer than the head; anal pointed, but little shorter than the caudal; ventrals reaching beyond the origin of the dorsal; pectorals a little longer than the head; six gill-rakers; three series of scales on the cheeks; preopercle naked; end of upper lateral line one and one-half scales from the dorsal; dorsal and anal naked.

A black ocellus at the base of the upper caudal lobe; a dark bar along the anterior edge of the preopercle; a dark stripe from the upper angle of the gill-opening to in front of the caudal ocellus, interrupted in front and behind the lateral bar at the end of the pectoral; about six obscure bars, the middle one bordered by light in front and behind, and intensified into a spot below the lateral line; a light band across the end of the caudal peduncle. Anal blue-black, with a few light spots on the posterior membranes; dorsal margined with dark, the membranes of the soft part having obscure spots along the basal portion in front of the prolonged part, the membranes behind this with light spots along their entire length; caudal with light streaks along the membrane to the distal two fifths, where it is crossed by about five series of translucent spots.

APPENDIX II.
BIBLIOGRAPHY.

AN ANNOTATED LIST OF PAPERS DEALING WITH THE FISHES OF PANAMA, COLOMBIA, WESTERN ECUADOR, AND WESTERN PERU.

By C. H. Eigenmann.

In the following Bibliography I have listed all the principal papers making contributions to the fauna of the area, exclusive of such general works as Günther, *Catalogue of the Fishes of the British Museum*, and Cuvier and Valenciennes, *Histoire Naturelle des Poissons*.

Several papers stand out. These are Steindachner 1878, 1879, 1880, and 1902; Boulenger 1898 and 1899, and the numerous short papers of Regan, especially those of 1913 and 1914, and his larger volumes, 1907–08. The most important single paper is that of Meek and Hildebrand, 1916.

Abbott, James Francis.

1899. The Marine Fishes of Peru. *Proceedings Academy Natural Sciences Philadelphia*, 1899, pp. 324–364.

Describes, p. 342, *Pisciregia beardsleei* gen. et spec. nov. = *Basilichthys semotilus* (Cope).

Bayern, Princessin Therese von.

1900. Vorlaüfiger Bericht über einige während einer Reise nach Südamerika, 1898, gesammelte neue Fische. *Anz. K. K. Akad. Wiss. Wien*, XXXVII, pp. 206–208.

These fishes were later dealt with in detail by Steindachner, 1902, *q. v.*

Bean, Barton A.

1908. On *Ctenolucius* Gill, a Neglected Genus of Characin Fishes, with Notes on the Typical Species. *Proceedings U. S. National Museum*, XXXIII, 1908, pp. 701–703.

Calls attention to the genus *Ctenolucius* described by Gill, 1861.

Boulenger, G. A.

1887. On New Siluroid Fishes from the Andes of Colombia. *Annals and Magazine of Natural History*, (5), XIX, pp. 348–350.

Describes *Stygogenes guentheri*, *Chætostomus setosus*, and *Trichomycterus nigromaculatus*.

The following table gives the species listed by Boulenger (1898–9) in his "*Poissons de l'Équateur.*" (See p. 244.)

	Rios Mira and Chota.	Guayaquil Basin.	Santiago Basin.
Arius labiatus sp. nov.		×	
Hoplias microlepis		×	
Lebiasina bimaculata		×	
Piabucina elongata			×
Astyanax brevirostris		×	
" *festæ*		×	
Bryconamericus simus	×		
" *rutilis*		×[1]	×
Hemibrycon polyodon		×[2]	×
Brycon atricaudatus	×	×	×[2]
" *dentex*		×	
" *striatulus?*			×[3]
" *alburnus*		×	
Salminus affinis?			×[4]
Leporinus frederici? ecuadoriensis		×	
Curimatus troscheli		×	
" *guentheri = boulengeri*		×	
Prochilodus humeralis		×	
" *nigricans*			×
Pimelodus buckleyi		×[5]	
Rhamdia cinerascens		×	
" *humilis*			×
" *parvus*			×
Pygidium kneri			×
" *tænium*			×
Cetopsis macroteronema			×
Astroblepus prenadilla	×		×
" *festæ*			×
Loricaria frenata = panamensis	×		
" *jubata*	×		
Plecostomus spinosissimus as *festæ*		×	
Chætostomus microps[6]			×
" *dermorhynchus*		×	×
" *platycephalus*			×
Sternarchus albifrons			×
Eigenmannia æquilabiatus		×	
Pœcilia festæ[7]			
Acara rivulata		×	
" *syspilus*			×
Heros festæ		×	
Crenicichla saxatilis			×
Sicydium salvini[8]	×		

[1] Probably *peruanus.* [2] The specimen from Zamora probably a different species. [3] If this is really *striatulus* it is found on both slopes. [4] It may be doubted whether this identification is correct. [5] This identification needs verification. [6] *Chætostomus brevis* Regan. [7] West of Guayaquil. [8] As *Oreogobius rosenbergii.*

1890. Descriptions of Two New Species of the Siluroid Genus *Arges*. *Proceedings Zoölogical Society London*, 1890, 450–452, pl. 41.

Describes *Arges taczanowskii* and *Arges whymperi*.

1895. Description of a New Characinoid Fish of the Genus *Parodon*. *Annals and Magazine Natural History*, (6), XVI, 1895, p. 480.

Describes *Parodon caliensis*.

1898 and 1899. Viaggio del Dr. Enrico Festa nell' Ecuador e regioni vicine. Poissons de l'Équateur (Première partie). *Bollettino dei Musei di Zoölogia ed Anatomia Comparata della R. Universitá Torino*, XIII, 1898, No. 329, 13 pp. (Deuxième partie), No. 335, 8 pp. (For list see p. 243.)

The following table gives the species listed by Boulenger (1899) in his "*Poissons de l'Amérique Centrale.*" (See p. 245.)

	R. Cucunati	Monkey Hill, Colon	Rio Lava	Rio Cranati	Lagnna della Pita	Sabana	Tuyra
Engraulis isehanus Jordan & Gilbert						+	
Piabueina festæ Boulenger					+		
Astyanax faseiatus (Cuvier)		+		+	+		
Raboides guatemalensis Gthr. (= *oeeidentalis?*)			+				
Curimatus magdalenæ Steind.					+		
Pœeilia mexieana Steind. (= ?)		+					
" *elongata* Gthr. (= *Pœeiliopsis elongata*)						+	+
Mugil hospes Jordan. (= *Joturus pichardi?*)						+	
Centropomus ensiferus Poey.						+	
Mesoprion griseus C. & V.							+
Lobotes surinamensis Bloch.							+
Corvina vermieularis Gthr.							+
" *ensifera* Jordan & Gilbert.							+
" *strabo* Gthr.	+			+		+	+
Gobius soporator C. & V.							+
Eutenogobius saggitula Gthr.	+						
Poriehthys notatus Girard.							+
Hippoglossina sabanensis Boulenger						+	
Symphurus williamsi Jordan & Culver.							+
Arius dovii Gill.						+	
" *guatemalensis* Gthr.			+			+	
" *planieeps* Steind.						+	
" *multiradiatus* Steind.				+			
Æluriehthys pinnimaculatus Steind.							+
Polynemus approximans Lay & Bennett						+	
Chætodon eapistratus Linnæus							+
" *humeralis* Gthr.							+
Chorinemus oeeidentalis Linnæus						+	

BOULENGER, G. A.

1899. Description of a New Genus of Gobioid Fishes from the Andes of Ecuador. *Annals and Magazine Natural History*, (7), IV, 1899, pp. 125–126.

Describes *Oreogobius rosenbergii* = *Sicydium salvini* Grant.

1899. Viaggio del Dr. Enrico Festa nel Darien e regione vicine. Poissons de l'Amérique Centrale. *Bollettino dei Musei di Zoölogia ed Anatomia Comparata della R. Universitá Torino*, XIV, 1899, No. 346, 4 pp. (*v.* p. 244).

1902. Description of Two New Fishes of the Genus *Loricaria* from Northwestern Ecuador. *Annals and Magazine Natural History*, (7), IX, 1902, pp. 69–71.

Describes *Loricaria frenata* = *Sturisoma panamense* and *Loricaria jubata*.

1903. Description of a New Fish of the Genus *Arges* from Venezuela. *Annals and Magazine Natural History*, (7), XI, June 1903, pp. 601 and 602.

Describes *Arges orientalis*.

1911. Description of Three New Characinid Fishes from Southwestern Colombia. *Annals and Magazine of Natural History*, (8), VII, pp. 212–213.

Describes *Lebiasina multimaculata; Luciocharax striatus* = *Ctenolucius beani* (Fowler); *Curimatus lineopunctatus*.

COPE, EDWARD D.

1874. Description of Some Species of Reptiles obtained by Dr. John F. Bransford, Assistant Surgeon United States Navy, while attached to the Nicaraguan Surveying Expedition in 1873. *Proceedings Academy Natural Sciences Philadelphia*, pp. 64–72.

Describes in a footnote, p. 66, *Protistius semotilus* gen. et sp. nov.

1874. On Some Batrachia and Nematognathi brought from the Upper Amazon by Prof. Orton. *Proceedings Academy Natural Sciences of Philadelphia*, 1874, pp. 120–134.

Records, p. 132, *Trichomycterus rivulatus* from Arequipa.

1877. Synopsis of the Cold-blooded Vertebrata Procured by Prof. James Orton during his Exploration of Peru in 1876–77. *Proceedings American Philosophical Society*, XVII, 1877, pp. 33–49.

Notes on *Trichomycterus pardus*, p. 46, and *poeyanus*, p. 47.

1878. Synopsis of the Fishes of the Peruvian Amazon obtained by Professor Orton during his Expeditions of 1873 and 1877. *Proceedings American Philosophical Society*, 1878, pp. 673–701.

Describes in an Addendum, p. 700, *Gastropterus archæus* gen. et sp. nov. = *Basilichthys semotilus*.

DAY, FRANCIS.

1891. *Cyclopium cyclopum* Humboldt. Supplementary Appendix to Whymper's "Travels amongst the Great Andes of the Equator." London, 1891, pp. 137–139.

Records several species of *Astroblepus* under the above name. See Boulenger, 1890, and Regan, 1904, for a discussion of the same specimens.

EIGENMANN, C. H., AND FORDICE, MORTON W.

1885. A Review of the American Eleotridinæ. *Proceedings Academy Natural Sciences Philadelphia*, 1885, pp. 66–80.

Defines the genera and species of this subfamily from Panama, etc.

EIGENMANN, CARL H., AND ROSA SMITH.

1888. A List of the American Species of Gobiidæ and Callionymidæ, with Notes on the Specimens Contained in the Museum of Comparative Zoölogy at Cambridge, Massachusetts. *Proceedings California Academy Sciences*, (2), I, 1888, pp. 51–78.

Records specimens from Panama and Ecuador.

1889. Preliminary Notes on South American Nematognathi II, *Proceedings California Academy Sciences*, (2), II, 1889, pp. 28–56.

Describes *Loricaria panamensis* sp. nov., Panama, and *Ancistrus chagresi* sp. nov., from the Chagres.

1890. A Revision of the South American Nematognathi. *Occasional Papers California Academy Sciences*, I, 1890, pp. 1–508.

Defines genera and species and gives synonymy, bibliography, and distribution.

1891. Catalogue of the Fresh-water Fishes of South America. *Proceedings U. S. National Museum*, XIV, pp. 1–81.

Discusses principles of distribution and lists the species.

EIGENMANN, CARL H.

1893. Catalogue of the Fresh-water Fishes of Central America and Southern Mexico. *Proceedings U. S. National Museum*, 1893, pp. 53–60.

Supplements the preceding paper.

1903. New Genera of South American Fresh-water Fishes and New Names for Some Old Genera. *Smithsonian Miscellaneous Collections*, XLV, pp. 144–148.

Defines *Othonophanes, Gilbertella* = *Gilbertolus*.

1905. The Fishes of Panama. *Science*, N. S., XXII, pp. 18–20.

Discusses the relation of the fishes of the Chagres and those from the Pacific side.

EIGENMANN, CARL H., AND OGLE, FLETCHER.

1907. An Annotated List of Characin Fishes in the United States National Museum and the Museum of Indiana University, with Descriptions of New Species. *Proceedings U. S. National Museum*, XXXIII, 1907, pp. 1–36.

Describes the following new genera and species from Panama and the

Atrato basin: *Gilbertolus, Curimatus boulengeri, Prochilodus beani, Hemigrammus inconstans, Astyanax emperador, A. atratoënsis, Charax atratoënsis, Astyanax orthodus.*

EIGENMANN, CARL H.

1908. Preliminary Descriptions of New Genera and Species of Tetragonopterid Characins. Zoölogical Results of the Thayer Brazilian Expedition. *Bulletin Museum Comparative Zoölogy*, LII, 1908, pp. 93–106.

Describes *Hyphessobrycon panamensis* from Panama.

1909. The Fresh-water Fishes of Patagonia and an Examination of the Archiplata-Archhelenis Theory. *Reports of the Princeton University Expedition to Patagonia*, III, 305, 310, 315.

Lists the species, discusses distribution, and outlines the Panama problems.

1911. Description of Two New Tetragonopterid Fishes in the British Museum. *Annals and Magazine Natural History*, (8), VII, pp. 215–217.

Describes *Nematobrycon palmeri* and *Knodus meridæ*.

1912. Some Results from an Ichthyological Reconnaissance of Colombia, South America. Part I. *Indiana University Studies*, No. 16, September 1912. (Issued December 23.)

Describes four new genera and thirty-one new species.

1913. The same; Part II. *Indiana University Studies*, No. 18, March 1913. (Issued June 3.)

Describes two new genera and twenty-six new species.

1914. New Fishes from Western Colombia, Ecuador, and Peru. *Indiana University Studies*, No. 19, 1914, pp. 1–15.

Describes four new genera and eighteen new species from Colombia and Ecuador.

1914. Some Results from Studies of South American Fishes. *Indiana University Studies*, No. 20, 1914, pp. 4–26.

Describes *Stevardia aliata*.

1914. On New Species of Fishes from the Rio Meta Basin of Eastern Colombia and on Albino or Blind Fishes from near Bogotá. *Indiana University Studies*, No. 23, 1914, pp. 229–230.

Describes *Copeina metæ, Otocinclus spectabilis*, and *Corydoras metæ*.

EIGENMANN, CARL H., AND HENN, ARTHUR WILBUR.

1914. On New Species of Fishes from Colombia, Ecuador, and Brazil. *Indiana University Studies*, No. 24, 1914, pp. 231–234.

Describes *Rhoadsia minor, Hemigrammus barrigonæ, Hyphessobrycon metæ*.

EIGENMANN, CARL H., AND FISHER, HOMER G.

1914. The Gymnotidæ of Trans-andean Colombia and Ecuador. *Indiana University Studies,* No. 25, 1914, pp. 235–237.

Describes *Sternarchus mariæ.*

EIGENMANN, CARL H.

1915. The Cheirodontinæ, a Subfamily of Minute Characid Fishes of South America. *Memoirs Carnegie Museum,* VII, p. 1–99, map, and plates II–XVII.

Describes and figures the species of this subfamily including those from the present area.

1916. *Apareiodon,* a New Genus of Characid Fishes. *Annals Carnegie Museum,* X, 1916, pp. 71–76.

1916. New and Rare Fishes from South American Rivers. *Annals Carnegie Museum,* X, 1916, pp. 77–86.

Figures *Corydoras metæ, Otocinclus spectabilis,* and describes *Trachycorystes fisheri, Imparfinis microps, Nannorhamdia nemacheir, Cetopsorhamdia nasus* gen. et spec. nov., *Ancistrus melas, Hemiancistrus landoni, Pseudancistrus carnegiei.*

1916. Description of Three New Species of Characid Fishes. *Annals Carnegie Muscum,* X, 1916, pp. 87–90.

Describes *Leporinus ecuadoriensis* and *Astyanax magdalenæ.*

1916. On the Species of *Salminus. Annals Carnegie Museum,* X, 1916, pp. 91–92.

Gives key to the four species including that from the Rio Magdalena.

1917. *Pimelodella* and *Typhlobagrus. Memoirs Carnegie Museum,* VII, 1917, pp. 251-258, Plates XXXIII, XXXIV, and XXXV.

Lists and gives a key to the species, and lists the specimens from this area.

1917. Descriptions of Sixteen New Species of Pygidiidæ. *Proceedings American Philosophical Society,* LVI, 1917, pp. 690–703.

P. latidens, metæ, stramineum, dorsostriatum, latistriatum, regani, from the present area.

1917. The American Characidæ. *Memoirs Museum Comparative Zoölogy.* XLIII, 1918. Parts I–III issued, other parts in press and in preparation.

Describes and figures the species of this family.

1917. Eighteen New Species of Fishes from Northwestern South America. *Proceedings American Philosophical Society,* LVI, 1917, pp. 673–689.

Describes the following from the present area: *Astroblepus latidens, cyclopus, santanderensis, frenatus, grixalvii, micrescens, Hemiancistrus wilsoni, Pseudancistrus pediculatus, Ancistrus triradiatus, Chætostomus leucomelas,*

Joturus daguæ, Stolephorus branchiomelas, Stellifer melanocheir, Pomadasys sinuosus, Hemieleotris levis, Sicydium hildebrandi, Gobius daguæ, Awaous decemlineatus, Brycon ecuadoriensis, Brycon meeki.

1917. The Pygidiidæ. *Proceedings Indiana Academy of Sciences,* 1917, pp. 59–66.

1918. The Pygidiidæ, a Family of South American Catfishes. *Memoirs Carnegie Museum,* VII, 1918, pp. 259–373, plates XXXVI–LVI.

1919. The Irwin Expedition. *Science,* (N. S.) L., Aug., 1919, pp. 100–102.

1920. The Irwin Expedition. *Indiana University Alumni Quarterly,* Jan., 1920, pp. 1–16.

1920a. The Fishes of Lake Valencia, Caracas, and of the Rio Tuy at El Concejo, Venezuela. *Indiana University Studies,* No. 44, March 1, 1920, pp. 1–13, plates I–III.

1920b. South America West of the Maracaibo, Orinoco, Amazon, and Titicaca Basins, and the Horizontal Distribution of its Fresh-water Fishes. *Indiana University Studies,* No. 45, June, 1920, pp. 1–24.

Gives tables showing the horizontal distribution of 386 species and varieties.

1920c. The Fishes of the Rivers Draining the Western Slope of the Cordillera Occidental of Colombia (Rios Atrato, San Juan, Dagua, and Patia). *Indiana University Studies,* No. 46, Sept., 1920, pp. 1–19.

While there has been intermigration between the San Juan and the Atrato, the low continental divide between these two rivers at Istmina has been an effective barrier against the southward migration of a number of genera.

1920d. The Fish Fauna of the Cordillera of Bogotá. *Journal Washington Academy Science,* X, Oct., 1920, pp. 460–468.

Deals with the fishes in the higher waters of the Cordillera of Bogotá.

1920e. The Fresh-water Fishes of Panama East of Longitude 80° W. *Indiana University Studies,* No. 47A, Dec., 1920, pp. 3–19.

Demonstrates that the fishes of the Chagres River came in part from the north, in part from the Atrato, *via* the Tuyra and Chepo Rivers.

1920f. The Magdalena Basin and the Horizontal and Vertical Distribution of its Fishes. *Indiana University Studies,* No. 47B, Dec., 1920, pp. 20–34.

The original fauna of the Magdalena was segregated from the eastern fauna by the formation of the Cordillera of Bogotá within the life of many of the present species.

1921. The Origin and Distribution of the Genera of the Fishes of South America West of the Maracaibo, Orinoco, and Amazon Basins. *Proceedings American Philosophical Society,* LX, 1921, pp. 1–6.

The present genera were in small part derived from the ocean, in small part through immigration from the north, in large part by segregation from the east with, or without, subsequent modification.

Evermann, Barton Warren, and Kendall, William Converse.

1905. An Interesting Species of Fish from the High Andes of Central Ecuador. *Proceedings Biological Society of Washington,* XVIII, 1905, pp. 91–106.

Discusses specific characters within the genus *Cyclopium.*

Evermann, Barton Warren, and Goldsborough, E. L.

1910. Notes on Some Fishes from the Canal Zone. *Proceedings Biological Society Washington,* XXII, pp. 95–104.

Describes *Cheirodon gorgonæ.*

1910. Further Notes on Fishes from the Canal Zone, *ibid.,* XXIII, pp. 3–6.

Evermann, Barton Warren, and Radcliffe, L.

1917. The Fishes of the West Coast of Peru and the Titicaca Basin. *Bulletin U. S. National Museum,* No. 95, pp. 1–166.

Deals mostly with marine fishes. Reviews also the fresh-water fishes of western Peru.

Fowler, Henry W.

1903. Descriptions of New, Little Known, and Typical Atherinidæ. *Proceedings Academy Natural Sciences of Philadelphia,* 1903, pp. 737–742.

Redescribes and figures *Protistius semotilus* Cope, p. 737, plate XLIV, and *Gasteropterus archæus,* p. 738, plate XLIII.

1906. Further Knowledge of Some Heterognathous Fishes. Part I. *Proceedings Academy Natural Sciences of Philadelphia,* 1906, pp. 293–351, *ibid.* Part II, pp. 431–483, with 60 figures.

Gives descriptions of specimens in the Academy's Collections, among them, p. 465, *Belonocharax beani* gen. et spec. nov., based on specimens referred by Gill, 1861, to *Ctenolucius.*

1911. New Fresh-water Fishes from Western Ecuador. *Proceedings Academy Natural Sciences of Philadelphia,* 1911, pp. 493–520.

Describes *Prochilodus stigmaturus, Rhoadsia altipinna, Brycon scapularis, Astyanax notemigonoides, Astyanax sciurus, Piabucina aureoguttata,* and *Æquidens azurifera.*

1915. Notes on Nematognathous Fishes. *Proceedings Academy Natural Sciences of Philadelphia,* 1915, pp. 203–244.

Notes on p. 228, *Pygidium rivulatum = pardus = piuræ,* and p. 229, *Pygidium poeyanum,* and p. 242, *Cyclopium chimborazoi.*

Garman, Samuel W.

1877. On the Pelvis and External Sexual Organs of Selachians. *Proceedings Boston Society Natural History,* XIX, pp. 210.

Deals in part with *Potamotrygon.*

1895. The Cyprinodonts. *Memoirs Museum Comparative Zoölogy,* XIX, No. 1, 1895, pp. 5–179, plates I–XII.

A monograph of all the American Cyprinodontidæ.

1913. The Plagiostomia (Sharks, Skates, and Rays). *Memoirs Museum Comparative Zoölogy,* XXXVI, 1913, pp. 1–515. 77 plates.

Considers among others *Potamotrygon magdalenæ.*

GILL, THEODORE.

1861. The Fishes. Letter to Arthur Schott, Dated: Smithsonian Institution, Washington, D. C., January 14, 1861, in *Senate 36th Congress, 2d Session, Ex. Doc.* No. 9, pp. 257–259, 1861.

Contains a list of genera collected during a "Survey for an interoceanic ship-canal near the Isthmus of Darien." (*Ctenolucinus,* err. typ.)

Catalogue of the Fishes of the Eastern Coast of North America, etc. *Supplement Proc. Acad. Nat. Sci. Phila.,* XIII, 1861, p. 8.

Describes genus *Ctenolucius* Gill.

1863. Descriptive enumeration of a collection of fishes from the Western Coast of Central America, Presented to the Smithsonian Institution, by Capt. John M. Dow. *Proceedings Academy Natural Sciences of Philadelphia,* 1863, pp. 162–174.

1876. Notes on Fishes from the Isthmus of Panama, Collected by Dr. J. F. Bransford, U. S. N. *Proceedings Academy Natural Sciences of Philadelphia,* 1876, pp. 335–339.

Describes as new: *Platypœcilus mentalis* = *Mollienisia sphenops; Piabucina panamensis; Rhamdia bransfordii* = *Rhamdia wagneri; Loricaria bransfordii* = *Loricaria uracantha.*

GRANT, WILLIAM ROBERT OGILVIE.

1884. A Revision of the Fishes of the Genera *Sicydium* and *Lentipes,* with Descriptions of Five New Species. *Proceedings Zoölogical Society London,* 1884, pp. 153–172, pls.

Describes *Sicydium salvini.*

GÜNTHER, ALBERT.

1859. List of Cold-blooded Vertebrata Collected by Mr. Fraser in the Andes of Western Ecuador. *Proceedings Zoölogical Society London,* 1859, pp. 89–93.

Describes *Arges brachycephalus* and *Leporinus mülleri.*

1859. Second List of Cold-blooded Vertebrata Collected by Mr. Fraser in the Andes of Western Ecuador. *Proceedings Zoölogical Society London,* 1859, pp. 402–420, pl. 2.

Describes *Chromis rivulata, Anodus troschelii, Prochilodus humeralis, Chalceus alburnus, Chalceus brevirostris.*

1860. Third List of Cold-blooded Vertebrata Collected by Mr. Fraser in Ecuador. *Proceedings Zoölogical Society of London*, 1860, pp. 233–234, pl. 10.

Describes *Pimelodus cinerascens, P. elongatus, P. modestus, Brycon dentex.*

1864. On Some New Species of Central American Fishes. *Proceedings Zoölogical Society of London*, 1864, pp. 23–27, pls. 3 & 4; *Annals and Magazine Natural History*, (3), XIV, pp. 227–232.

1868. An Account of the Fishes of the States of Central America based on Collections made by Capt. J. M. Dow, F. Godman, Esq., and O. Salvin, Esq. *Transactions Zoölogical Society London*, VI, 1868, pp. 377–494, pls. 63–87. Read March 22, 1864, and December 13, 1866.

A general account of all of the fishes from Panama to Mexico.

Henn, Arthur.

1916. On Various South American Pœciliid Fishes. *Annals Carnegie Museum*, X, 1916, pp. 93–142, plates XVIII–XXI.

Describes and figures species from the present area. The new species are: *Rivulus magdalenæ, Gambusia caliensis, Diphyacantha chocoënsis, Neoheterandria elegans.*

Holton, Isaac F.

1857. "New Granada: Twenty Months in the Andes." New York, Harper Bros.

Very good general account and record of travel.

Humboldt, A. von.

1811. Mémoire sur l'Erémophilus et l'Astroblepus, deux nouveaux genres de l'Ordre des Apodes. Recueil d'Observations de Zoölogie et d'Anatomie, I, pp. 17–20, pls. VI and VII. Originally published in 1805.

1811a. Mémoire sur une Nouvelle Espèce de Gymnote de la Rivière de la Madelaine, *ibid.*, I, 46–48, pl. X. Originally published in 1807.

Humboldt, A. von, and Valenciennes, A.

1833. Recherches sur les Poissons Fluviatiles de l'Amérique Equinoxiale. *Recueil d'Observations de Zoölogie et d'Anatomie Comparée, ibid.*, II, pp. 141–216, originally published in 1817.

Johnson, R. D. O.

1912. Notes on the Habits of a Climbing Catfish (*Arges marmoratus*) from the Republic of Colombia. *Annals New York Academy of Sciences*, XXII, pp. 327–333.

Excellent account of the habits.

Jordan, David Starr, and Evermann, Barton Warren.

1896–1900. The Fishes of North and Middle America. *Bulletin U. S. National Museum*, No. 47, part I, 1896, part II, 1898, part III and part IV, 1900.

KNER, RUDOLPH, AND STEINDACHNER, FRANZ.

1864. Neue Gattungen und Arten von Fischen aus Central-Amerika. *Abhandlungen der Bayer. Akademie der Wissenschaften,* II Kl., Bd. X., Abth. I, 1864, pp. 1–59, 6 plates.

Describes *Heros altifrons, H. sieboldii, Acara cæruleopunctata, Eleotris pictus, Engraulis macrolepidotus, E. poeyi, Xiphophorus gilli, Saccodon wagneri* gen. et sp. nov., *Pseudochalceus lineatus* gen. et sp. nov., *Chalcinopsis striatulus* gen. et sp. nov., *Chalcinopsis chagrensis, Chalceus atrocaudatus, Bagrus arioides, Trichomycterus tænia, T. laticeps, Loricaria uracantha.*

MEEK, SETH E., AND HILDEBRAND, SAMUEL F.

1912. Descriptions of New Fishes from Panama. *Field Museum Natural History, Publication 158, Zoölogical Series,* Vol. X, No. 6, pp. 67–68.

Describes *Astyanax grandis* = *A. fasciatus* (Cuv.), *Hemigrammus minutus* = *Hyphessobrycon panamensis* Durbin, *Deuterodon atrocaudata* = *Gephyrocharax atrocaudata; Creagrutus notropoides, Eleotris latifasciatus.*

1913. New Species of Fishes from Panama. *Field Museum of Natural History, Publication 166, Zoölogical Series,* Vol. X, No. 8, pp. 77–91.

Describes twenty-six new species.

1916. The Fishes of the Freshwaters of Panama. *Field Museum of Natural History, Publication 191, Zoölogical Series,* X, No. 15, pp. 217–374.

A monograph of the fresh-water fishes of Panama.

PELLEGRIN, JACQUES.

1904. Contribution a l'étude anatomique, biologique, et taxonomique des Poissons de la famille des Cichlidés. *Mémoires de la Société Zoölogique de France,* XVI, 1904, pp. 41–402, pls. 4–7.

1907. Characidinidés Américains Nouveaux de la Collection du Museum d'Histoire Naturelle. *Bull. Museum d'Hist. Nat.,* XIII, 1907, pp. 25–27.

Describes *Tetragonopterus* (*Astyanax*) *riveti.*

1909. Mission Géodésique de l'Equateur. Collections Recueillies par M. le Dr. Rivet. Description de Deux Poissons Nouveaux de la Famille de Loricariidés. *Bull. Mus. d'hist. natur. Paris,* XV, 1909, pp. 517–519.

Describes *Chætostomus æquinoctialis* and *Arges regani.*

1912. Poissons de l'Equateur, Recueillis par M. le Dr. Rivet. *Mission Géodésique de l'Equateur* IX; Pt. B., pp. 1–15.

PETRE, LORAINE F.

1906. "The Republic of Colombia." London, Edward Stanford.

POSADA, ANDRES.

1909. Estudios Cientificos. Medellin, Colombia, 1909, pp. 1–432.

Gives a general account of the fishes of Colombia on pp. 283–322, and

describes *Ichthyoëlephas patalo* gen. et sp. nov., and twelve other new species. All have been disregarded in the foregoing memoir, as only one or two are possibly valid, and none can be positively identified without material taken at Medellin.

Regan, C. Tate.

1903. Descriptions of New South American Fishes in the Collection of the British Museum. *Annals and Magazine Natural History*, (7), XII, pp. 621–630.
Records *Trichomycterus retropinnis* sp. nov., St. Augustine.

1904. A Monograph of the Fishes of the Family Loricariidæ. *Transactions Zoölogical Society London*, XVII, part III, Oct. 1904, pp. 191–324, plates IX–XXI.

1905. The Systematic Arrangement of the Fishes of the Genus *Arges*. *Annals and Magazine Natural History*, (7), XV, June 1905, pp. 529–534.
A reply to the paper of Evermann & Kendall, 1905.

1905*a*. A Revision of the Fishes of the South American Cichlid Genera *Crenacara*, *Batrachops*, and *Crenicichla*. *Proceedings of the Zoölogical Society of London*, pp. 152–168, plates XIV, XV.
Records *Crenicichla geayi* Pellegrin, p. 161, from near Bogotá.

1905*b*. A Revision of the Fishes of the American Cichlid Genus *Cichlasoma* and of the Allied Genera. *Annals and Magazine of Natural History*, (7) XVI, 1905, pp. 60–77, 225–243, 316–340, and 433–445.

1905*c*. A Revision of the Fishes of the South American Cichlid Genera *Acara*, *Nannacara*, *Acaropsis*, and *Astronotus*. *Annals and Magazine of Natural History*, (7) XV, pp. 329–347.
Records *Acara cæruleopunctata* Kner and Steindachner from the Chagres.

1905*d*. A Revision of the Fishes of the American Cichlid Genus *Cichlasoma* and of the Allied Genera. *Annals and Magazine of Natural History*, (7) XVI, pp. 225–243 and 316–340.
Records *Cichlasoma maculicauda* sp. nov., p. 227, from the Chagres.
Cichlasoma sieboldii (Kner and Steind.), p. 235.
Cichlasoma kraussi Steind., p. 339, from Barranquilla.
Cichlasoma altifrons (Kner and Steind.), p. 242.

1906. A Revision of the South American Cichlid Genera *Retroculus*, *Geophagus*, *Heterogramma*, and *Biotœcus*. *Annals and Magazine of Natural History*, (7) XVII, pp. 49–66.
Geophagus crassilabris Steind., Panama.

1906*a*. Notes on Some Loricariid Fishes, with Descriptions of Two New Species. *Annals and Magazine of Natural History*, (7) XVII, pp. 94–98.
Describes *Plecostomus tenuicauda* Steind.

1907. Descriptions of New Loricariid Fishes from South America. *Proceedings of the Zoölogical Society of London*, pp. 795–800, plates XLII–XLIX.

Describes *Arges heterodon* sp. nov., p. 800, plate XLVIII, fig. 2, Jiminez, Western Colombia.

1907*a*. Descriptions of Two New Characinid Fishes from South America. *Annals and Magazine of Natural History*, (7) XX, p. 402.

Describes *Ctenocharax bogotensis* sp. nov. from Bogota = *Grundulus bogotensis* (Humboldt).

1907–1908. Pisces. *Biologia Centrali-Americana*, pp. 1–203.

A general account with maps and plates of the fresh-water fishes between Panama and Mexico.

1912*a*. Descriptions of New Cichlid Fishes from South America in the British Museum. *Annals and Magazine of Natural History*, (8) IX, pp. 505–507.

Describes *Geophagus pellegrini* sp. nov., Tado, Rio San Juan; *Geophagus hondæ* sp. nov., = *G. steindachneri* Eigenmann & Hildebrand, Honda; *Cichlasoma* (*Parapetenia*) *atromaculatum* sp. nov., Tado, Rio San Juan.

1912*b*. A Revision of the South American Siluroid Fishes of the Genus *Corydoras*, with a List of the Specimens in the British Museum (Natural History).

Describes *Corydoras melanotænia* sp. nov., Honda.

1912*c*. A Revision of the South American Characid Fishes of the Genera *Chalceus*, *Pyrrhulina*, *Copeina*, and *Pogonocharax*. *Annals and Magazine of Natural History*, (8) X, pp. 387–395.

Mentions *Copeina eigenmanni* sp. nov. from Bogotá. *Pyrrhulina semifasciata* Steind., Honda and Bogotá.*

1912*d*. A Revision of the Pœciliid Fishes of the Genera *Rivulus*, *Pterolebias*, and *Cynolebias*. *Annals and Magazine of Natural History*, (8) X, pp. 494–508.

Describes *Rivulus elegans* Steind., p. 498; *Rivulus brevis* n. sp., p. 504.

1912. Descriptions of New Fishes of the Family Loricariidæ in the British Museum. *Proceedings Zoölogical Society London*, 1912, pp. 666–670, plates LXXV–LXXVII.

Describes *Plecostomus hondæ* = *Cheiridodus* gen. nov., *Chætostomus palmeri* = *fischeri*, *Ch. paucispinis* = *fischeri*, *Oxyloricaria tamanæ*, *O. leightoni*, *Arges cirratus*.

1913. Fishes of Peru, Collected by Dr. H. O. Forbes. *Annals and Magazine of Natural History*, (8), XII, 1913, pp. 278–280.

Mentions *Lebiasina bimaculata*, *Tetragonopterus microphthalmus* and

* The locality Bogotá is erroneous. The specimens probably came from the base of the Eastern Cordillera.

Tetragonopterus simus from Pacasmayo, the latter two probably = *Bryconamericus peruanus.*

1913. The Fishes of the San Juan River, Colombia. *Annals and Magazine of Natural History,* (8) XII, Nov. 1913, pp. 462–473.

Enumerates fifty-five species of which all but five are in the British Museum. The following are described as new: *Brycon oligolepis, Creagrutus leuciscus = affinis, Xenurocharax spurrelli = Argopleura chocoënsis, Bryconamericus rubricauda = ortholepis, B. juanensis = scopiferus, Hyphessobrycon condotensis = panamensis, Pimelodella eutænia, Nannorhamdia* (gen. nov.) *spurrelli, Pseudopimelodus transmontanus, Pygidium unicolor, P. spilosoma, Hemiancistrus holostictus, Ancistrus centrolepis, Gambusia caudovittata = Priapichthys nigroventralis, Cichlasoma biseriatum.*

1914. Fishes from the Condoto River, Colombia, Collected by Dr. H. G. F. Spurrell. *Annals and Magazine of Natural History,* (8) XIV, July 1914, pp. 31–33.

Describes *Sternarchus spurrellii, Hypopomus occidentalis, Sicydium condotense.*

1916. A New Loricariid Fish of the Genus *Cyclopium* from Ecuador. *Annals and Magazine of Natural History,* (8), XVIII, p. 80.

Describes *Cyclopium mindoënse.*

Scruggs, William L.

1905. "The Colombian and Venezuelan Republics with Notes on Other Parts of Central and South America." Boston, Little, Brown, and Company.

Describes parts of the Magdalena Basin.

Starks, Edwin Chapin.

1906. On a Collection of Fishes Made by P. O. Simons in Ecuador and Peru. *Proceedings U. S. National Museum,* XXX, 1906, pp. 761–800, pls. 65–66.

Records fishes from Guayaquil, Eten, Paita, Callao.

Steindachner, Franz.

1878. Zur Fisch-Fauna des Magdalenen-Stromes. *Denkschriften d. Kaiserlichen Akademie der Wissenschaften Wien,* XXXIX, pp. 19–78, Taf. I–XV.

Report on a collection of over two hundred fishes from cienegas at the mouth of the Magdalena, consisting of thirty species, of which sixteen or seventeen were new.

1879. Ichthyologische Beiträge, VIII, *Sitzb. K. Akademie Wiss. Wien,* I. Abth. Juli, 1879.

Recording six new species from the Cauca River.

1879. Über Einige Neue und Seltene Fisch-Arten aus den K. K. Zoölogischen Museen zu Wien, Stuttgart, u. Warschau. *Denkschriften Kaiserlichen Akademie der Wissenschaften Wien,* XLI, pp. 20–72.

Contains figures of *Loricaria magdalenæ* (Tafel VII, figs. 2–3).

1879. Beiträge zur Kenntniss der Flussfische Südamerika's. *Denkschriften Kaiserlichen Akademie der Wissenschaften Wien*, XLI, 1879, pp. 151–172.

Contains an account of sixteen species of fishes of the Mamoni River at Chepo and of three species from Northwestern Peru. *Tetragonopterus branickii* = *T. peruvianus*, *Lebiasina bimaculata*.

1880. Zur Fisch-Fauna des Cauca und der Flüsse bei Guayaquil, *ibid.*, XLII, pp. 55–104, Taf. I–IX.

Report on forty-seven species of fresh-water fishes from the Cauca and its tributaries at Caceres. Among them five new species. Enumeration of seventy valid species from the Magdalena. Notes on twelve species from Guayaquil. Three new species.

1902. Herpetologische und Ichthyologische Ergebnisse einer Reise nach Südamerika. *Denkschriften Kaiserlichen Akademie der Wissenschaften Wien*, LXII, pp. 89–148, Taf. I–V.

Reports on ninety-two species of fishes collected between Barranquilla and Honda, at Ibagué and Bogotá, between Guayaquil and Chimborazo, at Lima, Arequipa, and Pacasmayo.

THOMINOT, ALEX.

1882. Sur un Saccodon d'espèce nouvelle venant de l'Equateur. *Bulletin Société Philomathique de Paris*, (7), VI, 1882, pp. 248–251.

Describes *Saccodon craniocephalum*.

VAILLANT, LEON.

1897. Contribution a l'étude ichthyologique du Chagres. *Bulletin Museum d'Histoire Naturelle*, III, pp. 220–223.

Compares the Chagres and Chepo faunas.

VALENCIENNES, ACHILLE.

1833. Nouvelles Observations sur le Capitan de Bogota. *Recueil d'Observations de Zoölogie et d'Anatomie Comparée*, II, p. 341.

WAGNER, MORITZ.

1864. Über die hydrographischen Verhältnisse und das Vorkommen der Süsswasserfische in den Staaten Parama und Ecuador. *Abhandlungen der K. bayer. Akademie der Wissenschaften*, II Cl., Bd. X, Abth. 1. pp. 1–49.

ADDENDA.

DRIVER, CHARLES.

1919. On the Luciopimelodinæ, a New Subfamily of the South American Siluridæ. *Proc. Am. Phil. Soc.*, LVIII, pp. 448–456.

Transfers *Megaloncma xanthum* to the genus *Perugia* of the *Luciopimelodinæ*.

EIGENMANN, C. H.

1922. The Nature and Origin of the Fishes of the Pacific Slopes of Ecuador, Peru, and Chili. *Proc. Am. Phil. Soc.*, LX, pp. 503–523.

Contends that the fishes of the western slopes were segregated by the formation of the Andes before the life-time of the present species.

APPENDIX III.

GAZETTEER AND INDEX OF LOCALITIES.

I have endeavored in the following pages to give all the localities from which fishes have been recorded within the territory covered by the preceding paper. Where possible, I have given the elevation above sea-level. In the higher altitudes these are frequently only approximations.

I have not been able to find on any of the maps accessible to me the names of a number of small quebradas (brooks), especially in the Province of Santander, and the spelling of their names is also a matter of doubt. I only know some of these localities from the labels furnished me by Señor Manuel Gonzales, who collected for me within several days' journey east, west, and north of Bogotá. The labels which were received from him were frequently torn, faintly written, or otherwise not clearly legible.

The numbers under each locality are those of the species given in serial order in the main body of the preceding memoir. The letter "A" is prefixed to all the numbers, which occur in Appendix I, which deals with the fishes of the Rio Meta. These numbers constitute an index to the species taken at each of the localities mentioned.

Abacon, Rio. Panama.

296.

Abirregas, Rio. Maracaibo Basin, near Merida, Venezuela.

Agua Clara. Town and river emptying into R. Trinidad, into the Chagres. Panama.

161; 166; 188; 245.

Agua Larga, west of Bogotá, now called Alban. (7,258 ft.)

44.

Alausi. River and town in the interandean park of the same name. Chanchan Basin. Directly east of Guayaquil, Ecuador. (9,400 ft.)

48 = *Astroblepus grixalvii* Humboldt.

Alban, Quebrada. Between Honda and Facatativa. Near top of divide on the Magdalena side. Colombia. (7,258 ft.)

38; 49; 51; 78; 107; 207; 214.

Alhajuela. On Limon Creek, upper Chagres, Panama.

254; 295; 342.

Altacar. Tributary of the R. Telembi, Colombia.

192; 200.

Ambalema. Town on the Magdalena above Honda, Colombia. (782 feet.)

Ambato, Ecuador. Town in the interandean park Latacunga, the drainage of which is into the Amazon.

Ancuya. On Rio Guaitara, highlands of western Colombia. Patia Basin. (5,000 ft.)
51 = *Astroblepus chotæ* (Regan).

Angel, El. In the highland park of Ibarra in northern Ecuador. Mira Basin. (10,000 ft.)
48 = *Astroblepus grixalvii* (Humboldt).

Apulo. Juntas de Apulo on the railway between Girardot and Facatativa. (1,500 ft.)
3; 13; 27; 28; 30; 57; 86; 103; 120; 122; 146; 194; 197; 201; 207; 247; 252; 253; 261; 262; 265; 267; 269; 273; 274; 339; 358.

Araijan. Pacific side of Panama, a short distance north of the Canal Zone.
161; 285; 289.

Arequipa. Town in southern Peru.
69; 70; 324.

Arguello, Quebrada. Santander, Colombia.
51.

Aruza, Rio. Tributary of the Tuyra, Darien, Panama.
166; 176; 218; 297.

Baipe, Rio. Boyaca, Colombia.
51 = *Astroblepus chotæ* (Regan); 100 = *Pseudancistrus carnegiei* (Eigenmann.)

Banco, El. City on the Rio Magdalena at the mouth of the Rio Cesar, Colombia.
10; 27; 32; 33; 94; 247; 253.

Barbacoas. Town near the mouth of the Rio Telembi, tributary of the Rio Patia, S. W. Colombia. (72 ft.)
26; 90; 115; 131; 172; 177; 192; 200; 257; 269; 309; 322; 352; 365; 379.

Barranca Alta. River near and parallel to the Rio Chanchan, southern Ecuador.
134; 135; 145; 158; 170; 171; 180.

Barrancas. On Rio Lebrija, a tributary of the lower Magdalena, Colombia.
183.

Barranquilla. Near the mouth of the Rio Magdalena. Including the species about the mouth of the Magdalena.
3; 9; 17; 30; 32; 33; 37; 86; 94; 114; 116; 133; 136; 146; 150; 151; 153; 179; 183; 247; 252; 259; 260; 262; 267; 269; 283; 297; 312; 313; 315; 328; 329; 330; 338; 343; 357.

Barrigón. Hamlet at the head of navigation in the Rio Meta, east of Bogotá. Intendencia del Meta, Colombia.
99; 205; 265; A6; A7; A8; A10; A11; A15; A17; A18; A19; A24; A25; A29; A30; A31; A32; A34; A35; A36; A37; A38; A39; A42; A45; A46; A49; A51; A55; A57; A58; A59; A60.

Bayano, Rio. River emptying into the Pacific south of Panama City. (*See* Rios Chepo and Mamoni).
281; 282; 332.

Beltran. Town on the Rio Magdalena opposite Ambalema, Colombia. *Salminus* is abundant here according to the reports of sportsmen.

Bernal Creek. Small creek near Honda, Colombia.
24; 27; 95; 121; 126; 185; 207; 244; 253; 262; 265; 339.

Blanco, Rio. Stream from crest of Cordillera east of Bogotá, Colombia.
A10; A21.

Boca de Certegui. Station on the Rio Pablo near the mouth of a tributary of the Rio Certegui, Colombia, Atrato Basin.
20; 24; 28; 117; 121; 122; 123; 133; 151; 154; 165; 169; 188; 193; 201; 208; 215; 258; 269; 309; 341; 358.

Boca de Cupe. A town on the Tuyra at the mouth of the Rio Cupe, Darien, Panama.
97; 117; 123; 127; 181; 208; 349; 355.

Boca del Guineo. Rio Calima, flowing into the lower San Juan, Colombia.
130; 161; 267; 270; 305; 345; 366.

Boca de Raspadura. A hamlet at the mouth of the Rio Raspadura near Istmina, Colombia. Atrato Basin. (*See* Raspadura.)

Bodega Central. Town on the Magdalena near the mouth of the Lebrija.
3; 125; A17.

Bogotá. Capital of Colombia, and name of river draining the plains of Bogotá. (*See* Rio Funza.)
67; 81; 164.

Boqueron, Rio. Atlantic side of the Canal Zone, Panama.
254.

Boquilla. Small hamlet west of Salento, at the western base of the Quindio Pass. Drains into the Rio Viejo, into the Cauca.
15; 40; 51; 61; 203; 223; 230; 301.

Bucay. On a tributary of the Rio Chimbo, Ecuador.
148; 162; 171; 346.

Buenaventura. A town on the western coast of Colombia at the mouth of the Rio Dagua.
6; 278; 279; 280; 294; 309; 325; 326; 333; 334; 360; 365; 367; 376; 377.

Buenavista. Town on the Rio Magdalena below La Dorada, Colombia.
28; 123; 153; 185; 196; 201; 253.

Cabarachia, Quebrada. Province of Santander, Colombia. Should possibly read Cabarachior.
49; 68.

Cachabé. A small village on the river of that name, Province of Esmeraldas, Ecuador. 1° N. 81° W. on Map of Wolf. (500 ft.)

Caceres. Town on the Cauca, one hundred and fifty-nine miles from its mouth. (660 ft.)
3; 10; 17; 27; 30; 31; 32; 33; 36; 37; 83; 86; 94; 103; 116; 133; 136; 144; 146; 147; 149; 153; 174; 179; 183; 191; 208; 247; 250; 252; 259; 261; 262; 265; 267; 269; 270; 297; 300; 338; 339; 343; 357.

Caiman. Hamlet on Cienega of Barranquilla, Colombia. (*See* the list for Barranquilla.)

Calamar. Town on the Magdalena, east of Cartagena. (72 ft.)
28; 30; 31; 36; 83; 86; 114; 116; 133; 136; 146; 153; 179; 185; 188; 196; 201; 247; 252; 253; 262; 265; 267; 269; 297.

Calamar Cienega, or Cienega del Cerro, east of the Rio Magdalena north of Calamar.
83; 133; 136; 146; 153; 185; 188; 196; 247; 252; 259; 283; 343; 357; 380.

Caldas. A town on the upper Rio Dagua emptying into the Pacific at Buenaventura, Colombia. (3,722 ft.)
16; 26; 42; 44; 46; 61; 98; 172; 175; 177; 320.

Cali. A town on the Rio Grande, an affluent of the upper Cauca.
20; 27; 57; 63; 126; 138; 154; 155; 175; 186; 198; 201; 204; 210; 216; 223; 233; 242; 243; 255; 267; 269; 273; 287.

Calima, Rio. A tributary of the lower Rio San Juan, Colombia.
16; 64; 130; 159; 161; 172; 177; 188; 200; 220; 221; 242; 249; 263; 265; 266; 267; 270; 272; 288; 305; 345; 351; 365; 366; 367; 379.

Callao. Port in Peru.
6; 73; 158.

Callejona, Quebrada de la. Santander, Colombia.
45.

Calobre, Rio. Bayano Basin, Panama.
111; 123; 133; 161; 167; 263; 355.

Cana. On the Rio Satigante, Tuyra Basin, Panama. See also Rio Grande.
52; 97; 102; 176; 218; 273; 290.

Candeleria. Isthmus of Panama.
340.

Caño Carneceria. A stream northwest of Cumaral. Llanos east of Bogotá, Colombia. See Carneceria.

Capeti Rio. Tuyra Basin. Panama.
119; 121.

Capitan, El. On Rio Mamoni, Panama.
249; 379.

Capitanejo, Quebrada. Santander, Colombia. Twenty-five miles east of Mogotes on the Rio Chicamocha. 6° 18′ 40″ N. 1° 0′ E. of Bogotá.
68 = *Pygidium nigromaculatum* (Boulenger).

Caqueta, Rio. Tributary of the Cauca, near Cali, Colombia.
128.

Caqueza. Between Bogotá and Villavicencio, thirty miles from Bogotá, Colombia. Elevation of the bridge of the Caqueza 5,300 ft.
A21; A22.

Cardenas, Rio. Pacific side of Canal Zone.
245.

Cargueirazo or Caraguairazo or Carchuairazo. Volcano in Chimbo Basin, Ecuador.
43 = *Astroblepus cyclopus* (Humboldt).

Cariyacu, Rio. Tributary of the Rio Angel (10,230 feet), Ecuador.
48 = *Astroblepus grixalvii* (Humboldt).

Carneceria. Caño in the llanos east of Bogotá, Intendencia del Meta, Colombia.
51; A23; A40; A41; A42; A47; A59; A60.

Cartagena. Port on north coast of Colombia.
296; 359.

Cartago. Town on the Rio Viejo about six miles from the Rio Cauca.
27; 95; 126; 138; 155; 175; 198; 201; 204; 206; 210; 216; 223; 243; 255; 267; 269; 273.

Casapalca. Smelter and town on the upper Rimac, Peru. *Orestias elegans* in the lakes above and west of Casapalca.

Cascajal, Rio. Atlantic side of Panama at Porto Bello.
219; 285; 296; 317.

Castigo. *See* Rio Guaitara.
175; 177.

Cauca, Rio. The largest tributary of the Rio Magdalena. Probably the oldest river of Colombia.

Cayambe. Town in the interandean park of Quito, Ecuador, Esmeraldas Basin. 0° 2′ N. (9,000-9,500 ft.)
48 = *Astroblepus grixalvii* (Humboldt).

Cerro Azul. Pacific side of Panama.
161.

Certegui. Quito Basin of the upper Atrato Basin, Colombia. (*See* Boca de Certegui.)

Chagres, Rio. Into the Atlantic near Colon, Panama.

Chame, Rio. Point and town about twenty-five miles north of Panama City.
16; 246; 264; 289; 293; 342; 379.

Chamisal, Quebrada. Between Honda and Facatativa, Colombia.
51; 78; 301.

Chanchan, Rio. Tributary of the Rio Chimbo, emptying into the Rio Guayas, Ecuador. Reached from station of Naranjito.
18; 43; 135; 158; 190; 225; 238; 264; 354; 365; 379.

Charala, Quebrada. Santander, south of Mogotes, Colombia.
45 = *Astroblepus santanderensis* (Eigenmann); 67 = *Pygidium bogotense* (Eigenmann).

Chepo. Town on the Rio Mamoni or Chepo, near head of tide. Panama.
16; 24; 104; 122; 123; 249; 264; 269; 349; 383.

Chiguancay. Tributary of the Rio Chanchan, southern Ecuador.
43 = *Astroblepus cyclopus* (Humboldt).

Chillo. Ecuador. (8,500 ft.)
48 = *Astroblepus grixalvii* (Humboldt).

Chimbe, or Chimbi? Quebrada de Santander, Colombia.
44 = *Astroblepus unifasciatus* (Eig.); 51 = *Astroblepus chotæ* (Regan).

Chimbi, Quebrada. Between Honda and Facatativa, near Alban, Colombia.
38 = *Astroblepus homodon* (Regan).

Chimbo, Rio. Emptying into the Guayas near Guayaquil, Ecuador. (Between 700 and 800 ft.)
48; 105; 148; 162; 171; 238; 346.

Chipaque. Seventeen miles southeast from Bogotá. (7,900 ft.; 9,000–9,500 ft. according to Chapman.)

Chiquinquira. City and river near southern boundary of Boyaca, Colombia. (8,480 ft.)
81 = *Eremophilus mutisii*, otherwise confined to the Plain of Bogotá.

Chiquinquiseto, Rio. Province Boyaca, Colombia.
164 = *Grundulus bogotensis* otherwise confined to the Plain of Bogotá.

Chirajara, Quebrada. Between Bogotá and Villavicencio, Colombia. (*See* Hirajara.)

Chirimoto. Town in northern Peru, on the Rio Totora. Atlantic drainage.
51; 52.

Chiriqui. District in western Veragua, Panama.
356.

Choachi. Town east of Bogotá on Atlantic side of crest, Colombia.
48; 51; A23.

Choco. The region of the San Juan and the Atrato, Colombia.

Chone. Town on river of the same name near the coast east of Colimes, Ecuador. Near 1° south latitude.
22; 158; 190; 212; 238; 264; 279; 310; 346; 360; 361; 384; 385.

Chorrerra, Rio. Town and small stream emptying into the Pacific north of the Panama Canal.
16; 112; 133; 176; 181; 200; 249; 264; 366; 370.

Chosica. Town on the Rio Rimac above Lima, Peru.
71; 158; 224; 324.

Chota, Rio. Below Paramba, Ecuador. (2,600 ft.)
51 = *Astroblepus chotæ* (Regan).

Chota, Valley. Northern Ecuador.
217 = *Bryconamericus simus* (Boulenger).

Cincinnati. Twenty miles from Santa Marta, Colombia. (4,500 ft.)
67.

Cisnero, or Juntas. A town on the Rio Dagua, Colombia. (1,046 ft.)
16; 26; 42; 53; 98; 175; 177; 221; 353; 373.
Cituro. Rio Cupe, Tuyra Basin, Panama.
104; 127; 141; 176; 208; 256; 297; 358.
Cobarachior (ia?), Quebrada. Santander. (*See* Cabarachior.)
Coello, Rio. Western tributary emptying into the Magdalena near Girardot, Colombia.
Colimes. On the Rio Daule, Ecuador. North of Guayaquil.
7; 18; 85; 134; 135; 139; 145; 158; 170; 173; 190; 212; 225; 264; 346; 365; 385.
Colon. Port at the Atlantic end of the Panama Canal.
182; 284; 295; 368.
Condoto, Rio. An upper, eastern tributary of the Rio San Juan, Colombia.
11; 16; 19; 26; 66; 91; 104; 105; 109; 110; 115; 122; 123; 124; 151; 159; 172; 177; 188; 200; 201; 208; 215; 220; 221; 235; 236; 242; 265; 266; 267; 271; 275; 276; 288; 300; 319; 322; 332; 343; 345; 351; 353; 375; 379.
Cordova. A town on the Rio Dagua, Colombia. (120 ft.)
16; 21; 75; 130; 177; 199; 200; 221; 267; 272; 332; 365.
Corozal. Pacific side of the Panama Canal Zone.
Costa Rica. State north of Panama.
181; 218; 238; 254; 366; 374.
Cotopaxi. Volcano south of Quito, Ecuador.
43 = *Astroblepus cyclopus* (Humboldt); 48 = *Astroblepus grixalvii* (Humboldt).
Cramalote, Quebrada. Brook at Villavicencio, east of Bogotá, Colombia. (1,496 ft.)
99; A1; A3; A8; A10; A11; A12; A13; A14; A15; A19; A22; A29; A30; A32; A42; A45; A46; A49; A51; A55; A59.
Cristalina, Quebrada. Twenty-eight kilometers above Puerto Berrio, Colombia. Elevation 1,000 feet.
51; 60; 301.
Cruz Verde, Paramo de. Southeast of Bogotá, Colombia. (9,900 ft.)
76 = *Pygidium venulosum* Steindachner.
Cucurrupi. Tributary of the Rio San Juan, Colombia.
200; 257; 365.
Cuenca. Town on the interandean park of the same name draining into the Amazon, Ecuador.
48 = *Astroblepus grixalvii* (Humboldt).
Culebra. On the Panama Canal. Sometimes on Atlantic side and sometimes on Pacific side.
161; 300.
Cultambo. Station on the Jequetepeque near Pacasmayo, Peru.
72; 158; 171; 224; 346; 365.

Cumaral. Hamlet and llanos northeast of Villavicencio. Intendencia del Meta, Colombia. (1,320 ft.)
126; A16; A27; A28; A32; A42; A52; A53; A54; A58; A59; A60.

Cundinamarca. Province in Colombia.

Cupe, Rio. A tributary of the Rio Tuyra, Darien, Panama.
104; 141; 165; 176; 208; 256; 291; 355; 358.

Dagua, Rio. Western Colombia. (*See* Buenaventura, Caldas, and Cisnero).

Daule, Rio. Forming with the Rio Vinces the Rio Guayas, Ecuador. (*See* Colimes.)

Densino, Quebrada da. Santander, Colombia.
49; 65.

Ducho, Rio de. Santander.
44; 49; 51.

Durango, Rio. Northwest Ecuador. (Into the Esmeraldas?) (350 ft., *fide* Rosenberg.)
11; 90; 105; 115.

Ecuador, Western (without more exact designation).
142; 184; 226; 231.

Empire, or Emperador. Station near Culebra in the Canal Zone, Atlantic side.
161; 218.

Encontradas, Lake Maracaibo, Venezuela.
133.

Esmeraldas. River in northwestern Ecuador, draining the area about Quito.
18; 158; 173.

Esperanza. Station near Tequendama on the plains of Bogotá, Colombia.
164.

Eten. Coast town in northern Peru.
23; 171.

Fosca, Rio del. Southeast of Bogotá, a short distance east of the crest of the Cordillera Oriental, Colombia. (4,500 ft.)
49; 52; 98; A9; A15; A21; A22.

Frijoles, Rio. Town and tributary of the middle Rio Chagres, Panama.
112; 161; 200; 340.

Fundación. South of Santa Marta, Colombia.
16; 123; 168; 195; 262; 297; 339; 343.

Funza, or Bogotá, Rio. River draining the plains of Bogotá.
67; 81; 164.

Gaira, Rio. At Gaira, Santa Marta, Colombia.
276; 277; 362.

Gatun, Rio. Town and tributary of the lower Chagres, Panama.
16; 87; 112; 113; 166; 167; 178; 182; 200; 245; 264; 342; 348; 378.

Girardot. Town on the Magdalena at end of the railway from Facatativa, Colombia. (1,089 ft.)

5; 13; 20; 24; 28; 57; 103; 104; 118; 120; 122; 126; 136; 146; 194; 196; 201; 207; 216; 247; 248; 253; 261; 262; 269; 273; 274.

Gorgona. Near Culebra, Canal Zone, Chagres Basin, Panama.
161; 166; 285; 323.

Grande, Rio. Emptying into the Pacific near Panama City.
87; 293; 372.

Grande de Térraba, Rio. Costa Rica.

Grande, Rio. Tuyra Basin near Cana, Panama. (*See* also Cana.)
97; 273.

Guadalupe. Santander, Colombia. 6° 2′ 30″ N. 0° 20′ 42″ east of Bogotá. (5,400 ft.)
45.

Guadrigua, Rio. Eastern slope east of Bogotá. Exact location not known.
205; A49; A50.

Guaduas, Rio. City between Honda and Facatativa, Colombia. (3,323 ft.)
38; 44; 51; 60; 74?; 78; 100; 307.

Guaitara, Rio. Tributary of the upper Patia. Southwestern Colombia.
22; 175; 177; 200; 222; 228; 257.

Guali, Rio. Western tributary emptying into the Magdalena at Honda, Colombia.

Guallupi. Opposite Lachis on the Rio Mira, Ecuador. (5,000 ft.)
43 = *Astroblepus cyclopus* (Humboldt).

Guamal, Quebrada. Between Honda and Facatativa, Colombia. Possibly this is Guadual?

Guanita = Juanita, *q. v.*

Guapota, Quebrada. Santander, Colombia. 6° 7′ 45″ N. 0° 25′ 10″ east of Bogotá. (3,300 ft.)
45; 51.

Guatemala. State in Central America.
254; 266; 318; 348.

Guatigua, Rio = Guatiquia or Guateque?
A42?

Guaranda. On the Rio Chimbo, Ecuador.
48 = *Astroblepus grixalvii* (Humboldt.)

Guayaquil. Port in Ecuador on the Guayas.
18; 56; 85; 135; 142; 143; 152; 173; 264; 267; 314; 327; 328; 333; 337; 346; 354; 360; 361; 364; 381; 383; 384; 385.

Guayas, Rio. Formed by the junction of the Rios Vinces and Colimes. Ecuador. (*See* also Guayaquil).
267; 336; 354.

Guineo. (*See* Boca de Guineo.)

Hato. Quebrada de Santander. Near Mogotes, Colombia. 0° 24′ 5″ E. 6° 20′ 3″ N. (4,300 ft.)
78 = *Pygidium striatum* M. & H.
Herrera. Station near Tequendama, Colombia.
81.
Hirajara. (*See* Chirajara.) Colombia, between Bogotá and Villavicencio.
52; A21; A22.
Honda. Town on the Magdalena River six hundred and thirty miles above Barranquilla. (693 ft.)
10; 14; 24; 27; 28; 31; 82; 86; 88; 95; 100; 121; 126; 136; 137; 146; 153; 157; 179; 185; 196; 201; 207; 216; 244; 247; 250; 252; 253; 261; 262; 265; 339.
Honda, Quebrada de la. Santander, Colombia.
65; 74.
Horizonte, Quebrada de. Santander, Colombia.
Huamani, Ecuador. Into Rio Napo.
48 = *Astroblepus grixalvii* (Humboldt).
Huambo, Rio. Northern Peru, Amazon Basin.
51; 52.
Huaras. On the Rio Santa, Peru. (10,700 ft.)
54.
Huigra. Town on the Chanchan, in the interandean park of Alausi, Ecuador. (4,000 ft.)
51 = *Astroblepus chotæ* (Regan).
Ibagué. Town west of Bogotá on the base of Tolima, Colombia. (4,286 ft.)
228; 301; 339.
Ibarra. Town in the interandean park of Ibarra, Mira Basin, northern Ecuador, 0° 20′ N. (7,000 ft.)
Imbabura. Volcano north of Quito, Ecuador.
43 = *Astroblepus cyclopus* (Humboldt).
Indio, Rio. Tributary of the upper Chagres, Panama.
178; 209; 317; 318; 321.
Istmina, Colombia. A town on the upper Rio San Juan, where it turns from a westward to southward flow.
19; 26; 46; 88; 91; 96; 104; 109; 115; 123; 124; 126; 130; 161; 172; 177; 188; 200; 208; 215; 220; 221; 236; 237; 242; 257; 263; 265; 267; 288; 309; 322; 332; 341; 345; 351; 353; 365; 379.
Jequetepeque, Rio. Discharging into the Pacific near Pacasmayo. (*See* Cultambo; Llallan, Pacasmayo.)
Jimenez. Near Cisnero, Rio Dagua, Colombia.
41; 52; 53.
Juanambu, Rio. Tributary of the upper Patia. Southwestern Colombia.
51 = *Astroblepus chotæ* (Regan).

Juan Diaz, Rio. Emptying into the Pacific a few miles south of Panama City.
181; 291; 370; 379.
Juanita. On the Rio Cauca, the port of Cali.
Included in the list under Cali.
Juntas. See Cisnero.
Jujiado, Rio. Tributary of lower San Juan. Western Colombia.
309.
Labaja. Santander; *see* Lubaja, Colombia.
44.
Lachis. On the Rio Mira above Paramba, Ecuador. (5,000 ft.)
43 = *Astroblepus cyclopus* (Humboldt); 52 = *Astroblepus longifilis* (Steindachner).
La Dorada. Town at the head of navigation of the lower Magdalena, about six hundred and fifteen miles from its mouth. (627 ft.)
Largateria. Northern tributary of the Chagres, Panama.
167; 254.
La Serena. Coast town near Coquimbo, Chili.
311.
Latacunga. Town in the interandean park of the same name, draining into the Amazon, Ecuador. (9,055 ft.).
48 = *Astroblepus grixalvii* (Humboldt).
Lebrija, Rio. An eastern tributary of the Rio Magdalena, Colombia.
153.
Lima. Capital of Peru, on the Rio Rimac.
71; 158; 224.
Limon Creek. At Alhajuela, Panama.
342.
Lisa, Rio. Tributary of the Rio San Juan. Western Colombia.
159; 208.
Llallan. Station on the upper Jequetepeque, inland from Pacasmayo, Peru. (2,437 ft.)
23; 55; 72; 158; 171; 224; 346.
Los Llanos de Sandona. Near Tuquerres, southwestern Colombia. (5,000 ft.)
51 = *Astroblepus chotæ* (Regan).
Los Llanos. The plains of eastern Colombia. (*See* Barrigón, Carneceria, Cumaral.)
62.
Lubaja, Quebrada. Santander, Colombia.
44.
Machachi. Town in the interandean park, Quito, Ecuador. (9,500 ft.)
48 = *Astroblepus grixalvii* (Humboldt.)
Madrid. Town on the plains of Bogotá near Facatativa, Colombia. (8,500 ft.)
67; 81; 164.

Magdalena. Largest river in Colombia.

Magui, Rio. Tributary of the Rio Patia above the Telembi, southwestern Colombia.
90; 106; 115; 123; 172; 189; 257; 265; 269; 335; 344; 352; 379.

Mamatoco, Rio Manzanares. Santa Marta, Colombia.
276; 296; 343.

Mamoni, Rio. See Chepo and Bayano.
16; 24; 104; 122; 123; 133; 167; 249; 263; 264.

Manabi, Ecuador.
309.

Managru. Upper Quito Basin of the Atrato, Colombia.
4; 114; 130; 151; 154; 165; 188; 201; 208; 215; 242; 263; 265; 267; 269; 270; 288; 341; 345; 351.

Mandingo, Rio. Chagres Basin.
178; 347.

Mango, Quebrada del. Santander, Colombia.
65.

Manzanares, Rio. Near Santa Marta, Colombia.
276; 296; 343.

Maracaibo. Extreme northwestern corner of Venezuela.
28; 133; 137; 313; 357.

Maria Luisa. Hacienda on the Rio Mira in northern Ecuador below Paramba.

Mariquita. Railway station southwest of Honda, Colombia. (1,805 ft.)

Marrigante. Panama, Tuyra Basin.
29; 35; 268; 269.

Marte Arnade, Rio. Panama.
84; 133.*

Marutiba. (Possibly Marcetita.) Between Bogotá and Villavicencio, Colombia.
52; A21; A22.

Matucana. Town on the Rio Rimac above Chosica, Peru.
71; 158; 324.

Matachin. Panama Canal Zone, Atlantic side.

Merida. Town on the Cordillera de Merida in the Maracaibo Basin, Venezuela.
205; A13; A20; A27.

Meta, Rio. Tributary of the Orinoco, eastern Colombia. (*See* Appendix I).
17; 99; 125.

Milligali. Hacienda southwest of Quito, Ecuador, belonging to L. Söderström. Esmeraldas Basin.
48.

Millo, Rio. Maracaibo Basin, near Merida, Venezuela.

* Also *Xiphostoma hujeta; Piabucina erythrinoides; Ailurichthys bagre.*

Mindi. Near the Atlantic coast of the Canal Zone, between Gatun and Colon, Panama.
348; 360; 369; 371.
Mindo. Hacienda, west of Quito, Ecuador. Esmeraldas Basin. (4,108 ft.)
43; 51; 59; 163; 239.
Mira. Town in the interandean park, Ibarra, northern Ecuador. Mira Basin.
Mira, Rio. Northwestern Ecuador.
171.
Mirador. Ecuador.
190.
Missimbi, Rio. Empire, Canal Zone, Panama.
340.
Mogotes. Rio, Santander, Colombia. About ten miles southeast of San Gil, 0° 42′ 42″ E. 6° 16′ N. (5,582 to 5,626 ft.)
45; 52.
Monte Liria. On the Rio Gatun, Chagres Basin.
87; 113; 166; 178; 182; 245; 348; 378.
Munguido, Rio. Tributary of the Rio San Juan, western Colombia.
58; 200; 265; 267.
Naradol, Quebrada. Santander.
Naranjal. Between Bogotá and Villavicencio. (*See* Quebrada Naranjal.)
A22.
Naranjito. Rio Barranca Alto, and Rio Chanchan from the station of Naranjito, Ecuador.
89; 145; 152; 158; 171; 180; 238; 346; 354; 365; 379.
Negro, Rio. Antioquia, Colombia.
52.
Negro, Rio. River on the eastern slope east of Bogotá, Colombia.
49; 99; A1; A2; A3; A5; A6; A8; A10; A19; A22; A30; A42; A43; A49; A50; A56; A59.
Neiva. Town on the upper Magdalena, one hundred and ninety-three miles above Honda, Colombia.
New Granada. Old name for Panama.
113; 181; 350; 356.
Nicaragua. State in Central America.
254; 285.
Northwestern Ecuador, without nearer designation, probably Esmeraldas Basin.
123.
Novita. A town on the Rio Condoto, emptying into the San Juan, Colombia.
130; 235.
Obispo. Station on the Rio Chagres.
200; 264; 285; 347.

Ocamonte, Quebrada. Santander, 0° 35′ 35″ E. 6° 9′ 45″ N. (4,620 ft.)
65.

Orquiza, Rio. Eastern slope of Cordillera Oriental; exact location not known; but it is east of Bogotá.
A43.

Pacasmayo. Coast town in northern Peru.
23; 72; 158; 171; 224; 316; 346.

Pacho, Rio de. Between Honda and Facatativa, or Boyaca. (5,893 ft.)
49 = *Astroblepus micrescens* (Eigenmann.)

Paila. A town on the Rio Paila, a tributary of the upper Cauca, Colombia.
95; 126; 138; 146; 156; 175; 198; 201; 204; 206; 210; 223; 233; 243; 255.

Paita. Northwest coast of Peru. The fresh-water fishes reported from Paita actually came from some miles inland from the Chira or the Piura River.

Palmira Pass. Atlantic slope, Ecuador.
48 = *Astroblepus grixalvii* (Humboldt.)

Papallacta. Northeastern face of the Huamani. Atlantic slope, Ecuador.
48 = *Astroblepus grixalvii* (Humboldt.)

Paraiso. Pacific slope of Panama, Canal Zone.
372.

Paramba. Town or hacienda on the Rio Mira, northern Ecuador, east of Cachabé. 0° 55′ N. 80° 39′ W. on map of Wolf. (3,500 ft.)
59 = *Pygidium laticeps* (Kner); 171 = *Brycon atricaudatus* (Kner); 372 = *Sicydium salvini* (Grant.)

Patia, Rio. Southwestern Colombia.

Pava, Quebrada la, Santander.
45; 51.

Pedro Miguel. Pacific slope of the Panama Canal Zone.
256.

Pelada, Quebrada de la, Santander.
45; 49; 51; 100.

Peñas Blancas. Station on the Magdalena near Puerto Berrio, Colombia.
24; 27; 28; 86; 122; 137; 138; 146; 196; 201; 207; 216; 247; 253; 261; 343.

Pembana. On the Rio Telembi, emptying into the Patia, southern Colombia.

Pequeño, Rio. Tributary of the upper Chagres, Panama.
200.

Perdices, Quebrada. Brook emptying into the Rio Negro above Villavicencio.
A22

Peripa, Rio. Tributary of the Rio Daule, Ecuador.
8; 145; 170; 171; 173; 346.

Pichincha. Volcano near Quito, Ecuador.

Piedra Moler. Bridge over the Rio Viejo east of Cartago, Colombia.
95; 104; 126; 146; 155; 175; 198; 201; 206; 211; 216; 223; 233; 255.
Piedras, Rio. Santander, Colombia.
67.
Pinchote, Quebrada de. Santander, Colombia, near San Gil. (4,150 feet.)
51; 77.
Piperel, Quebrada. Emptying into the Rio Negro above Villavicencio. Intendencia del Meta, Colombia.
A22.
Pisco. Coast town of Peru south of Callao.
311.
Pita, Laguna. Darien, Panama, on the Pacific side.
133; 160.
Piura. City in northern Peru on river of the same name.
23; 72; 158; 171; 224; 346.
Popayan. Southwestern Colombia.
48 = *Astroblepus grixalvii* (Humboldt.)
Porto Bello. On the Rio Cascajal, Panama. A coast town a few miles east of Colon.
161; 219; 286; 362.
Portoviejo, Ecuador. Near the coast at 1° north latitude.
22; 158; 190; 212; 346.
Potrero, Quebrada. Santander, Colombia.
49.
Pove, Rio. Santo Domingo de los Colorados, Ecuador. (1,848 ft.)
108 = *Chætostomus æquinoctialis* (Pellegrin.)
Puente Piedra. Near Lima, Peru, on the railway toward Ancon.
71; 158; 224.
Puente del Chimbo. Former railroad terminus, seventy miles from Guayaquil. (1,000 ft.)
Puente de Suba. North of Bogotá, Colombia.
67; 81; 164.
Puerto Berrio. Town on the Magdalena, Colombia. (424 ft.)
10; 30; 31; 32; 33; 36; 60; 136; 146; 153; 179; 201; 216; 247; 252; 357.
Puerto Negria. A station at the head of steam navigation on the Rio San Juan, Colombia.
21; 109; 115; 123; 124; 130; 151; 172; 200; 208; 215; 257; 263; 265; 309; 326; 332; 341; 343; 365; 366; 379.
Puerto del Rio. Cienega on Central Magdalena.
3; 86; 196; 247; 265; 267; 269; 338; 380.
Puertoviejo, Near coast, west of Guayaquil. (*See* Portoviejo.)
Puerto Wilches. Town on the Rio Magdalena. (346 feet.)
3; 24; 27; 28; 32; 179; 185; 196; 201; 247; 253.

Punta Toro. Western Point of Limon Bay near Colon. (*See* Toro Point.)

Quetame. East of Bogotá, Colombia. (4,700 ft.)

Quibdo. A town at the junction of the Rios Quito and Atrato, Western Colombia.
4; 10; 16; 24; 28; 34; 36; 58; 114; 123; 129; 133; 137; 146; 151; 153; 169; 177; 185; 192; 195; 201; 208; 215; 249; 251; 258; 260; 265; 270; 288; 341; 343; 351; 357; 358; 380.

Quito. Capitol of Ecuador. (9,375 ft.)
48 = *Astroblepus grixalvii* (Humboldt.)

Quito, Rio. A tributary emptying into the Rio Atrato at Quibdo, Colombia.

Raspadura. Town and river, the latter of the Atrato Basin just north of the Rio San Juan. (*See also* Boca de Raspadura.)
4; 104; 110; 114; 115; 130; 151; 154; 161; 177; 188; 201; 208; 220; 236; 240; 249; 265; 267; 270; 288; 341; 342; 345; 351; 358.

Raya, Quebrada de la. Santander, Colombia.
68.

Reservoir Creek. Gorgona, Canal Zone, Panama.
347.

Rimac, Rio. River of Central Peru emptying into the Pacific at Callao.
71; 158; 224; 307; 324.

Rinconada. Hacienda north of Angel, Province of Cachi, Ecuador. (3,110 M.)
48 = *Astroblepus grixalvii* (Humboldt).

Riobamba. Town in the interandean park of the same name, draining into the Amazon, Ecuador. (9,000 ft.)
48 = *Astroblepus grixalvii* (Humboldt).

Roncador, Rio. Eastern slope of Cordillera Oriental. East of Bogotá, Colombia.
205; A13; A21; A49.

Ropero, Quebrada de la. Emptying into the Rio Suarez near 5° 43′ North. Bogotá, Colombia.
78; 107.

Rosario, Rio. Small stream emptying into the Pacific near Tumaco.
326.

Rosario, Rio. Tributary of lower San Juan.
6; 365; 366.

Salidero. Northwestern Ecuador (probably on the Esmeraldas). (350 ft., *fide* Rosenberg.)
105.

Sandona. Southern Colombia, Los Llanos de Sandona.
51 = *Astroblepus chotæ* (Regan); 62 = *Pygidium tænium* (Kner).

San Gil. Santander. (3,628 ft.)
78; 100; 107; 205; A49.

San Javier. Northwestern Ecuador. Rio Esmeraldas? (60 ft., *fide* Rosenberg.)
90; 115; 163.

San Joaquin, Quebrada de. Santander, near San Gil, Colombia. (6,500 ft.)
47; 49.
San Juan, Rio. Stream in western Colombia, emptying near Buenaventura.
San Lorenzo. Santa Marta, Colombia. (4,500 ft.)
11; 67; 68; 318; 372.
San Lorenzo. On the Rio Telembi, tributary of the R. Patia, southwestern Colombia.
26; 58; 172; 177; 257; 352; 379.
San Pablo. Lake at base of Caraquairazo, Ecuador.
43 = *Astroblepus cyclopus* (Humboldt).
Santa, Rio. The largest river emptying into the Pacific in Peru.
54 = *Astroblepus simonsi* (Regan).
Santa Elena. Near the coast west of Guayaquil, Ecuador.
303 = *Pseudopœcilia festæ* (Boulenger).
Santa Eulalia. Upper tributary of the Rio Rimac, Peru.
Santa Marta. Northern city on Caribbean sea, east of the Magdalena.
67; 68; 276; 296; 343.
Santander. Province in Colombia examined between San Gil and Bogotá.
67; 229.
Santa Rita, Quebrada. Antioquia, Colombia.
38; 52.
Santiago. Capital of Chile.
311.
Santiago, Rio. A river in northwestern Ecuador. (There is also a river of the same name in southeastern Ecuador.)
181. (? 250 Eastern Ecuador.)
San Vicente. Near Santa Elena west of Guayaquil, Ecuador.
303 = *Pseudopœcilia festæ* (Boulenger).
Sapayo, Rio. Northwest Ecuador, into Rio Cayapas, into the Rio Santiago.
163; 344.
Sarjento, Quebrada. Between Honda and Facatativa, Colombia. (4,000 ft.)
38; 44; 51; 60; 78; 107.
Satigante, Rio. A tributary of the Rio Tuyra, Panama.
97; 218; 289.
Seco, Rio. Near Honda, between Honda and Facatativa, Colombia.
339; 358.
Siachia, Quebrada de. Santander.
49.
Sipi, Rio. Upper San Juan Basin. Western Colombia.
75.
Soplaviento. Town on Dique de Cartagena between Cartagena and Calamar, Colombia.

10; 17; 27; 28; 30; 31; 32; 33; 36; 83; 86; 94; 103; 114; 116; 133; 136; 137; 146; 153; 169; 179; 185; 196; 207; 213; 214; 234; 244; 247; 252; 253; 262; 265; 267; 269; 270; 276; 283; 338; 339; 343; 357; 358.

St. Augustine. On headwater tributary of the Rio Magdalena. (5,000 ft.)

51 = *Astroblepus chotæ* (Regan); 80 = *Pygidium retropinne* (Regan).

Suaita, Quebrada. Province Santander, Colombia. 0° 19′ 30″ E.; 5° 58′ N. (6,369 ft.)

65; 164.

Suarez, Rio. Draining the highlands of Santander into the Magdalena. (*See* Santander.)

Suba. Town a short distance north of Bogotá. (*See* Puente de Suba.)

Sucio, Rio. A town at the junction of the Rio Sucio with the Rio Atrato, Colombia.

3; 16; 28; 34; 146; 251; 263; 357.

Suescum. Into Rio Funza? Cundinamarca, 5° 2′ 25″ N. 0° 11′ E. of Bogotá, Colombia. (7,073 ft.)

45 = *Astroblepus santanderensis* (Eigenmann).

Sullana. On the Rio Chira, northwestern Peru.

23; 132; 171; 224; 384.

Sumuco, Quebrada. Brook on eastern slope of Cordillera Oriental, not far from Villavicencio.

49; 52; A10; A21; A22.

Susa, Rio. Nearly halfway between Hato and Chiquinquira. 0° 4′ 45″ E. 5° 54′ 35″ N., Cundinamarca, Colombia. Near the laguna Fuquene. (8,471 ft.)

49 = *Astroblepus micrescens* (Eigenmann).

Susumuco. (*See* Sumuco).

Tabernilla. Atlantic side of the Canal Zone.

167; 254.

Tado. On junction of the Rio Tado with the Rio San Juan, western Colombia. (316 ft.)

79; 104; 115; 122; 130; 208; 215; 221; 237; 257; 265; 309; 322; 341; 351; 365; 379.

Tamana, Rio. An upper, eastern tributary of the Rio San Juan, western Colombia.

11; 75; 101; 104; 124; 130; 159; 221; 235; 343.

Tambo. A station at the headwaters of a small stream of the Atrato Basin, just north of Istmina.

24; 159; 161; 188; 215; 220; 236; 288; 345; 351.

Tambo, Rio. Southern Peru, south of Mollendo.

324.

Tamocal, Rio. At San Lorenzo near Santa Marta, Colombia. (800 ft.)

276; 318; 372.

Telembi, Rio. A tributary of the Rio Patia from the south. Southwestern Colombia.

4; 11; 22; 106; 115; 123; 131; 172; 177; 189; 222; 237; 257; 265; 267; 269; 309; 322; 335; 344; 352; 379.

Tengavita. Eastern slope of Cordillera Oriental near Bogotá, Colombia. Exact location not known to the recorder.
99; A10; A22.

Tequendama. Falls of the Rio Funza or Bogotá, Colombia.

Térraba, Rio Grande de. A river of Costa Rica.
374.

Tiabaya. Town a short distance from Arequipa on the Rio Chile, Peru.
70; 324; no other species at Tiabaya.

Toche. Small hamlet at the eastern base of the Quindio Pass, Colombia.
48 = *Astroblepus grixalvii* (Humboldt).

Toro Point. Point of land near the Atlantic end of the Panama Canal. (*See* Punta Toro.) 161; 285; 299; 317; 368.

Totora, Rio. Northern Peru. Atlantic slope.
51; 52.

Trinidad, Rio. Aqua Clara, Canal Zone. Chagres Basin, Panama.
254; 362.

Truando, Rio. A western tributary emptying into the Atrato near Rio Sucio, Colombia.
3; 4; 16; 24; 28; 34; 36; 83; 92; 114; 117; 129; 133; 137; 146; 151; 153; 154; 161; 165; 168; 169; 188; 192; 193; 195; 201; 202; 208; 215; 220; 241; 249; 258; 263; 265; 266; 270; 300; 306; 309; 341; 343; 351; 357; 358; 382.

Trujillo. Town near the coast in northern Peru inland from Salaverry.
158; 310.

Tumaco. Town on an island in southern Colombia.
6; 278; 280; 309; 338 (footnote); 361.

Tumbez, Rio. Emptying into the Pacific in northern Peru.
334.

Tungarahua or Tungaragua. Volcano south of Cotopaxi, Ecuador.
43 = *Astroblepus cyclopus* (Humboldt).

Tuquerres. Town in the highlands of southwestern Colombia in the Patia Basin. Collections were made at 9,600 ft. and 10,090 ft.
48 = *Astroblepus grixalvii* (Humboldt).

Tuyra. Pacific slope stream of southern Panama.
16; 24; 29; 35; 87; 104; 117.

Usme Sur. Town on the Tunjuelo near Bogotá, Colombia.
81.

Varriri, Quebrada. Santander, Colombia.
45; 51.

Ventura. Ecuador. Near Guayaquil.
304.

Veragua. Western Panama.
93; 356.

Villavicencio. City at eastern base of the Cordillera of Bogotá, Intendencia del Meta, Colombia. 0° 30′ E. 2° 15′ 10″ N. (1,496 ft.)
24; 49; 99; 205; A1; A2; A3; A4; A5; A6; A8; A10; A11; A12; A13; A14; A15; A19; A22; A26; A29; A30; A32; A35; A39; A42; A43; A44; A45; A46; A49; A50; A51; A54; A55; A56; A58; A59.

Villeta. Between Honda and Facatativa, Colombia. (Between 2,669 and 2,778 ft.)
38; 78; 107; 301.

Vinces, Rio and Town. North of Guayaquil, Ecuador.
12; 18; 25; 85; 134; 135; 139; 140; 145; 152; 158; 170; 187; 225; 227; 264; 304; 346; 385.

Vitor, Valle and Rio. Southern Peru not far from Arequipa.
324; no other species at Vitor.

Yambi, Rio. Tributary of Rio Telembi, southwestern Colombia.
172; 177; 352.

Yape. Tributary of the Rio Tuyra, Panama.
97; 111; 117; 127; 232; 291.

Zamora, Rio. Draining the interandean park Loja in southern Ecuador, toward the Marañon. (*See* Boulenger.)

Zipaquira, Quebrada. Province Norte Colombia.
0° 1′ 40″ E. 4° 56′ 35″ N. (8,668 ft.)

Zurumilla, Rio. Upper course of the Rio Tumbez. Between Ecuador and Colombia.
158.

EXPLANATION OF PLATE I.

FIG. 1. *Xyliphius magdalenæ* Eigenmann. *Type.* No. 4829, C. M., 32 mm. Girardot.

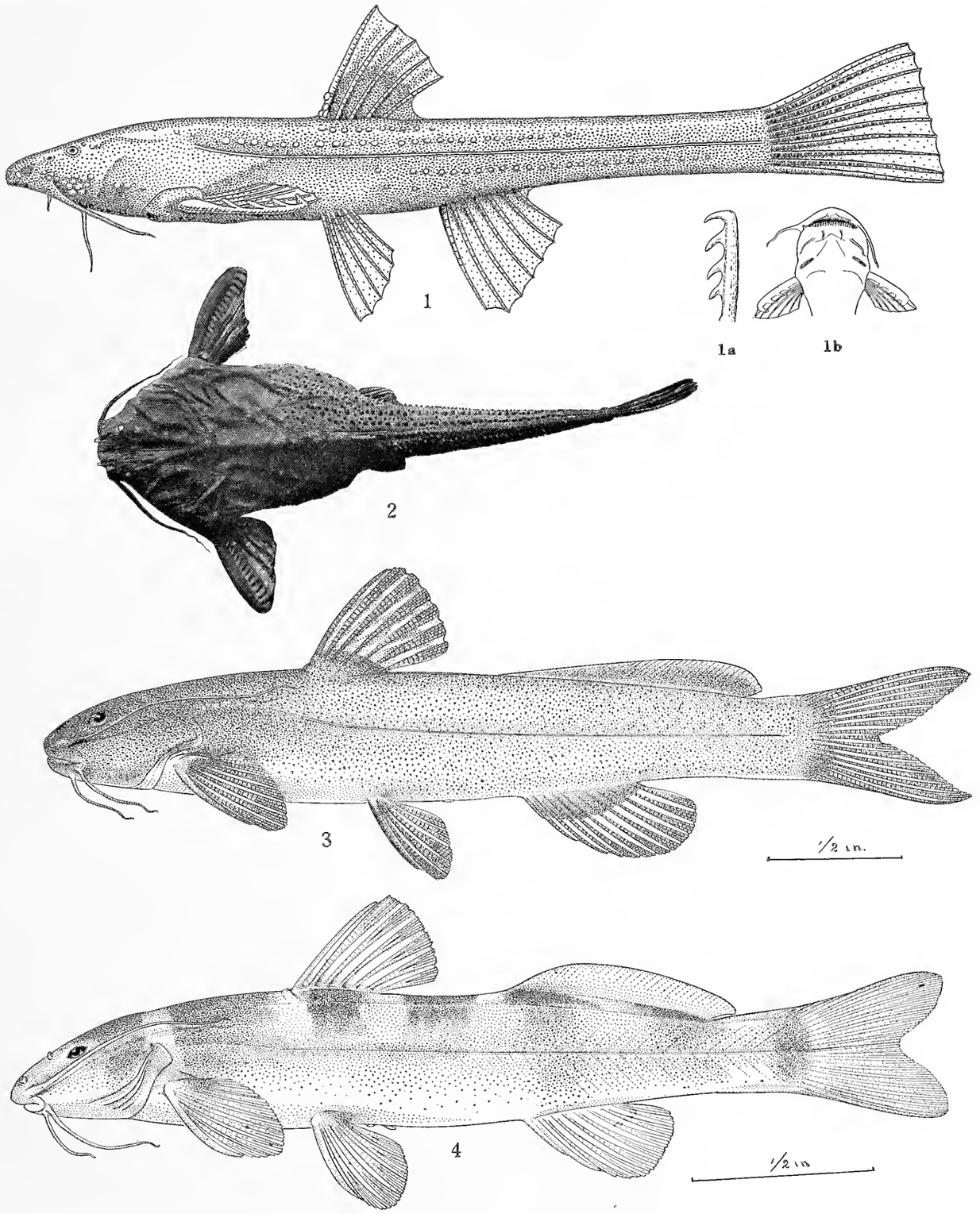
FIG. 1a. Enlarged view of distal extremity of pectoral spine of *X. magdalenæ.*

FIG. 1b. Enlarged view of the under side of the head of *X. magdalenæ.*

FIG. 2. *Bunocephalus colombianus* Eigenmann. No. 5483, C. M., 136 mm. Managru.

FIG. 3. *Cetopsorhamdia boquillæ* Eigenmann. *Type.* No. 3923, C. M., 81 mm. Boquilla.

FIG. 4. *Chasmocranus rosæ* Eigenmann. *Type.* No. 3841, C. M., 65 mm. Rio Negro, Villavicencio.

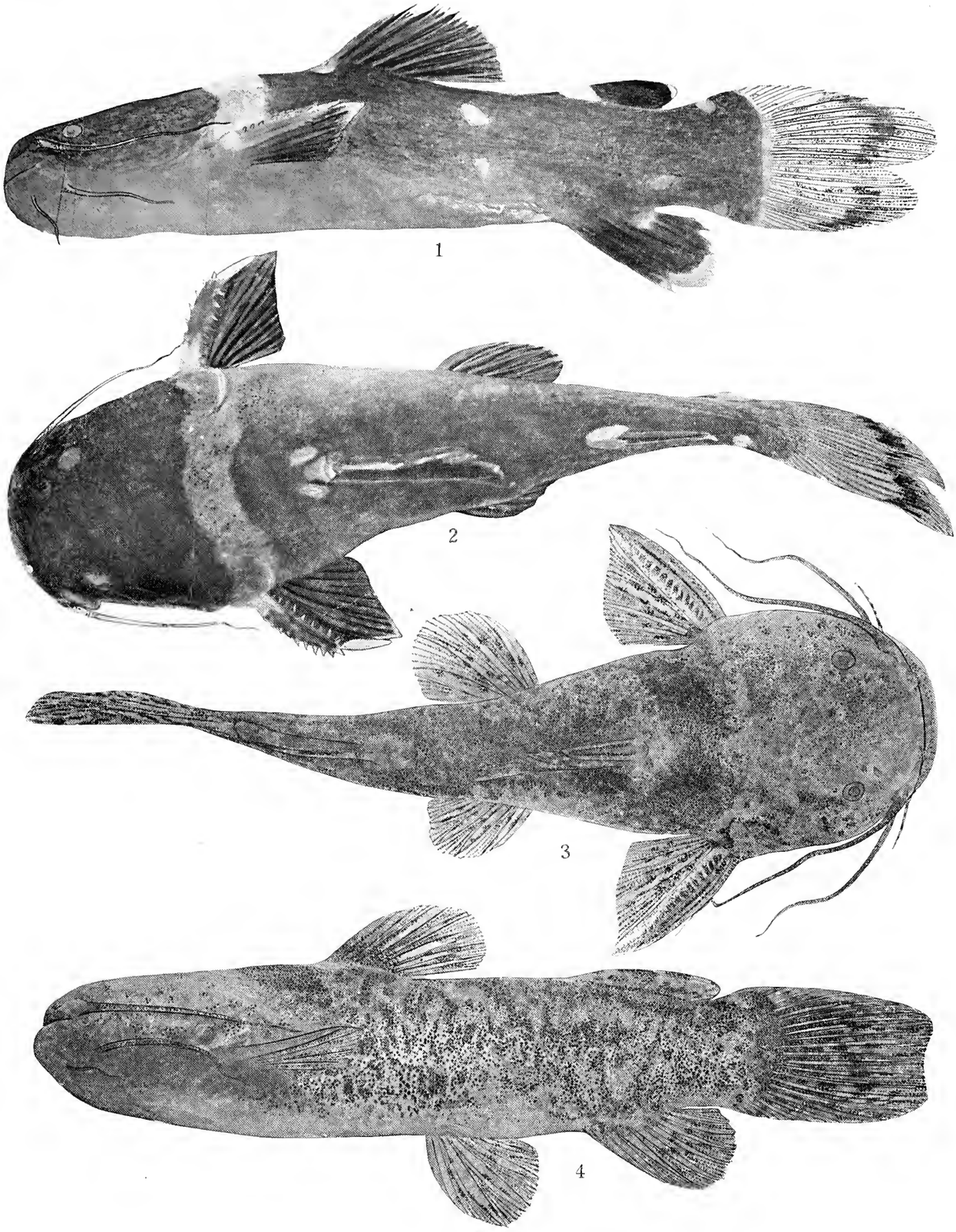


Xyliphius, Bunocephalus, Cetopsorhamdia, Chasmocranus.

EXPLANATION OF PLATE II.

FIGS. 1–2. *Pseudopimelodus transmontanus* Regan. No. 13008, I. U. M., 73 mm. San Lorenzo, Patia Basin.

FIGS. 3–4. *Microglanis variegatus* Eigenmann and Henn. *Type*. 13106, I. U. M., 45 mm. Vinces.



Pseudopimelodus, Microglanis.

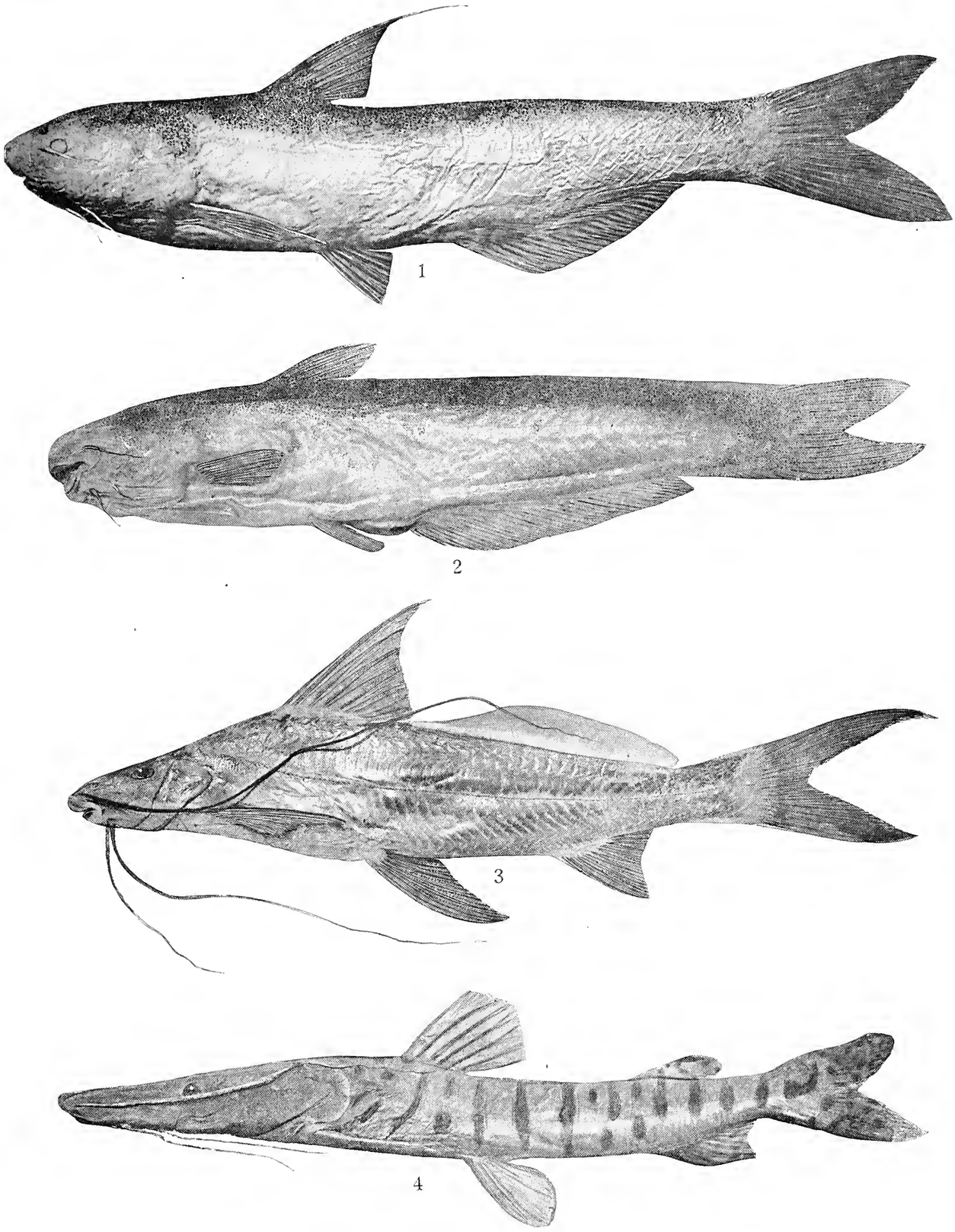
EXPLANATION OF PLATE III.

FIG. 1. *Hemicetopsis othonops* Eigenmann. *Type*. No. 4830, C. M., 120 mm. Girardot.

FIG. 2. *Hemicetopsis amphiloxa* Eigenmann. *Type*. No. 5332, C. M., 88 mm. Patia Basin.

FIG. 3. *Perugia xanthus* Eigenmann. *Type*. No. 4822, C. M., 202 mm. Girardot.

FIG. 4. *Pseudoplatystoma fasciatum* (Linnæus). No. 13551, I. U. M., 400 mm. Puerto Berrio.



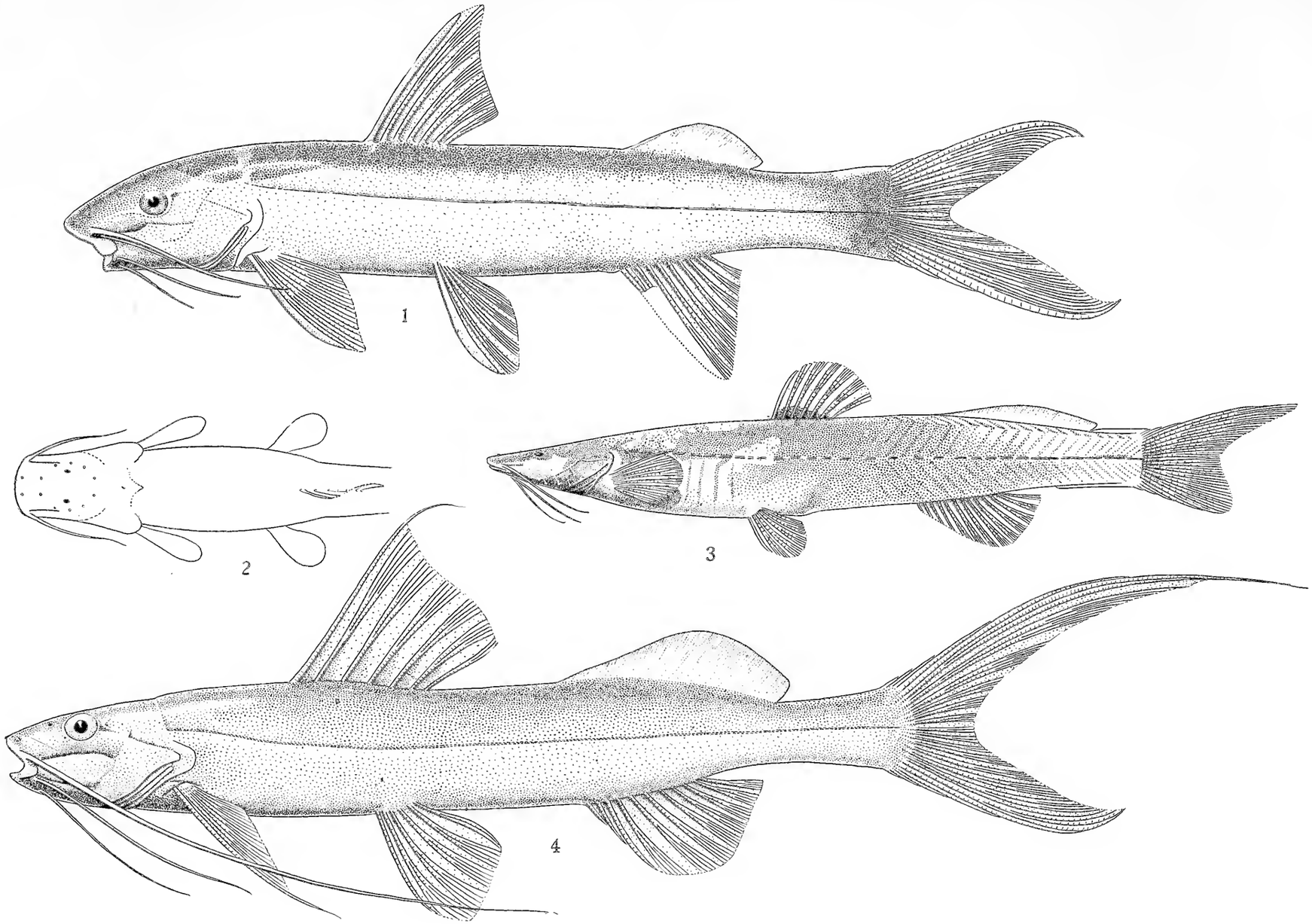
Hemicetopsis, Perugia, Pseudoplatystoma.

EXPLANATION OF PLATE IV.

FIG. 1. *Cetopsorhamdia nasus* Eigenmann and Fisher. *Type*. No. 7124, C. M., 72 mm. Honda.

FIGS. 2–3. *Imparfinis microps* Eigenmann and Fisher. *Type*. No. 6776, C., 75 mm. Rio Negro, emptying into Rio Meta at Villavicencio.

FIG. 4. *Nannorhamdia nemacheir* Eigenmann and Fisher. *Type*. No. 7125, C. M., 105 mm. Girardot.

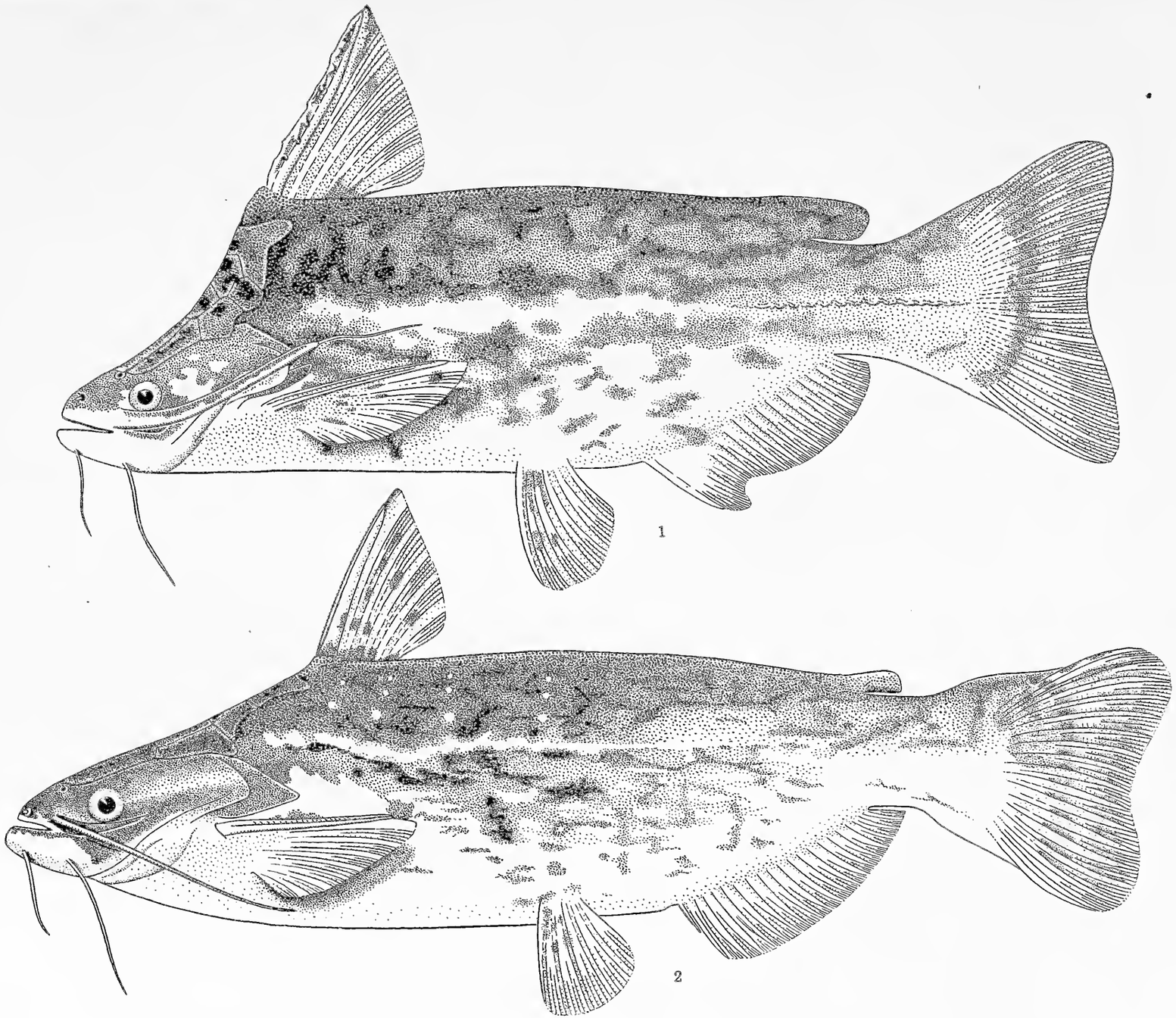


Cetopsorhamdia, Imparfinis, Naimorhamdia.

EXPLANATION OF PLATE V.

FIG. 1. *Trachycorystes fisheri* Eigenmann. *Type*. ♂. No. 6667*a*, C. M., 250 mm.

FIG. 2. *Trachycorystes fisheri* Eigenmann. *Allotype*. ♀. No. 6667*b*, C. M., 275 mm.



Trachycorystes fisheri. 1♂, 2♀.

EXPLANATION OF PLATE VI.

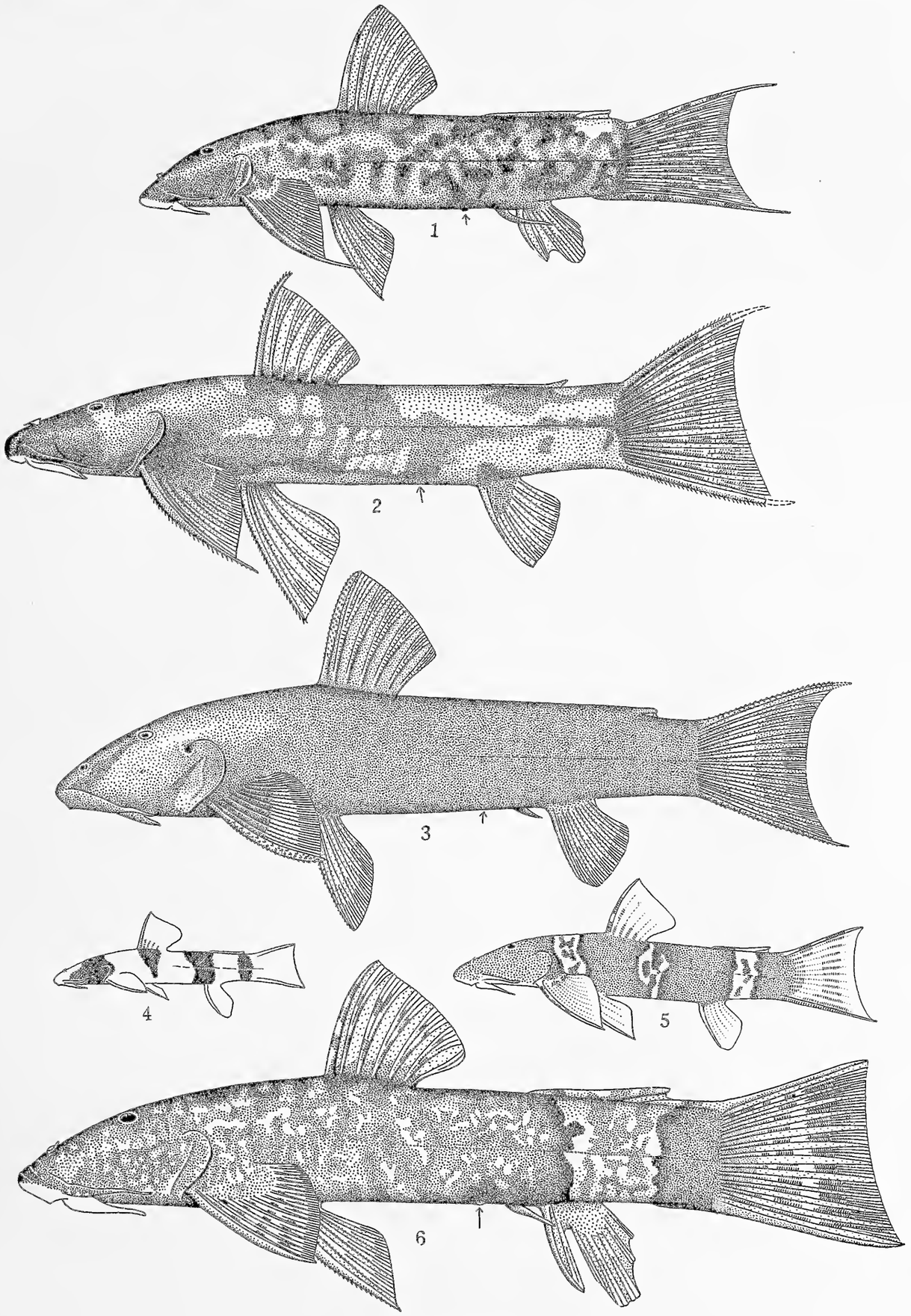
FIG. 1. *Astroblepus homodon* (Regan). No. 7353, C. M., 63 mm. Quebrada Sarjento.

FIG. 2. *Astroblepus chapmani* Eigenmann. *Type*. No. 4863, C. M., 75 mm. Boquilla.

FIG. 3. *Astroblepus latidens* Eigenmann. *Type*. No. 7362a, C. M., 57 mm. Piperel.

FIGS. 4–5. *Astroblepus trifasciatus* (Eigenmann). No. 4869, C. M., 23 and 41 mm. Caldas.

FIG. 6. *Astroblepus trifasciatus* (Eigenmann). *Type*. No. 4868, C. M., 85 mm. Caldas.



Astroblepus.

EXPLANATION OF PLATE VII.

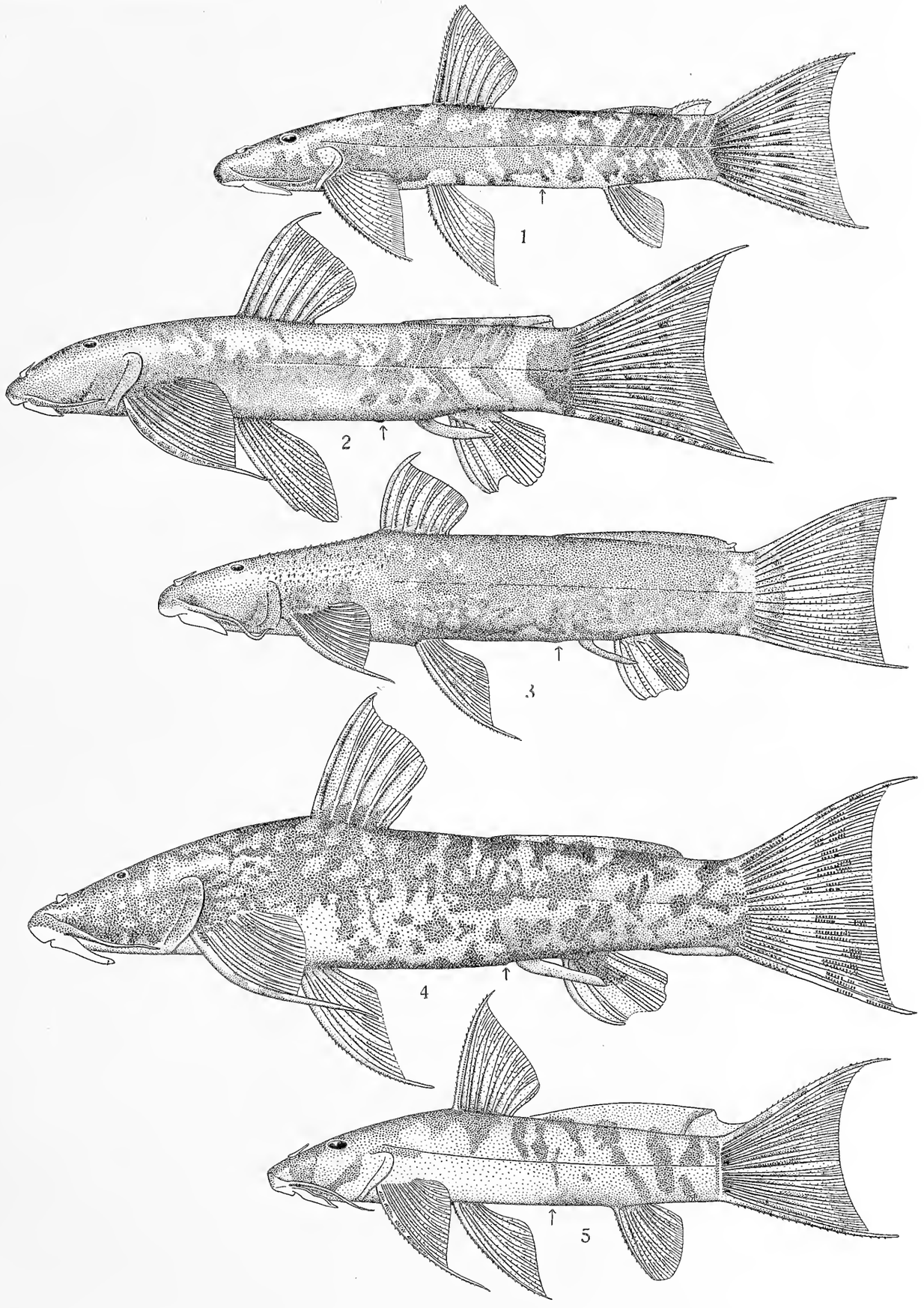
FIG. 1. *Astroblepus cyclopus* (Humboldt). No. 7389, C. M., 39 mm. Hacienda Lachis.

FIG. 2. *Astroblepus unifasciatus* (Eigenmann). *Type.* No. 4871, C. M., 57 mm. Caldas.

FIG. 3. *Astroblepus cirratus* (Regan). Based on type of *Cyclopium ventrale* Eigenmann. No. 4866, C. M., 75 mm. Caldas.

FIG. 4. *Astroblepus micrescens* Eigenmann. *Type.* No. 7372a, C. M., 69 mm. Agua Larga.

FIG. 5. *Astroblepus chotæ* (Regan). No. 7421, C. M., 38 mm. Quebrada Guadual.



Astroblepus.

EXPLANATION OF PLATE VIII.

FIG. 1. *Corydoras melanotænia* Regan. No. 15039, I. U. M., 43 mm. Barrigón.

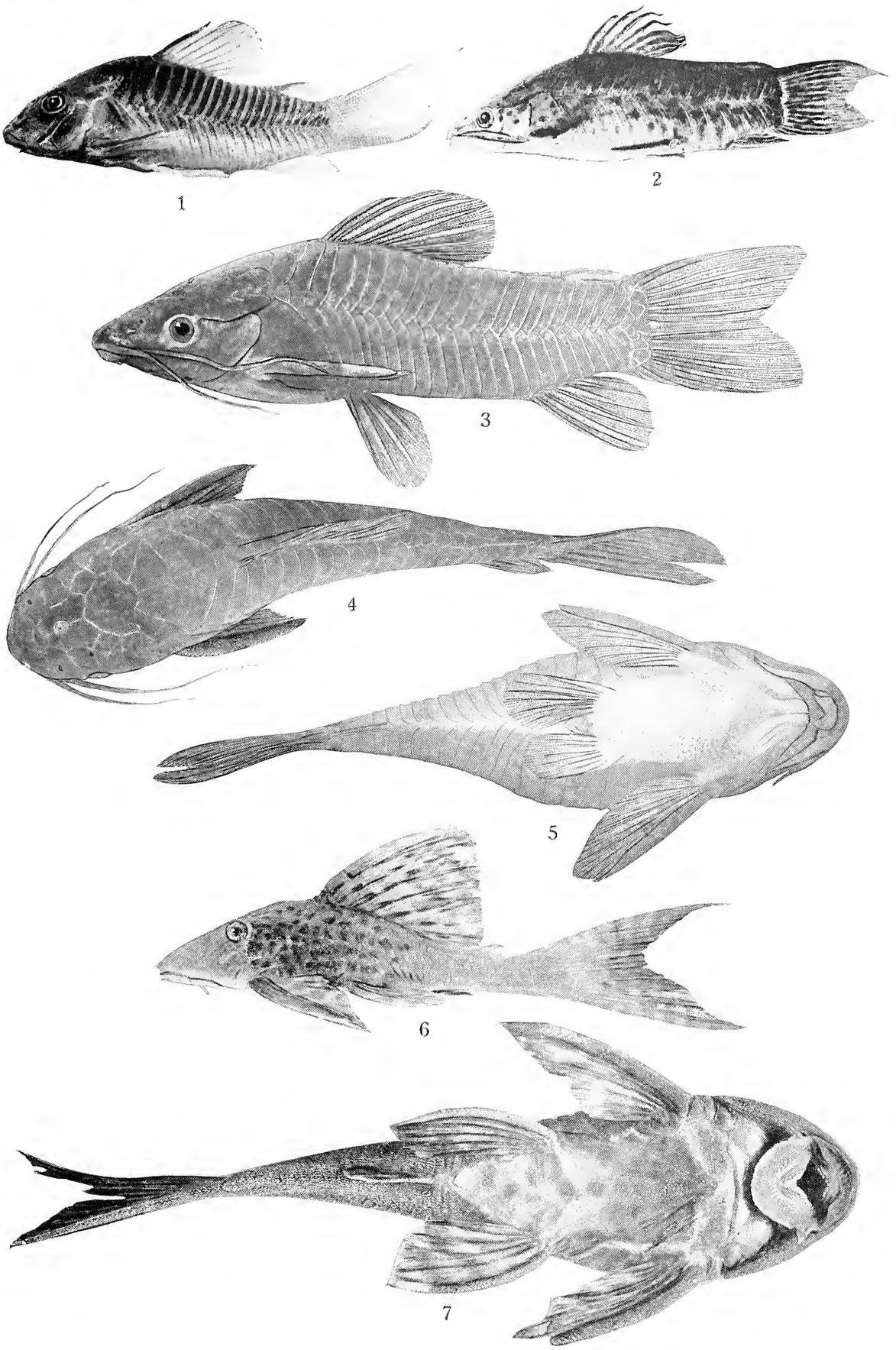
FIG. 2. *Hoplosternum magdalenæ* Eigenmann. No. 13970, I. U. M., *juv.*, 62 mm. Truando.

FIG. 3. *Hoplosternum magdalenæ* Eigenmann. *Type*. No. 5081, C. M., 107 mm. Soplaviento.

FIG. 4. Dorsal view of the type of *Hoplosternum magdalenæ* Eigenmann.

FIG. 5. *Corydoras metæ* Eigenmann. Ventral view of *Type*, No. 13451, I. U. M., 52 mm. Barrigón.

FIGS. 6–7. *Cheiridodus hondæ* (Regan). No. 13922, I. U. M., 108 mm. Istmina.



Corydoras, Hoplosternum, Cheiridodus.

EXPLANATION OF PLATE IX.

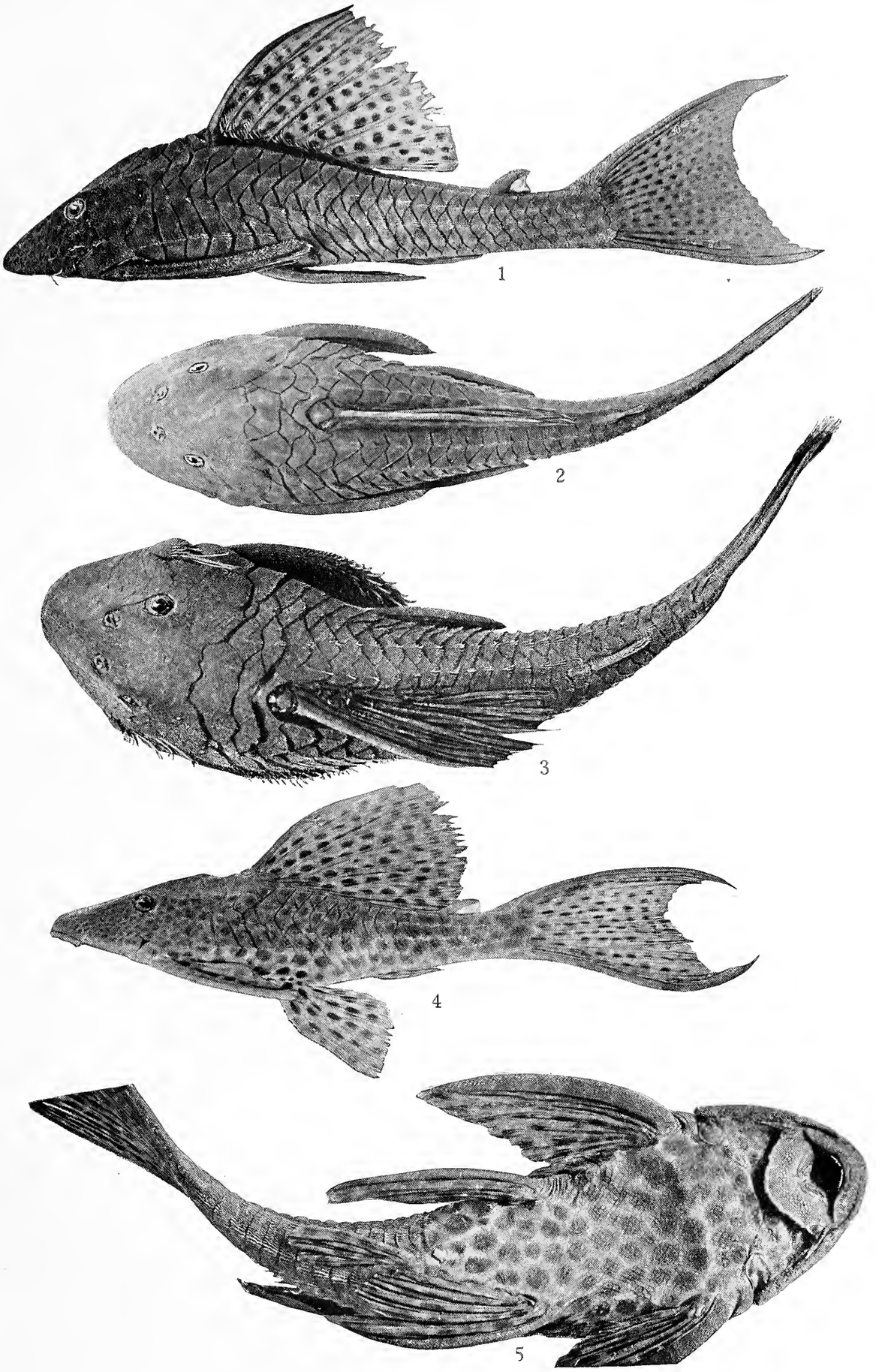
FIG. 1. *Hemiancistrus annectens* Regan. No. 13914, I. U. M., 257 mm. Patia.

FIG. 2. *Hemiancistrus annectens* Regan. No. 13914, I. U. M., 257 mm. (Dorsal view.)

FIG. 3. *Hemiancistrus landoni* Eigenmann. *Type.* No. 13654, I. U. M., 255 mm. Naranjito, Ecuador.

FIG. 4. *Hemiancistrus holostictus* Regan. No. 7569, C. M., 137 mm. Istmina.

FIG. 5. *Hemiancistrus wilsoni* Eigenmann. No. 13921, I. U. M., 127 mm. Truando.



Hemiancistrus.

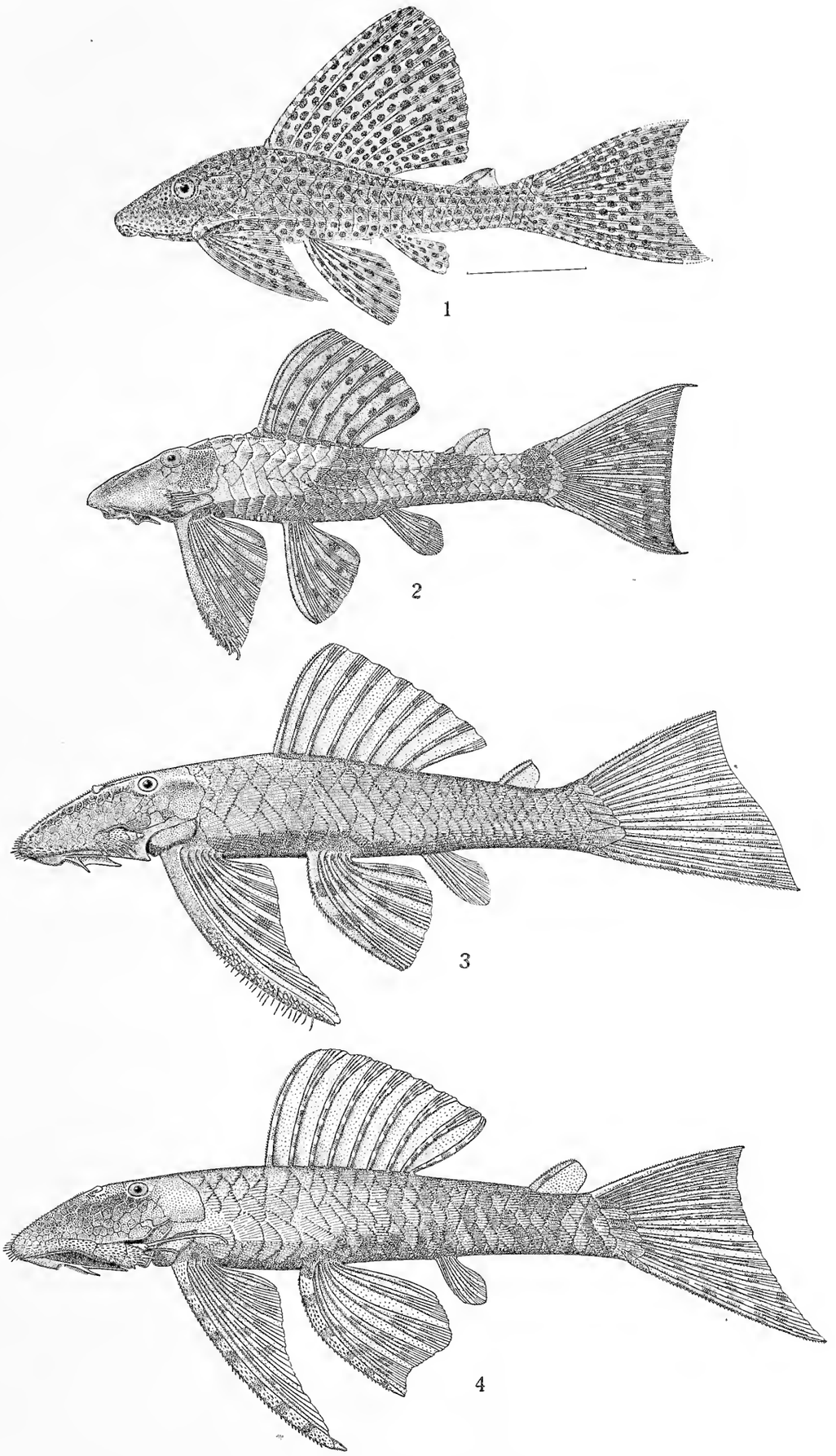
EXPLANATION OF PLATE X.

FIG. 1. *Hemiancistrus wilsoni* Eigenmann. *Type*. No. 7570, C. M., 133 mm. Truando.

FIG. 2. *Hemiancistrus landoni* Eigenmann. *Type*. No. 13654, I. U. M., 255 mm. Naranjito, Ecuador.

FIG. 3. *Pseudancistrus carnegiei* Eigenmann. *Type*. No. 7346, C. M., 110 mm. Rio San Gil.

FIG. 4. *Pseudancistrus pediculatus* Eigenmann. *Type*. No. 7348, C. M., 118 mm. Rio Negro, Villavicencio.



Hemiancistrus, Pseudancistrus,

EXPLANATION OF PLATE XI.

FIG. 1. *Cochliodon plecostomoides* Eigenmann. *Type.* No. 15043, I. U. M., 256 mm. Villavicencio.

FIG. 2. Dorsal view of head of type of *Cochliodon plecostomoides* Eigenmann.

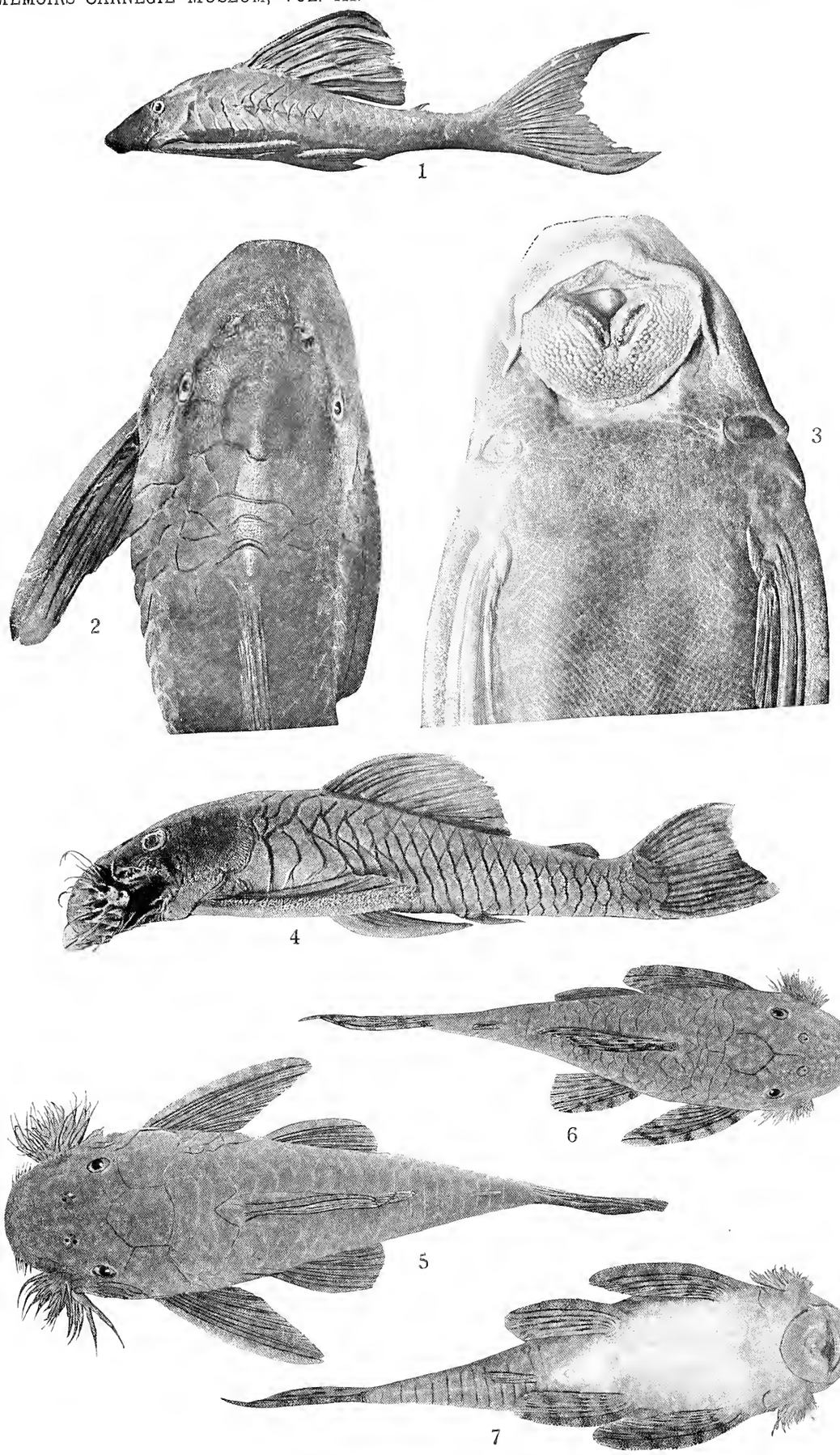
FIG. 3. Ventral view of head of type of *Cochliodon plecostomoides* Eigenmann.

FIG. 4. *Lasiancistrus caucanus* Eigenmann. *Type.* No. 2824, C. M., 171 mm. Cartago.

FIG. 5. *Lasiancistrus caucanus* Eigenmann. No. 12683, I. U. M., 173 mm. Cartago.

FIG. 6. *Lasiancistrus mayoloi* Eigenmann. *Paratype.* No. 4827, C. M., 117 mm. Istmina.

FIG. 7. *Lasiancistrus mayoloi* Eigenmann. (Ventral view of same specimen.)



Cochliodon, Lasioncistrus.

EXPLANATION OF PLATE XII.

FIG. 1. *Pseudancistrus daguæ* Eigenmann. *Type.* No. 4842, C. M., 79 mm. Caldas. (Ventral view.)

FIG. 2. *Pseudancistrus daguæ* Eigenmann. (Dorsal view of the type.)

FIG. 3. *Pseudancistrus pediculatus* Eigenmann. No. 13928, I. U. M., 112 mm. Quebrada Cramalote, Villavicencio.

FIG. 4. *Chætostomus thomsoni* Regan. No. 13659, I. U. M., 84 mm. Quebrada Guadual.

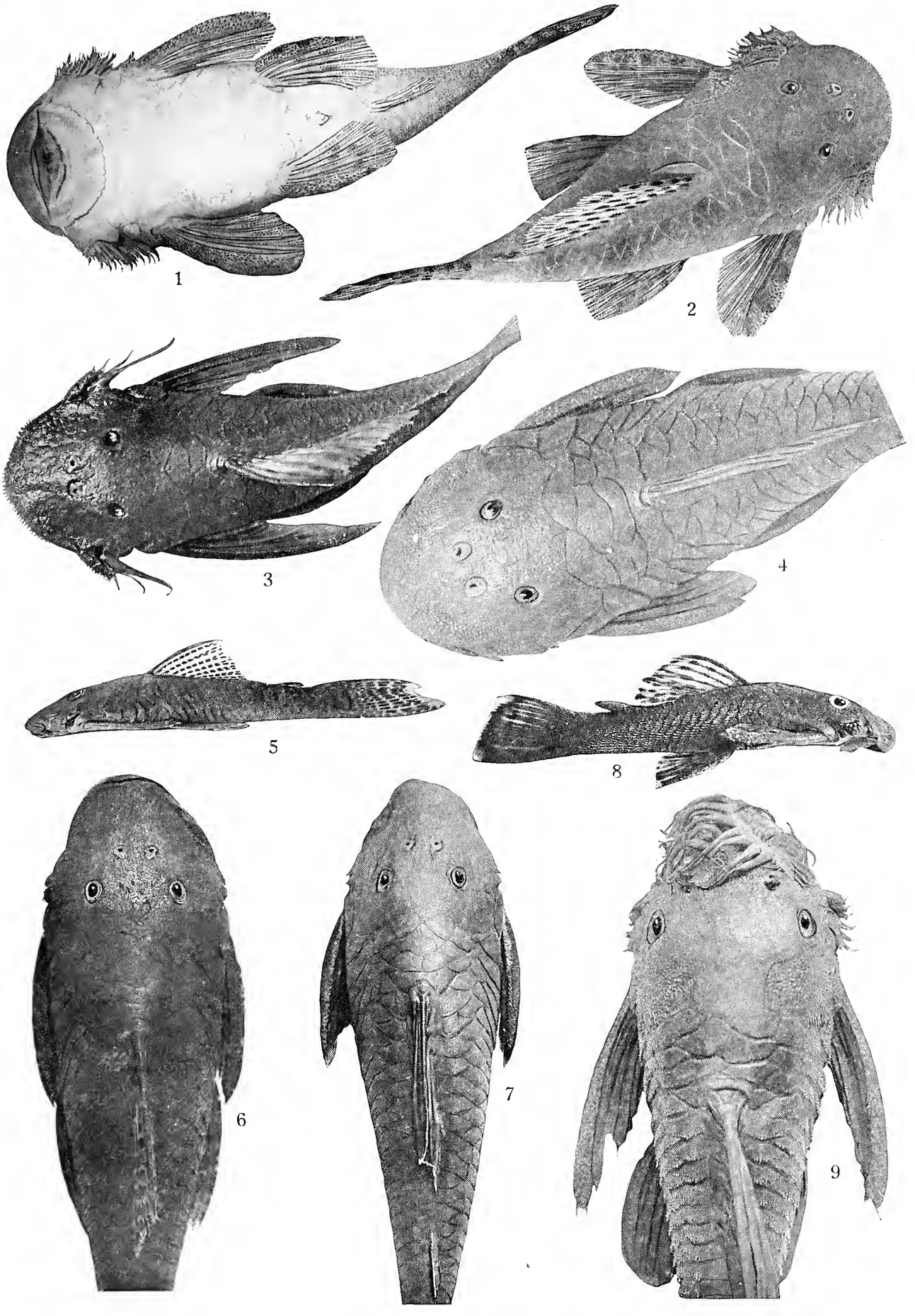
FIG. 5. *Chætostomus leucomelas* Eigenmann. *Type.* No. 13652, I. U. M., 140 mm. Rio Patia.

FIG. 6. *Chætostomus leucomelas* Eigenmann. (Dorsal view of type greatly enlarged.)

FIG. 7. *Chætostomus lepturus* Regan. No. 15302, I. U. M., 191 mm. Rio San Juan.

FIG. 8. *Ancistrus triradiatus* Eigenmann. *Paratype.* No. 7578, C. M., 52 mm. Villavicencio.

FIG. 9. *Ancistrus centrolepis* Regan. No. 13936, I. U. M., 184 mm. Truando.



Pseudancistrus, Chatostomus, Ancistrus.

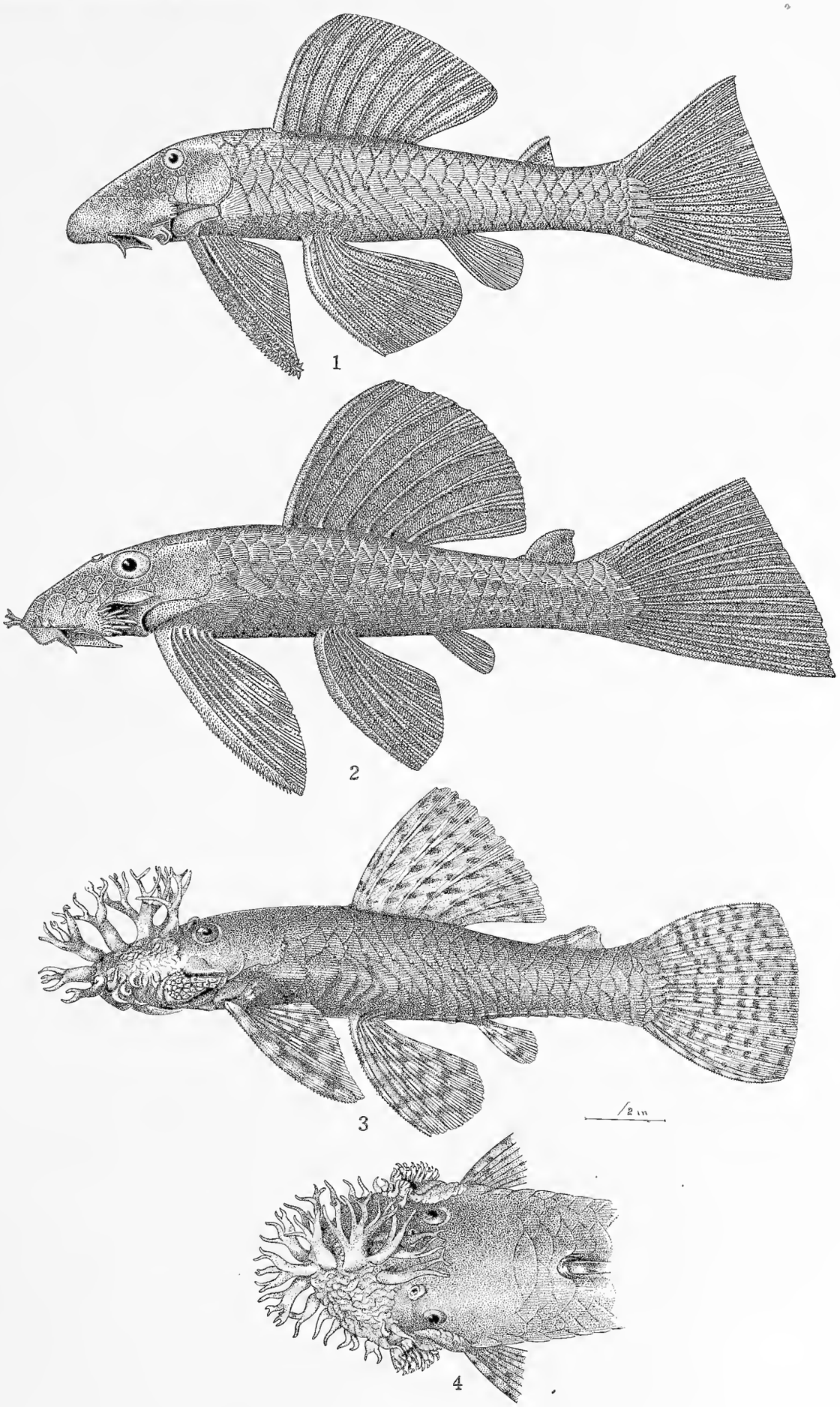
EXPLANATION OF PLATE XIII.

FIG. 1. *Chætostomus fischeri* Steindachner. No. 13653, I. U. M., 230 mm. Naranjito, Ecuador.

FIG. 2. *Ancistrus centrolepis* Regan. Type of *A. melas* Eigenmann, No. 7335, C. M., 106 mm. Condoto.

FIG. 3. *Ancistrus triradiatus* Eigenmann. *Type.* No. 13935, I. U. M., 114 mm. Quebrada Cramalote, Villavicencio.

FIG. 4. *Ancistrus triradiatus* Eigenmann. (Enlarged dorsal view of head of type.)



Chætostomus, Ancistrus.

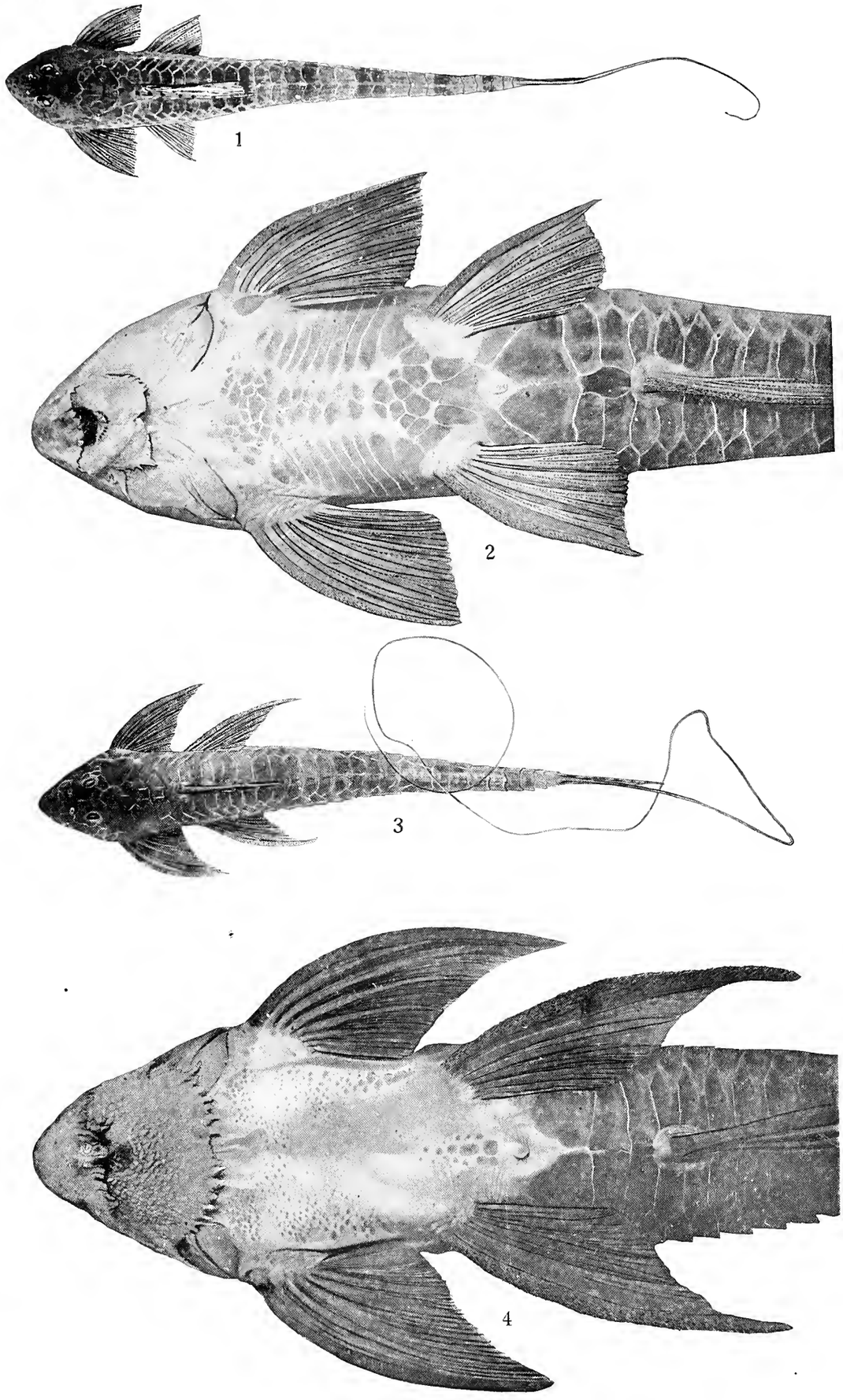
EXPLANATION OF PLATE XIV.

FIG. 1. *Loricaria seminuda* Eigenmann and Vance. *Type.* No. 3807, C. M., 182 mm. Girardot. (Dorsal view.)

FIG. 2. *Loricaria seminuda* Eigenmann and Vance. (Ventral view of type, enlarged.)

FIG. 3. *Loricaria gymnogaster* Eigenmann and Vance. *Type.* No. 12691, I. U. M., 182 mm. Apulo.

FIG. 4. *Loricaria gymnogaster* Eigenmann and Vance. (Enlarged ventral view of type.)



Loricaria.

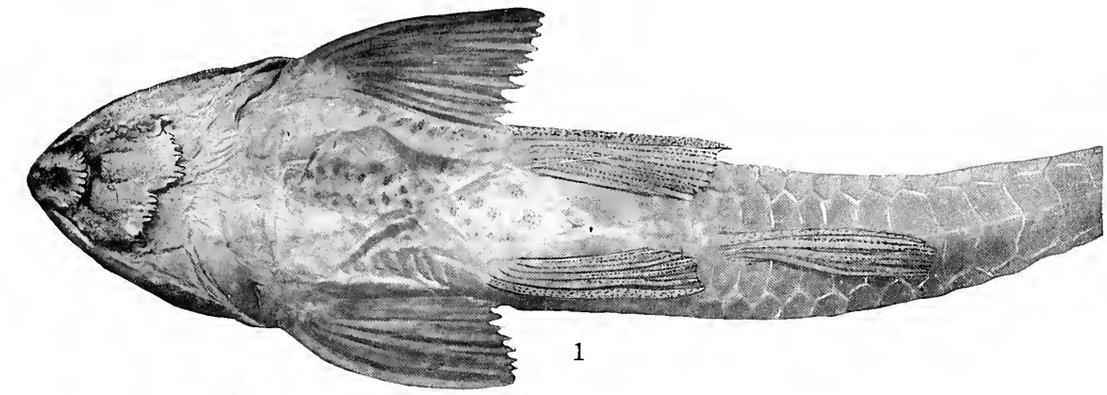
EXPLANATION OF PLATE XV.

FIG. 1. *Loricaria fimbriata* Eigenmann and Vance. *Type.* No. 3808, C. M., 114 mm. over all. Boca del Certegui. (Enlarged ventral view.)

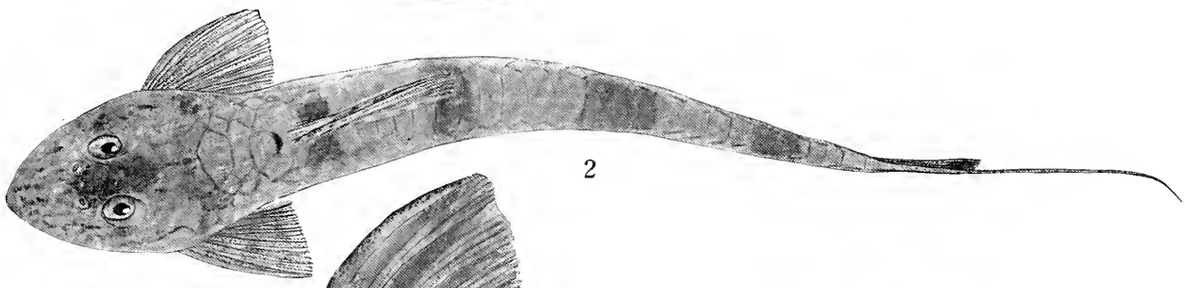
FIG. 2. *Loricaria fimbriata* Eigenmann and Vance. (Dorsal view of type.)

FIG. 3. *Loricaria latiura* Eigenmann and Vance. No. 3806, C. M., 210 mm. Boca de Certegui.

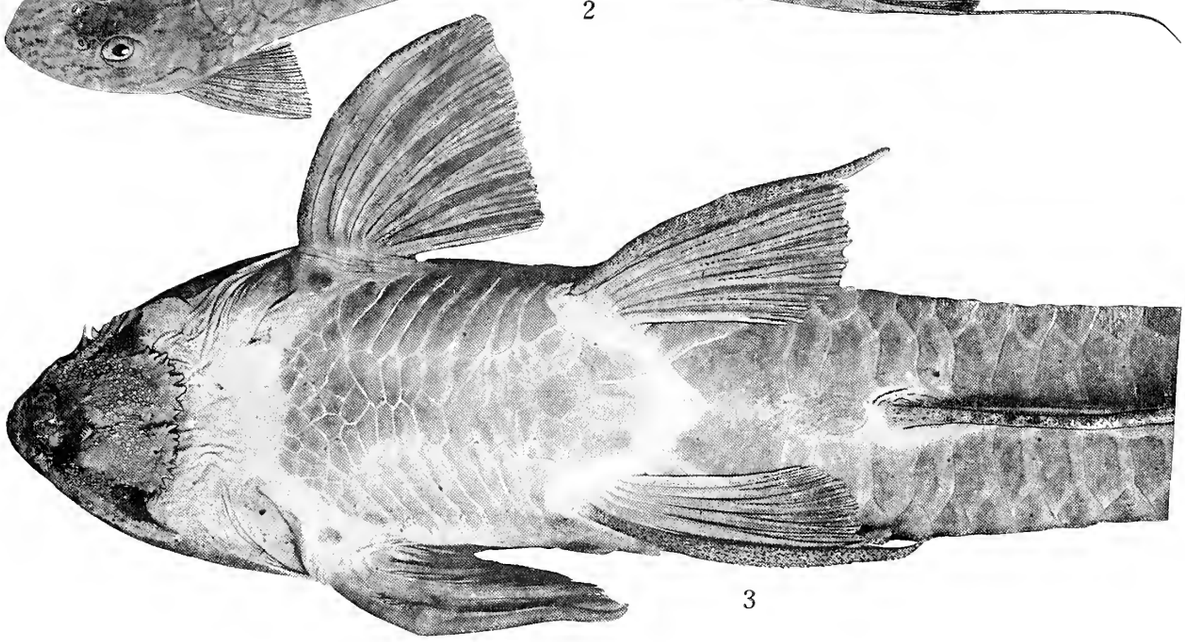
FIG. 4. *Loricaria magdalenæ* Steindachner. No. 12784, I. U. M., 192 mm. over all. Istmina.



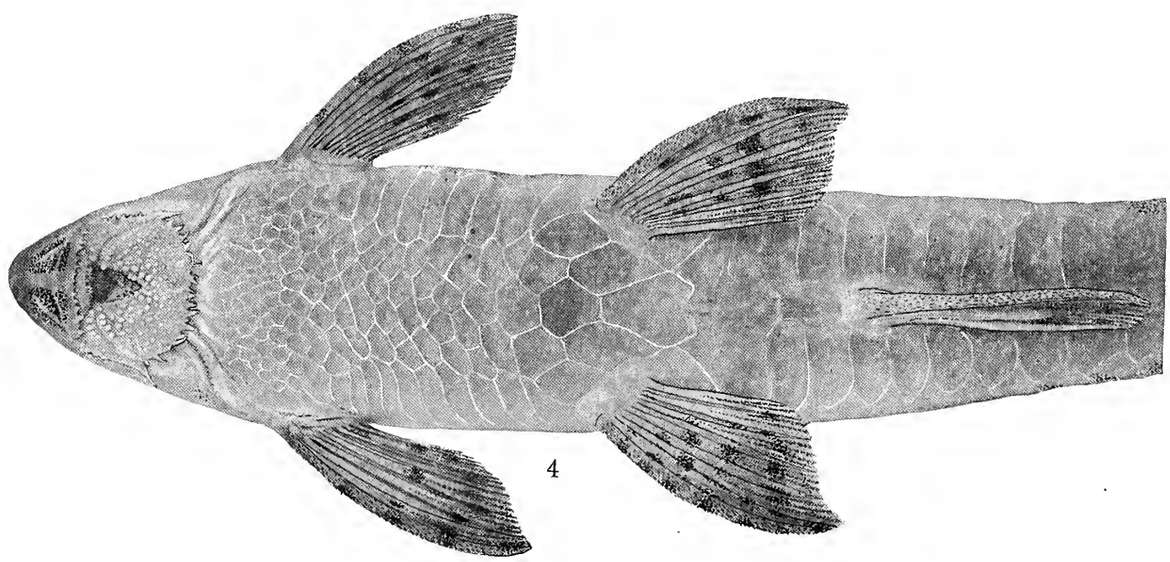
1



2



3



4

Loricaria.

EXPLANATION OF PLATE XVI.

FIG. 1. *Sturisoma leightoni* Regan. No. 12789, I. U. M., 111 mm. Paila. (Dorsal view.)

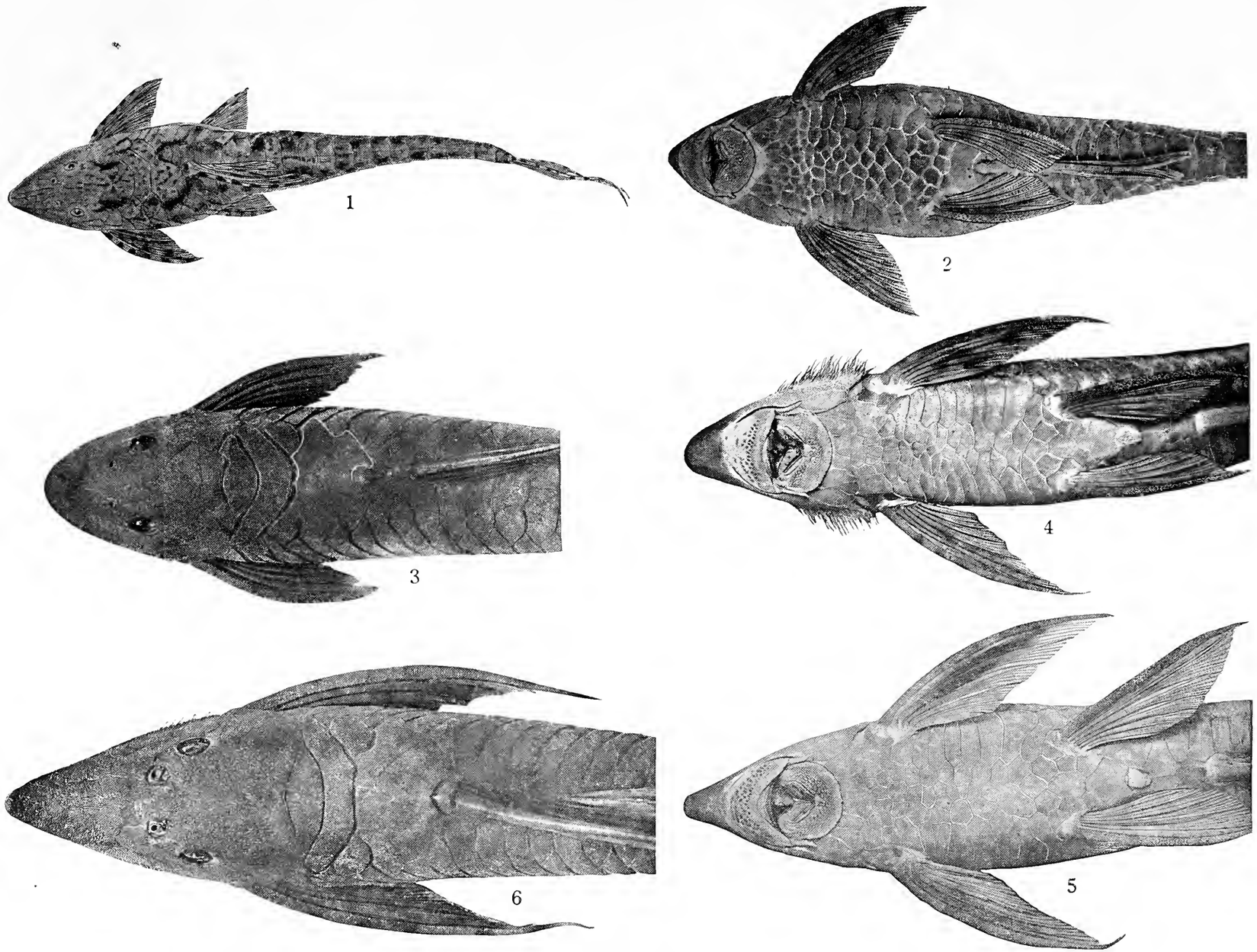
FIG. 2. *Sturisoma leightoni* Regan. Ventral view of the same specimen, enlarged.

FIG. 3. *Sturisoma cituriense* Meek and Hildebrand. No. 13990, I. U. M., 200 mm. to end of middle caudal ray. Boca de Cupe.

FIG. 4. *Sturisoma panamense* Eigenmann and Eigenmann. No. 12782, I. U. M., ♂, 226 mm. to tip of caudal. Istmina.

FIG. 5. *Sturisoma panamense* Eigenmann and Eigenmann. No. 12782, I. U. M., ♀, 227 mm. Puerto Negria.

FIG. 6. *Sturisoma panamense* Eigenmann and Eigenmann. No. 13966, I. U. M., 194 mm. to end of middle caudal rays. Certegui.



Sturisoma.

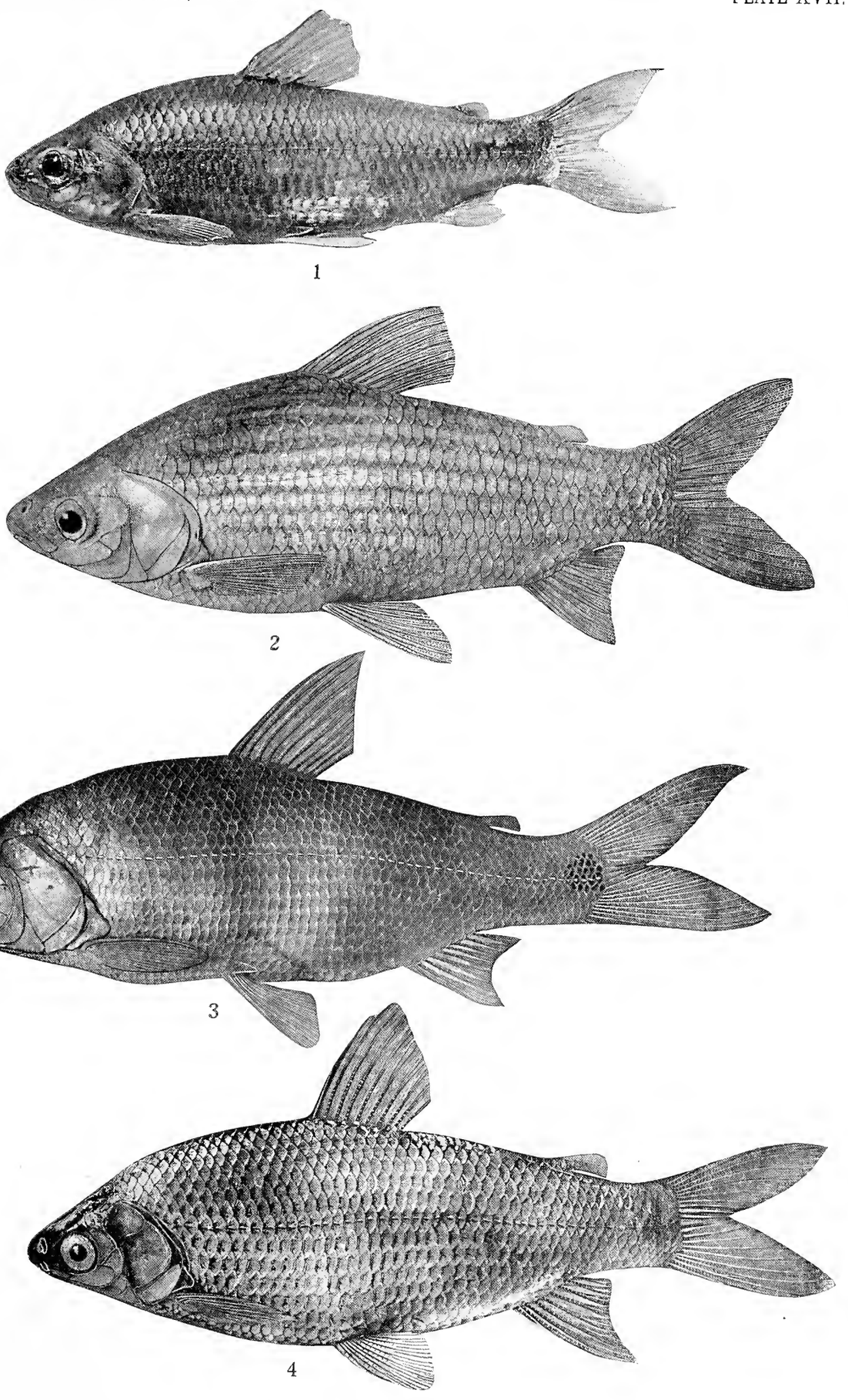
EXPLANATION OF PLATE XVII.

FIG. 1. *Curimatus metæ* Eigenmann. *Type.* No. 3844, C. M., 118 mm. Quebrada Cramalote, Villavicencio.

FIG. 2. *Curimatus magdalenæ* Steindachner. No. 5125, C. M., 200 mm. Boca de Certegui.

FIG. 3. *Curimatus boulengeri* Pellegrin. No. 13474, I. U. M., 197 mm. Naranjito, Ecuador.

FIG. 4. *Curimatus troschelį* Günther. No. 13538, I. U. M., 193 mm. Naranjito, Ecuador.



1

2

3

4

Curimatus.

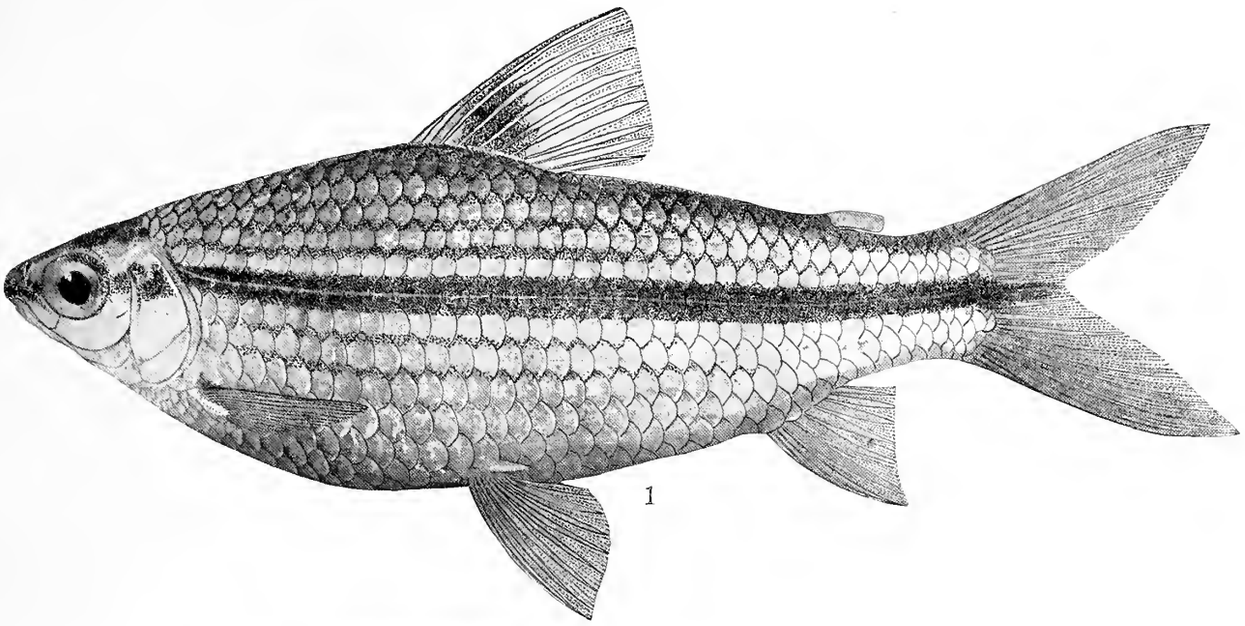
EXPLANATION OF PLATE XVIII.

FIG. 1. *Curimatus atratoënsis* Eigenmann. *Type*. No. 4814, C. M., 107 mm. Quibdo.

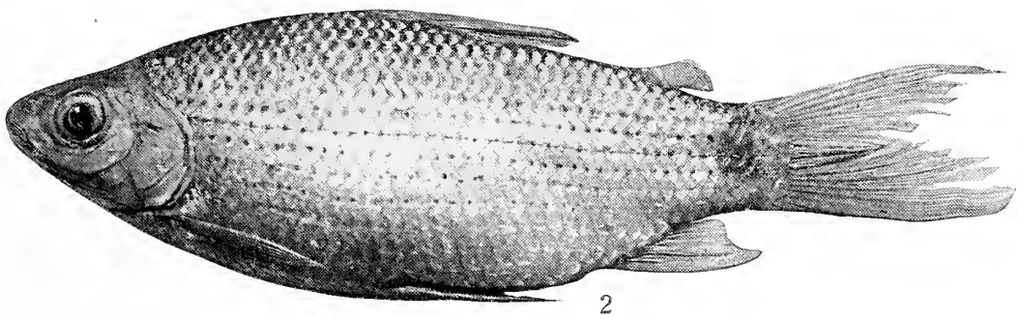
FIG. 2. *Curimatus lineopunctatus* Boulenger. No. 12807, I. U. M., 135 mm. Puerto Negria.

FIG. 3. *Curimatus patiæ* Eigenmann. *Type*. No. 5368, C. M., 168 mm. Barbacoas.

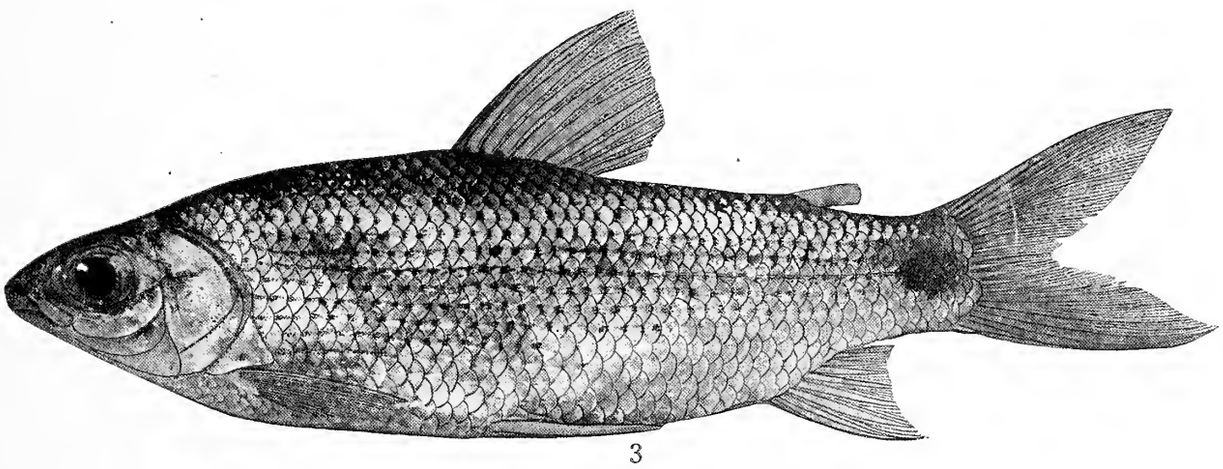
FIG. 4. *Curimatus peruanus* Eigenmann. *Type*. No. 15162, I. U. M., 160 mm. Sullana.



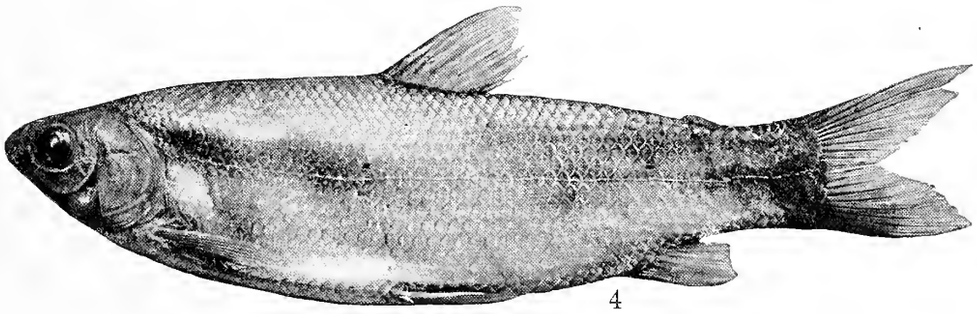
1



2



3



4

Curimatus.

EXPLANATION OF PLATE XIX.

FIG. 1. *Parodon suborbitalis* Cuvier and Valenciennes. No. 12831, I. U. M., 43 mm. Peñas Blancas.

FIG. 2. *Parodon caliense* Boulenger. No. 5115, C. M., 43 mm. Peñas Blancas.

FIG. 3. *Apareiodon ecuadoriensis* Eigenmann and Henn. *Type.* No. 13103, I. U. M., 49 mm. Vinces.

FIG. 4. *Apareiodon terminalis* Eigenmann and Henn. *Type.* 13104a, I. U. M., 40 mm. Vinces.

FIG. 5. *Prochilodus magdalenæ* Steindachner. No. 12885, I. U. M., 117 mm., *juv.* Calamar.

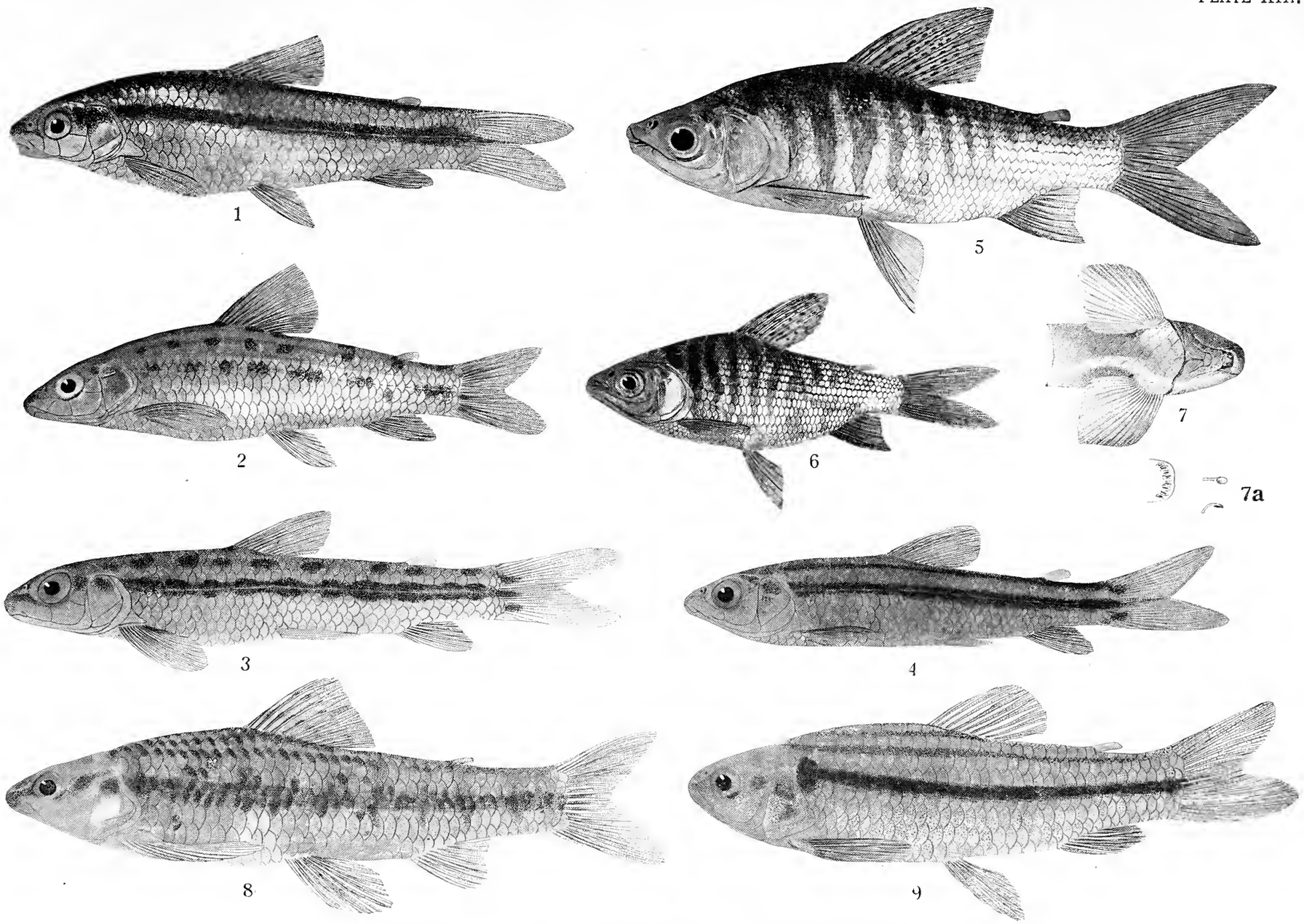
FIG. 6. *Prochilodus magdalenæ* Steindachner. No. 12885, I. U. M., 83 mm., *juv.* Calamar.

FIG. 7. *Saccodon wagneri* Kner and Steindachner. (Ventral view of head, after Kner and Steindachner.)

FIG. 7a. *Saccodon wagneri* Kner and Steindachner. (Teeth, after Kner and Steindachner.)

FIG. 8. *Characidium phoxocephalum* Eigenmann. *Type.* No. 4851, C. M., 68 mm. Paila.

FIG. 9. *Characidium caucanum* Eigenmann. *Type.* No. 4847, C. M., 51 mm. Cali.



Parodon, Apareiodon, Prochilodus, Saccodon, Characidium.

EXPLANATION OF PLATE XX.

FIG. 1. *Prochilodus humeralis* Günther. No. 13577, I. U. M., 206 mm. Naranjito Ecuador.

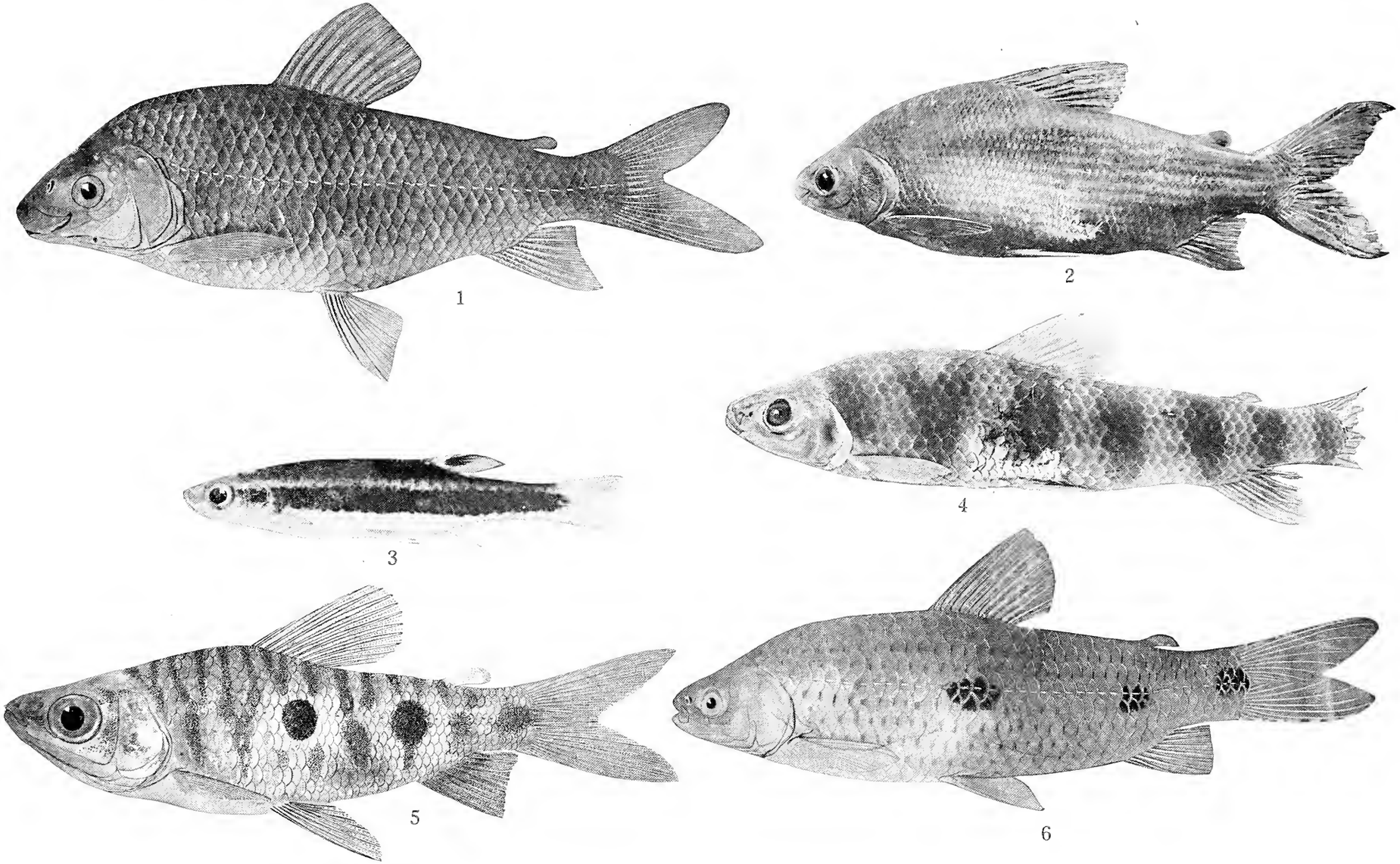
FIG. 2. *Prochilodus mariæ* Eigenmann. *Type*. No. 15150, I. U. M., 296 mm. Barrigón.

FIG. 3. *Copeina metæ* Eigenmann. *Type*. No. 13251, I. U. M., 35 mm. Barrigón.

FIG. 4. *Leporinus y-ophorus* Eigenmann. *Type*. No. 15026, I. U. M., 167 mm. to end of scales on caudal. Barrigón.

FIG. 5. *Leporinus muyscorum* Steindachner. Part of 13917, I. U. M., 41 mm., *juv*. Calamar.

FIG. 6. *Leporinus ecuadoriensis* Eigenmann and Henn. *Type*. No. 13116, I. U. M., 325 mm. Naranjito, Ecuador.



Prochilodus, Copeina, Leporinus.

EXPLANATION OF PLATE XXI.

FIG. 1. *Pyrrhulina lugubris* Eigenmann. *Type*. No. 15041, I. U. M., 53 mm., ♂. Barrigón.

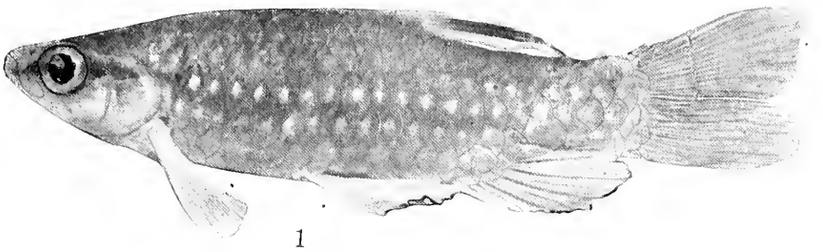
FIG. 2. *Lebiasina bimaculata* Cuvier and Valenciennes. No. 13069, I. U. M., 156 mm. Rio Chanchan.

FIG. 3. *Lebiasina multimaculata* Boulenger. No. 13068, I. U. M., 176 mm. Rio Calima.

FIG. 4. *Piabucina panamensis* Gill. No. 12961, I. U. M., 149 mm. Raspadura, Colombia.

FIG. 5. *Piabucina panamensis* Gill. Photograph of the type in the U. S. N. M.

FIG. 6. *Piabucina astrigata* Regan. No. 13534, I. U. M., 70 mm. Mindo, Ecuador.



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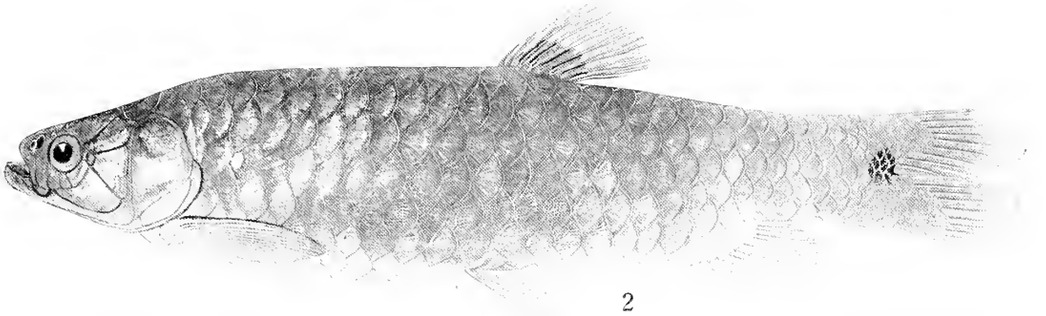
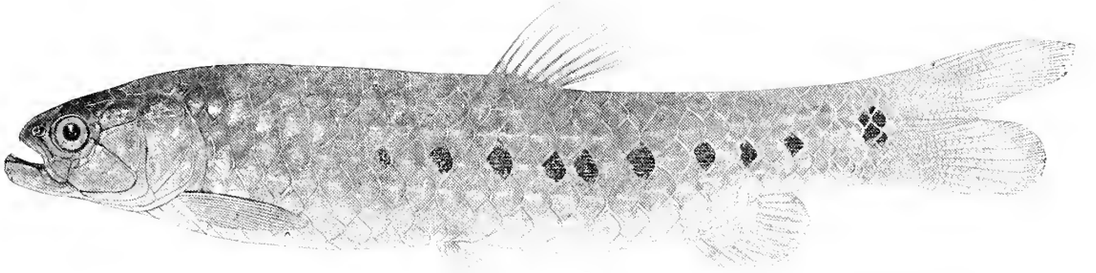


2



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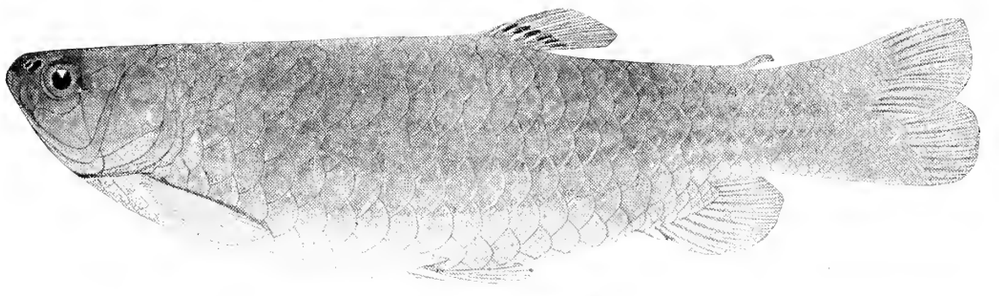

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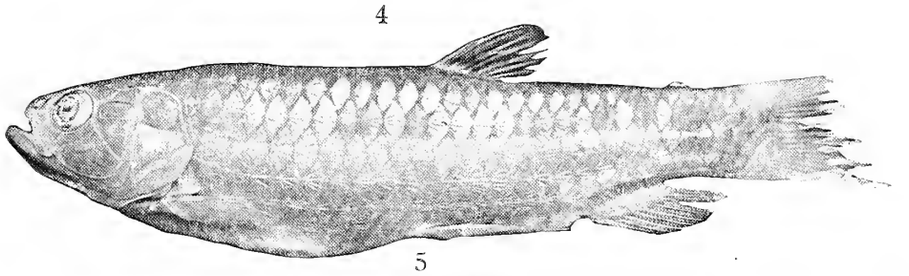
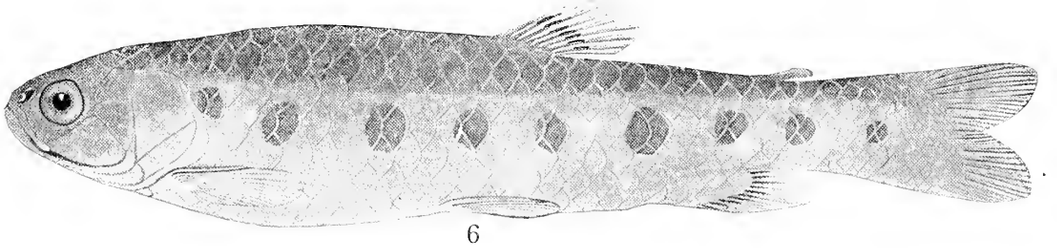


5



6

Pyrrhulina, Lebiasina, Piabucina.

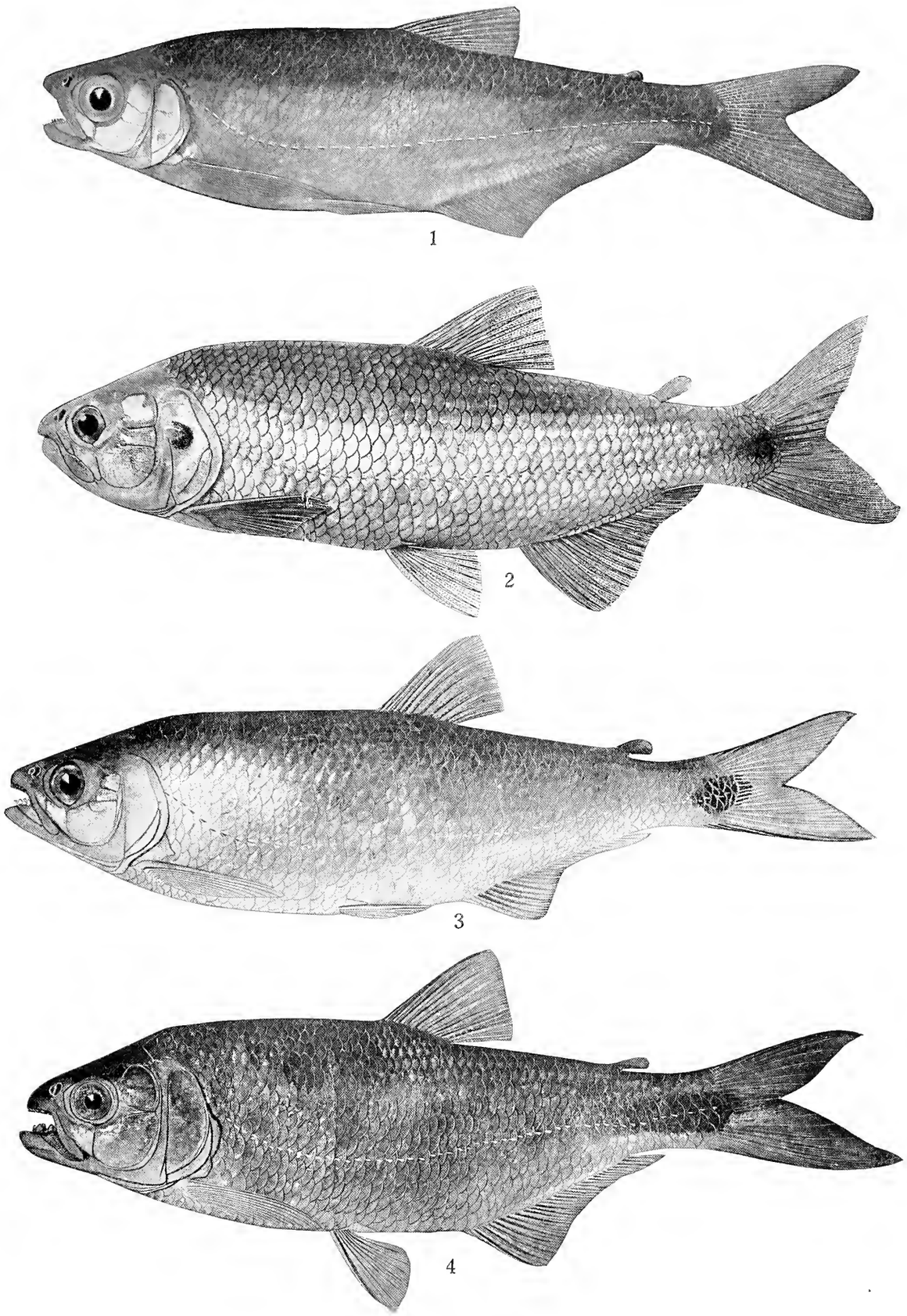
EXPLANATION OF PLATE XXII.

FIG. 1. *Brycon dentex* Günther. No. 13462, I. U. M., 154 mm. Colimes, Ecuador.

FIG. 2. *Brycon henni* Eigenmann. *Type.* No. 5152, C. M., 250 mm. Caldas.

FIG. 3. *Brycon oligolepis* Regan. No. 12977, I. U. M., 245 mm. Rio Telembi above Barbacoas.

FIG. 4. *Brycon ecuadoriensis* Eigenmann and Henn. *Type.* No. 13470, I. U. M., 245 mm. to end of lower caudal lobe. Naranjito, Ecuador.



Brycon.

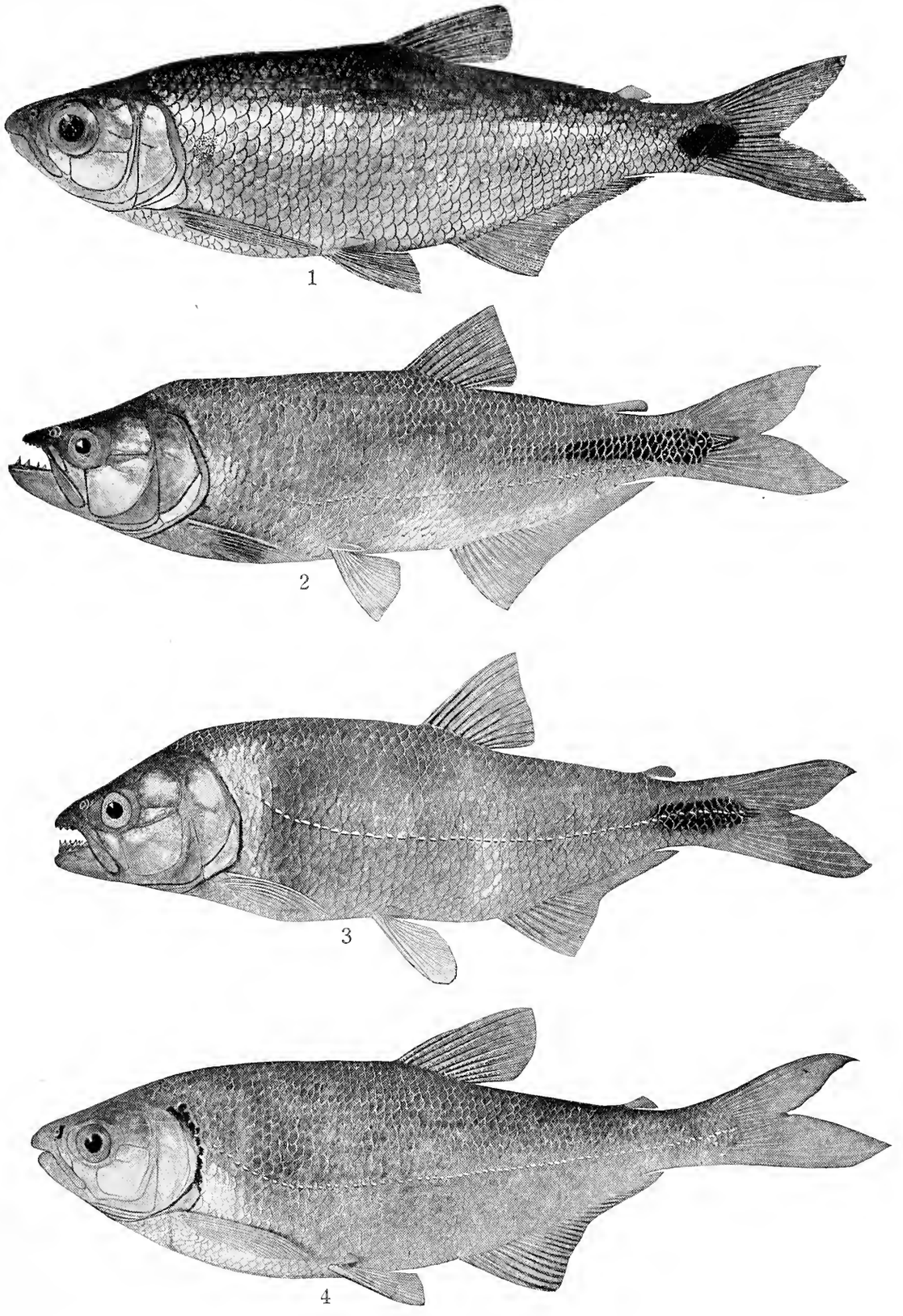
EXPLANATION OF PLATE XXIII.

FIG. 1. *Brycon petrosus* Meek and Hildebrand. Specimen in Field Museum of Nat. History, 127 mm. Mandingo.

FIG. 2. *Brycon alburnus* Günther. No. 13466, I. U. M., 315 mm. Naranjito, Ecuador.

FIG. 3. *Brycon atricaudatus* (Kner). No. 13463, I. U. M., 278 mm. Naranjito, Ecuador.

FIG. 4. *Brycon meeki* Eigenmann and Hildebrand. *Type.* No. 13467, I. U. M., 276 mm. Barbacoas, Colombia.



Brycon.

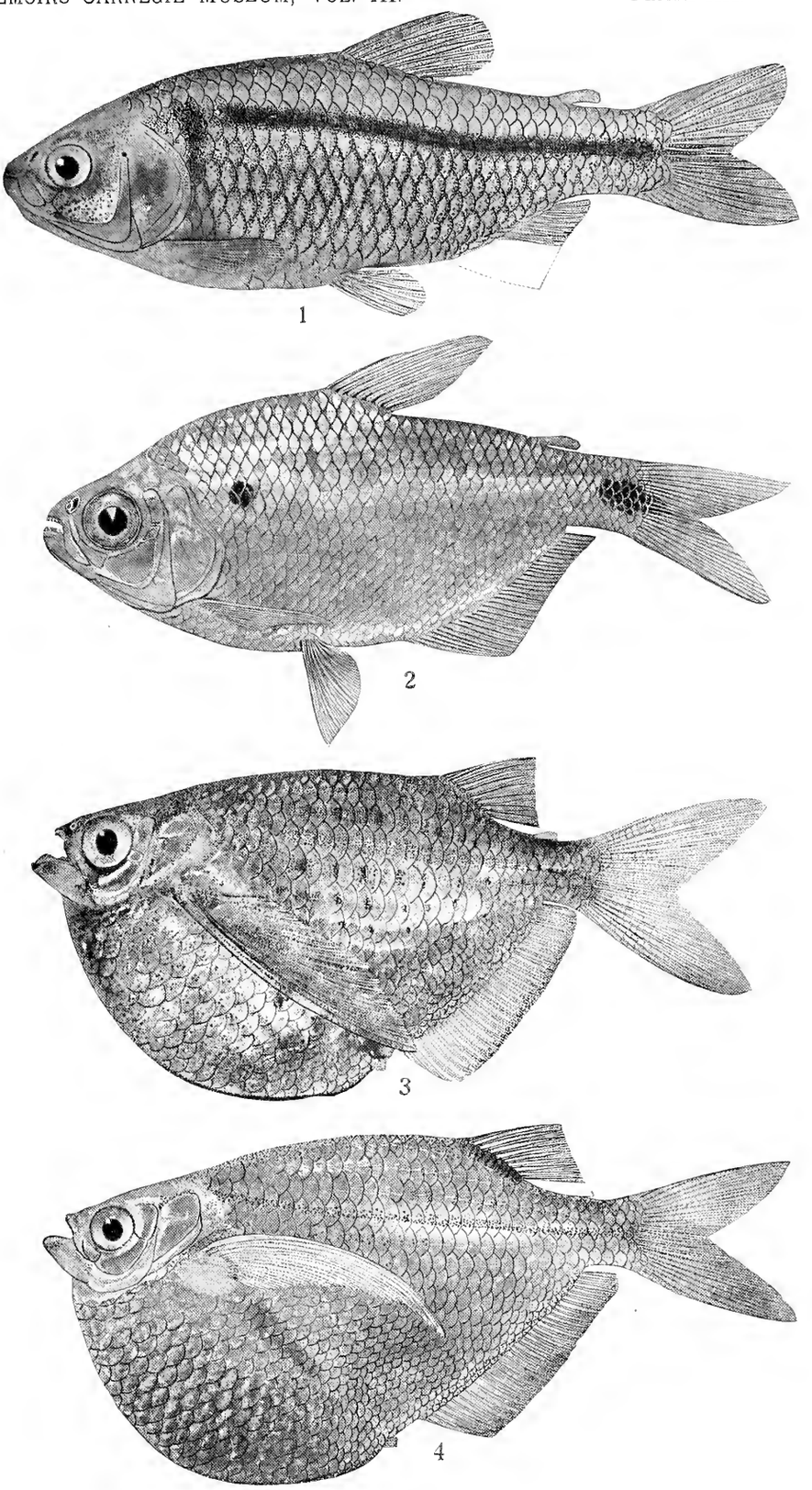
EXPLANATION OF PLATE XXIV.

FIG. 1. *Hyphessobrycon pœcilioides* Eigenmann. *Paratype.* No. 5901, C. M., 55 mm., ♀. Cali.

FIG. 2. *Astyanax magdalenæ* Eigenmann and Henn. *Type.* No. 5822, C. M., 53 mm. Girardot.

FIG. 3. *Thoracocharax maculatus* Steindachner. Type of *T. brevis* Eigenmann, No. 4845, C. M., 47 mm. Boca de Raspadura.

FIG. 4. *Thoracocharax magdalenæ* Eigenmann. *Type.* No. 4846, C. M., 48 mm. Girardot.



Hyphessobrycon, Astyanax, Thoracocharax.

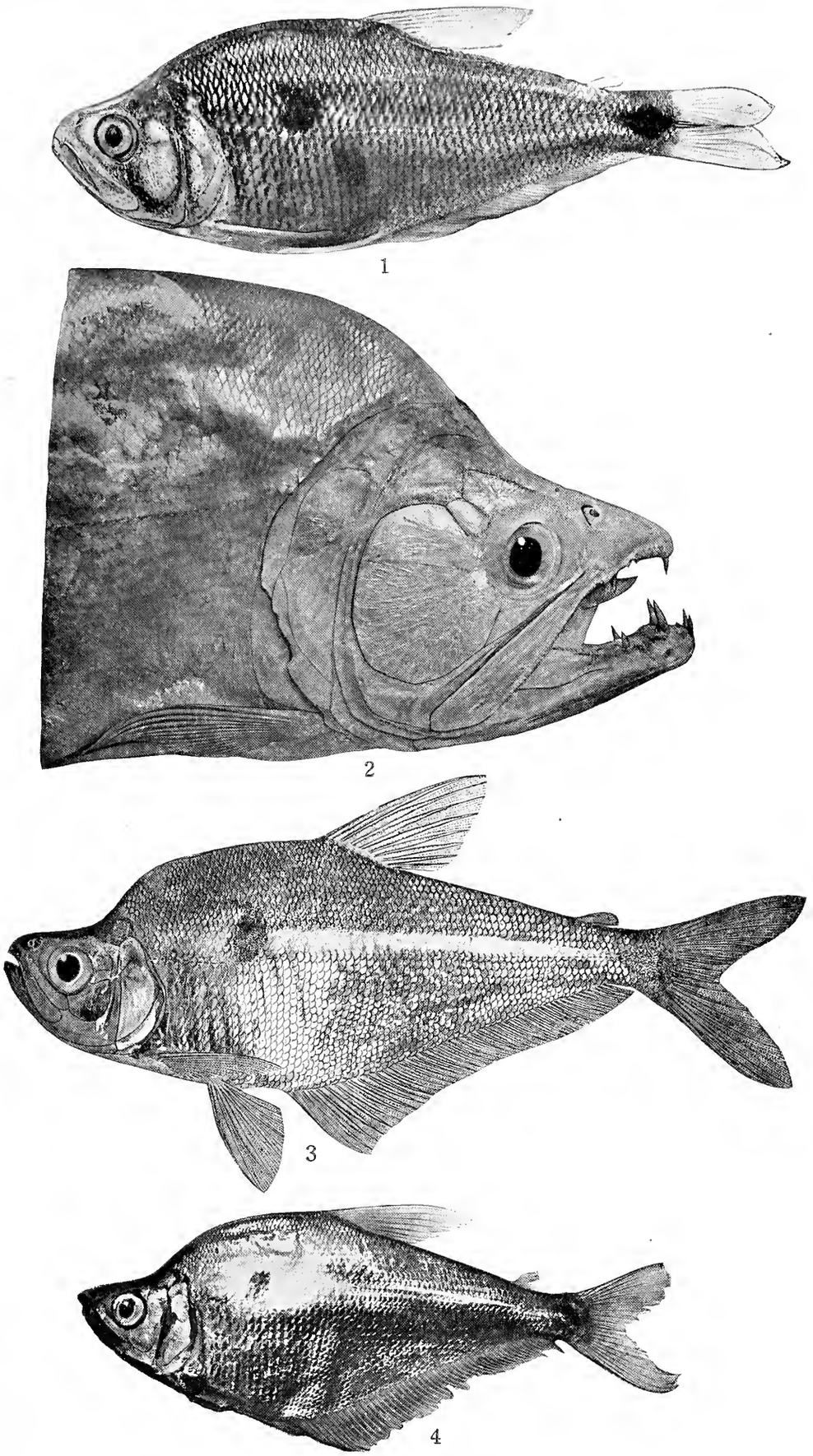
EXPLANATION OF PLATE XXV.

FIG. 1. *Charax metæ* Eigenmann. *Type.* No. 15027, I. U. M., 108 mm. Barrigón.

FIG. 2. *Charax atratoënsis* Eigenmann. *Type.* No. 1664, U. S. N. M., 300 mm. to end of lateral line. Truando.

FIG. 3. *Ræboides hildebrandi* Eigenmann. *Type.* No. 5186, C. M., 157 mm. Istmina.

FIG. 4. *Ræboides meeki* Eigenmann. *Type.* No. 3840, C. M., 126 mm. Quibdo.



Charax, Rœboides.

EXPLANATION OF PLATE XXVI.

FIG. 1. *Gilbertolus alatus* (Steindachner). No. 5628, C. M., 156 mm. Boca de Certegui.

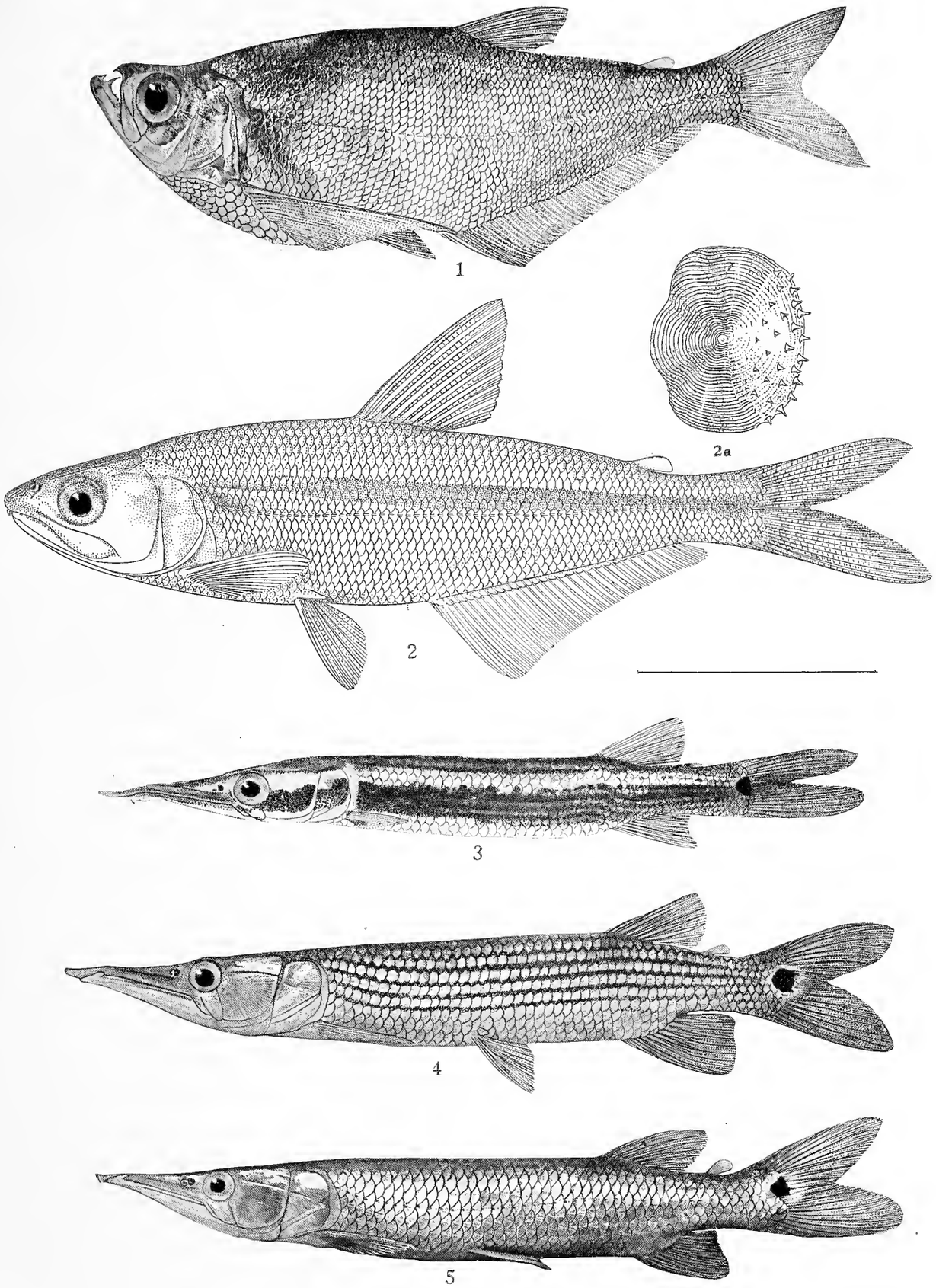
FIG. 2. *Acestrocephalus anomalus* (Steindachner). No. 5043, C. M., about 100 mm. Girardot.

FIG. 2a. Lateral scale of *Acestrocephalus anomalus* (Steindachner), magnified.

FIG. 3. *Ctenolucius beani* (Fowler). No. 13052, I. U. M., *juv.*, 85 mm. Managru.

FIG. 4. *Ctenolucius beani* (Fowler). No. 13051, I. U. M., 176 mm. Truando.

FIG. 5. *Ctenolucius insculptus* (Steindachner). No. 12718, I. U. M., 166 mm. Calamar.



Gilbertolus, Acestrocephalus, Ctenolucius.

EXPLANATION OF PLATE XXVII.

FIGS. 1–2. *Mollienisia caucana* (Steindachner). After Steindachner.

FIG. 3. *Mollienisia caucana* (Steindachner). No. 5826, C. M., ♀, 34 mm. Cienaga at Calamar.

FIG. 4. *Rivulus elegans* Steindachner. After Steindachner.

FIG. 5. *Gambusia caliensis* Eigenmann and Henn. *Type.* No. 6700, C. M., ♀, 34 mm. Cali.

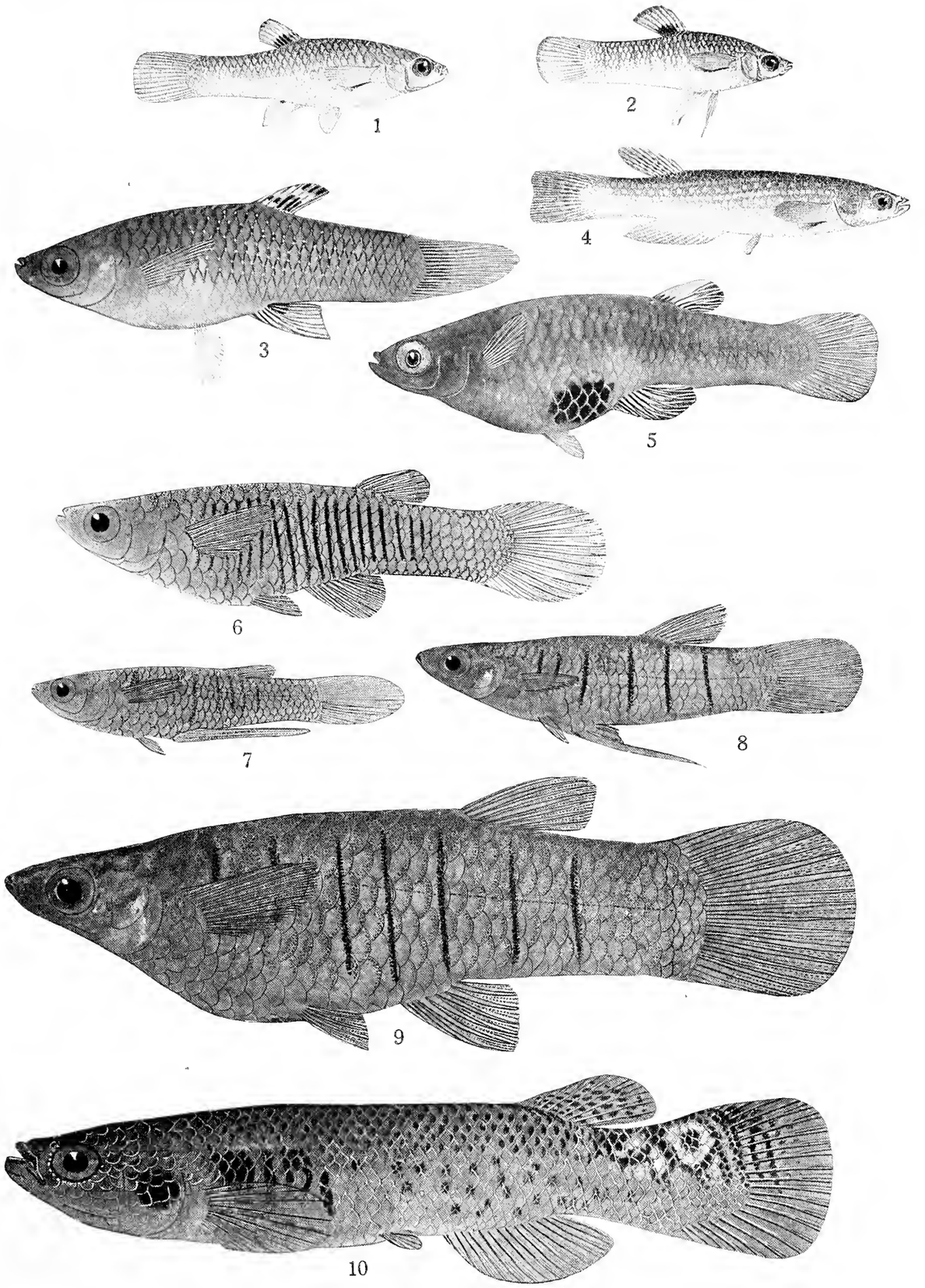
FIG. 6. *Pseudopœcilia fria* Eigenmann and Henn. *Type.* No. 13107a, I. U. M., ♀, 28 mm. Vinces.

FIG. 7. *Pseudopœcilia fria* Eigenmann and Henn. *Allotype.* No. 13107, I. U. M., ♂, 18.5 mm. Vinces.

FIG. 8. *Pœciliopsis colombiana* (Eigenmann and Henn). *Allotype.* No. 4838, C. M., ♂, 35 mm. Rio Dagua.

FIG. 9. *Pœciliopsis colombiana* (Eigenmann and Henn). *Type.* No. 4837, C. M., ♀, 64 mm. Rio Dagua.

FIG. 10. *Rivulus magdalenæ* Eigenmann and Henn. *Type.* No. 5813, C. M., 56 mm. Ibagué.



Mollienisia, Rivulus, Gambusia, Pseudopœcilia, Pœciliopsis.

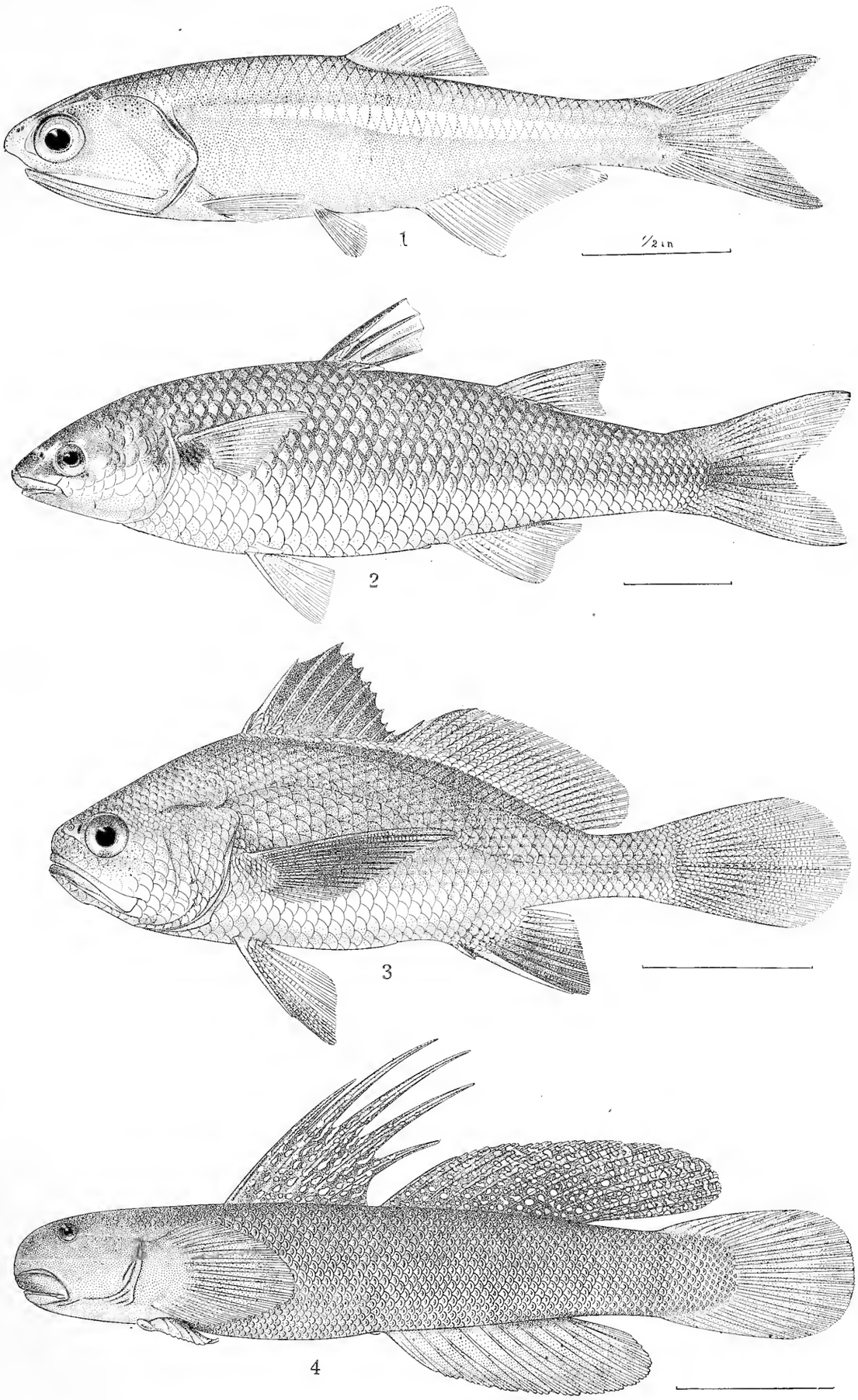
EXPLANATION OF PLATE XXVIII.

FIG. 1. *Stolephorus branchiomelas* Eigenmann. *Type.* No. 7491, C. M., 68 mm. Mouth of Rio Dagua.

FIG. 2. *Joturus daguæ* Eigenmann. *Type.* No. 7458, C. M., 195 mm. Rio Dagua at Caldas.

FIG. 3. *Stellifer melanocheir* Eigenmann. *Type.* No. 7520, C. M., 120 mm. Tumaco.

FIG. 4. *Sicydium hildebrandi* Eigenmann. *Type.* No. 7466, C. M., 135 mm. Rio Dagua at Cisnero.



Stolephorus, Joturus, Stellifer, Sicydium.

EXPLANATION OF PLATE XXIX.

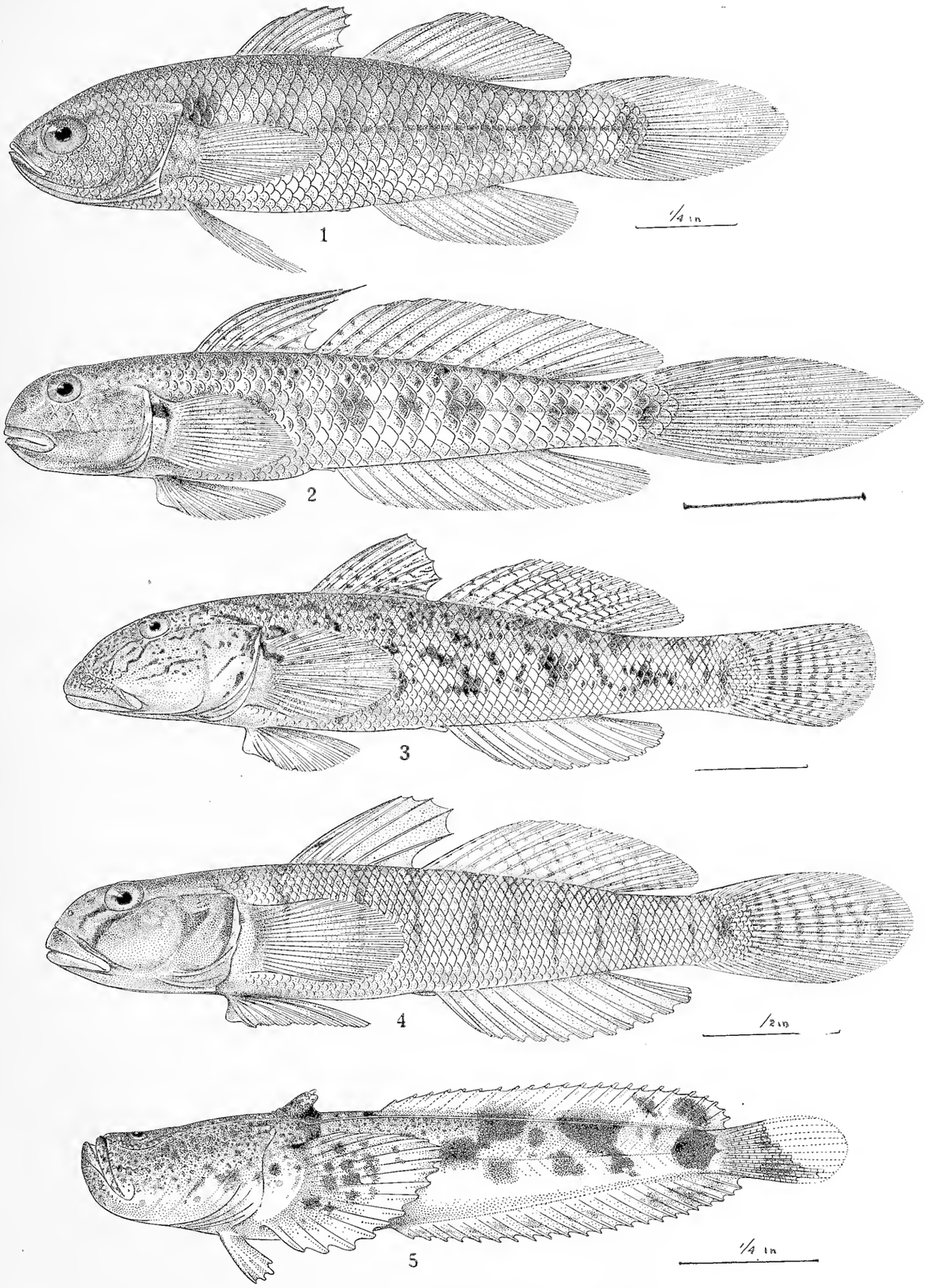
FIG. 1. *Hemieleotris levis* Eigenmann. *Type*. No. 13865, I. U. M., 48 mm. Buenaventura.

FIG. 2. *Gobius daguæ* Eigenmann. *Type*. No. 7481, C. M., about 133 mm. Rio Dagua.

FIG. 3. *Awaous transandeanus* (Günther). No. 7463a, C. M., 173 mm. Istmina.

FIG. 4. *Awaous decemlineatus* Eigenmann. *Type*. No. 7478, C. M., 80 mm. Quibdo.

FIG. 5. *Thalassophryne quadrizonatus* Eigenmann. *Type*. No. 3921, C. M., 35 mm. Truando.



Hemieleotris, Gobius, Awaous, Thalassophryne.

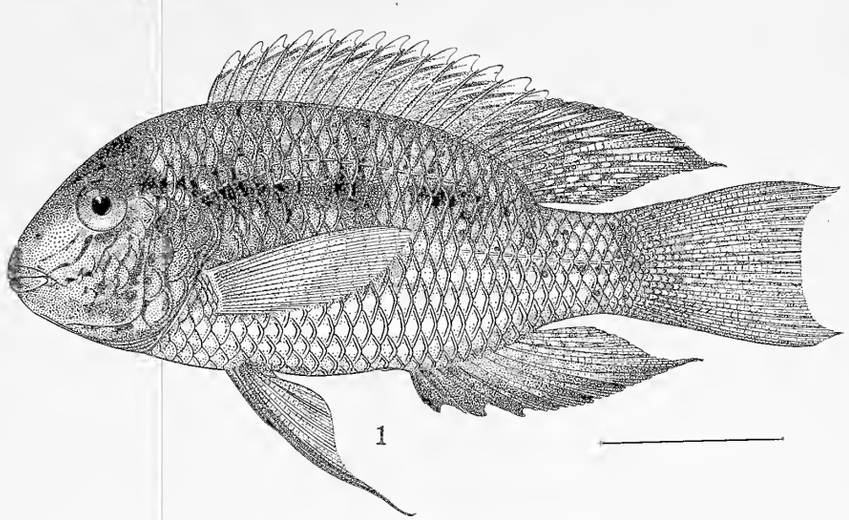
EXPLANATION OF PLATE XXX.

FIG. 1. *Æquidens mariæ* Eigenmann. *Type*. No. 15011, I. U. M., 110 mm. Cumaral.

FIG. 2. *Æquidens metæ* Eigenmann. *Type*. No. 13967, I. U. M., 155 mm. Barrigón.

FIG. 3. *Æquidens rivulatus* (Günther). No. 14191, I. U. M., 220 mm. over all, 202 mm. to end of caudal. Chone.

FIG. 4. *Æquidens biseriatus* Regan. No. 14198, I. U. M., 154 mm. Rio Calima.



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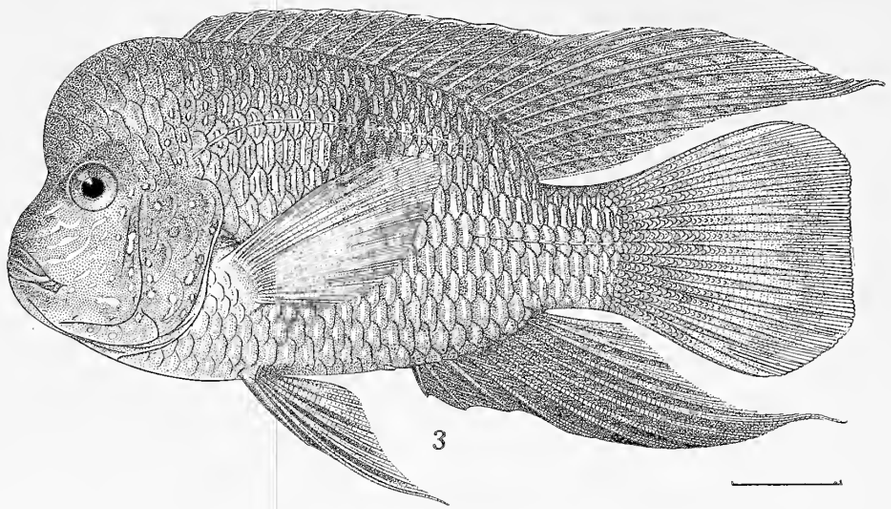

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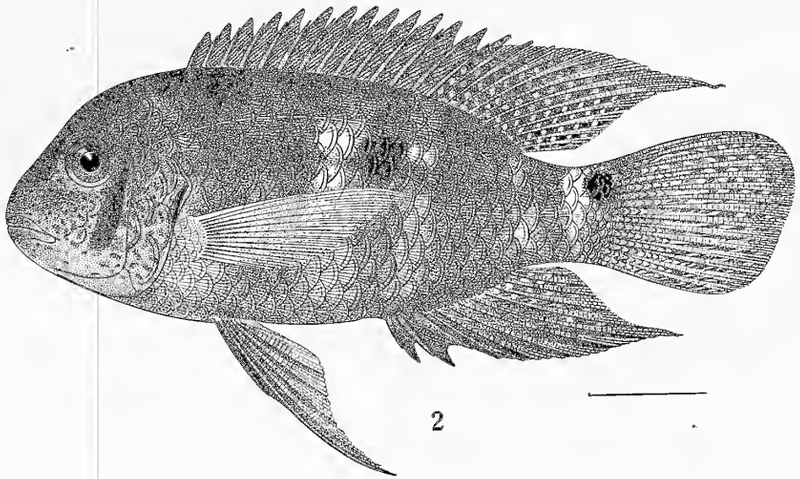

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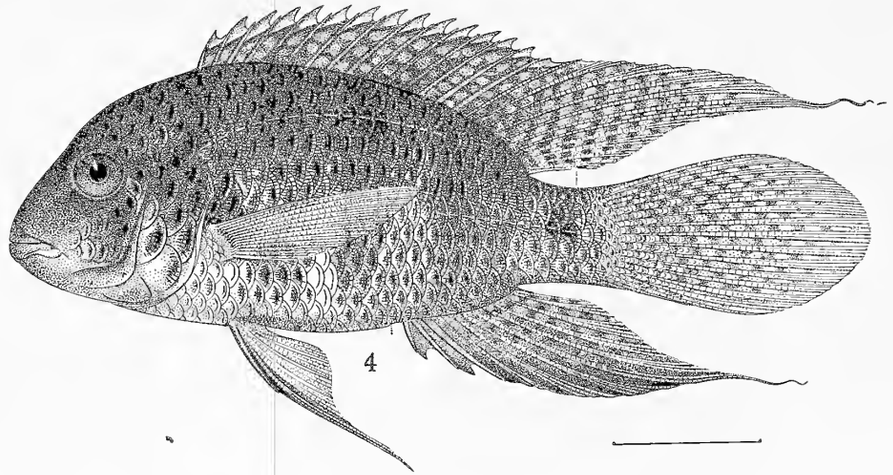


4

Æquidens.

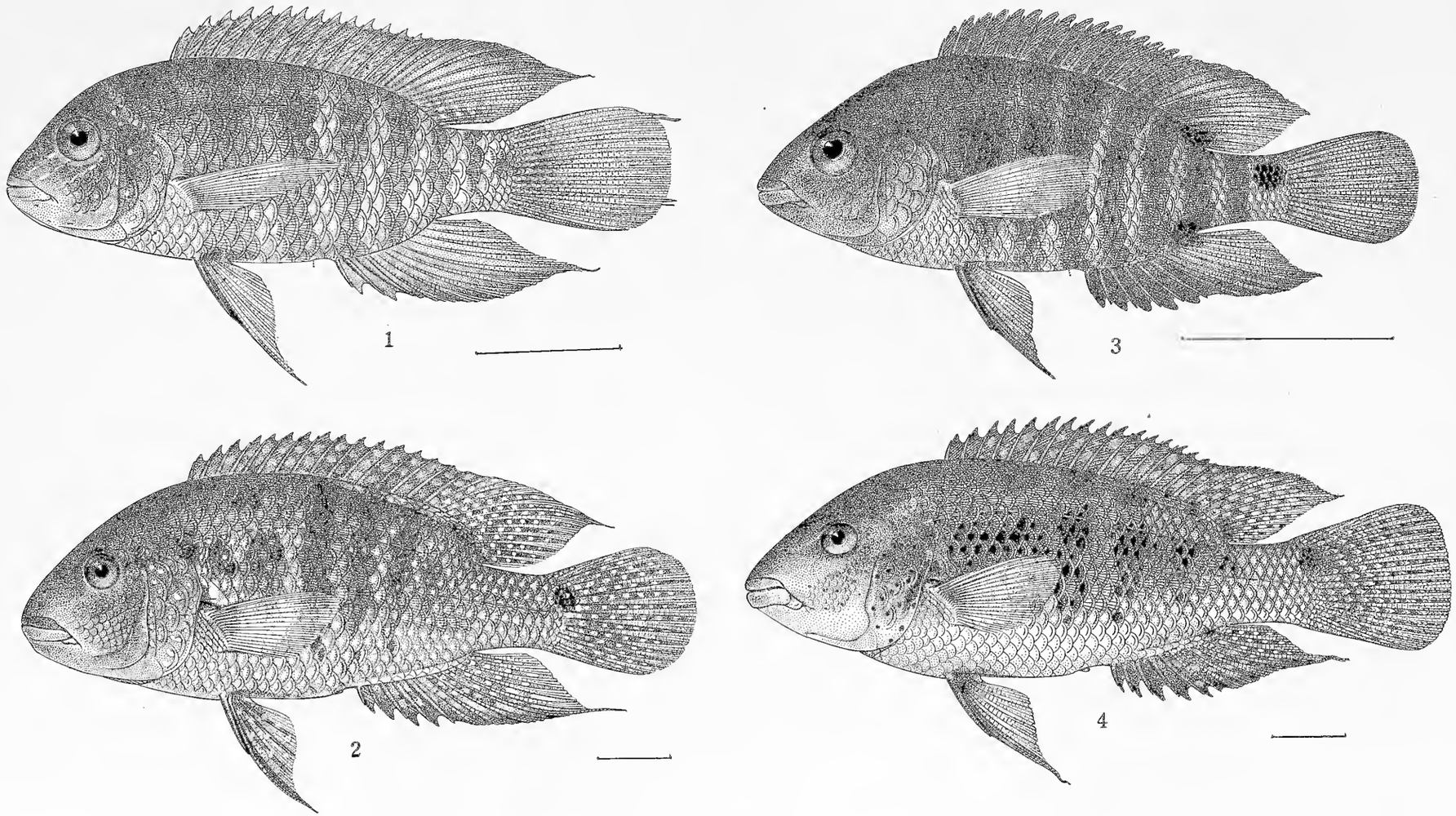
EXPLANATION OF PLATE XXXI.

FIG. 1. *Æquidens sapayensis* (Regan). No. 14196, I. U. M., 117 mm. to end of middle caudal rays. The fourth ray below the middle should be prolonged. Rio Telembi.

FIG. 2. *Cichlasoma ornatum* Regan. No. 14169, I. U. M., 225 mm. Rio Magui.

FIG. 3. *Cichlasoma ornatum gephyrum* Eigenmann. *Paratype.* No. 7639b, C. M., 78 mm. Rio Dagua, at Cordova.

FIG. 4. *Cichlasoma ornatum gephyrum* Eigenmann. *Type.* No. 7639a, C. M., 240 mm. Cordova.



Æquidens, Cichlasoma.

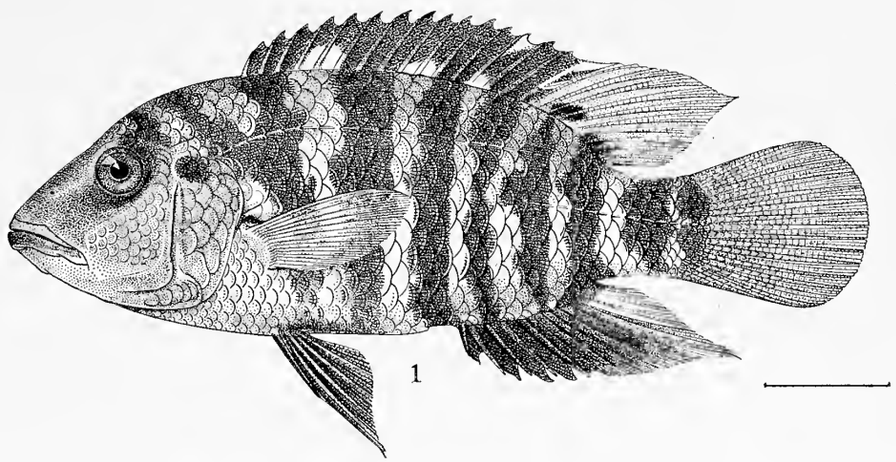
EXPLANATION OF PLATE XXXII.

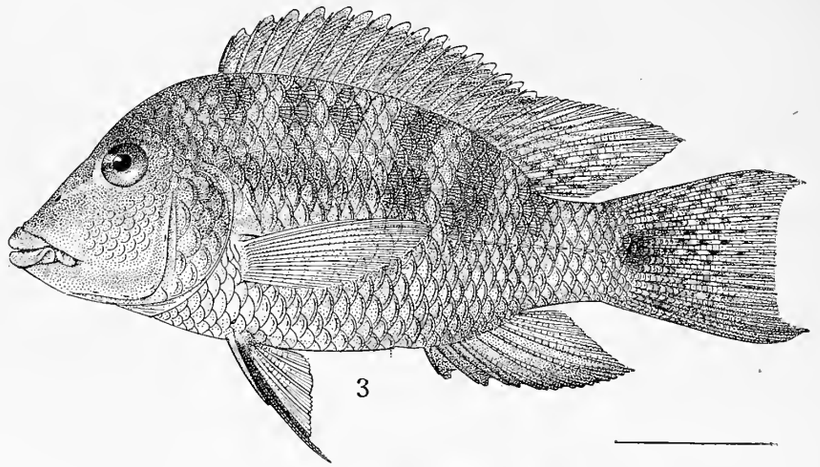
FIG. 1. *Cichlasoma festæ* (Boulenger). No. 14177, I. U. M., 174 mm. Rio Chanchan.

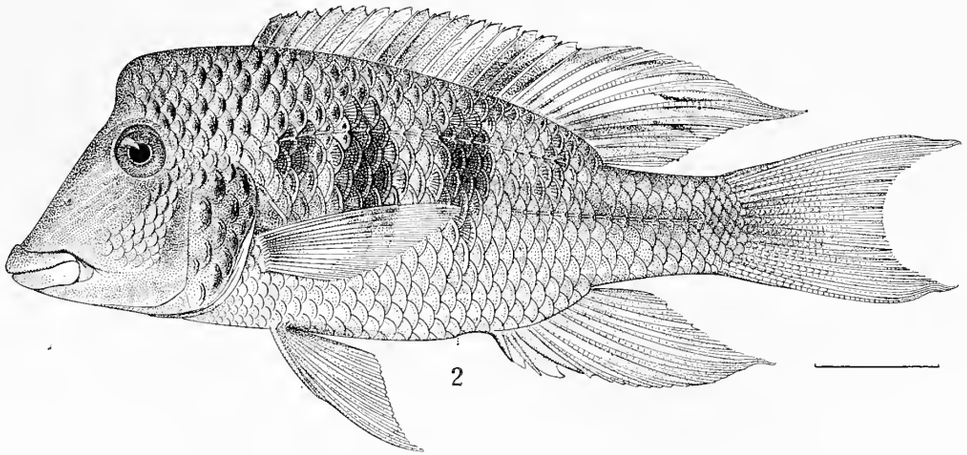
FIG. 2. *Geophagus pellegrini* Regan. No. 7617, C. M., 180 mm. to end of middle caudal rays. Istmina.

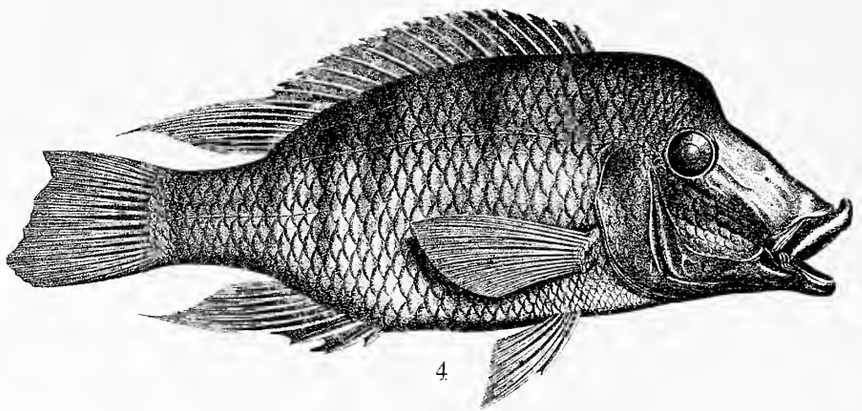
FIG. 3. *Geophagus steindachneri* Eigenmann and Hildebrand. No. 7605, C. M., 130 mm. Soplaviento.

FIG. 4. *Geophagus crassilabris* Steindachner. (After Steindachner.)









Cichlasoma, Geophagus.

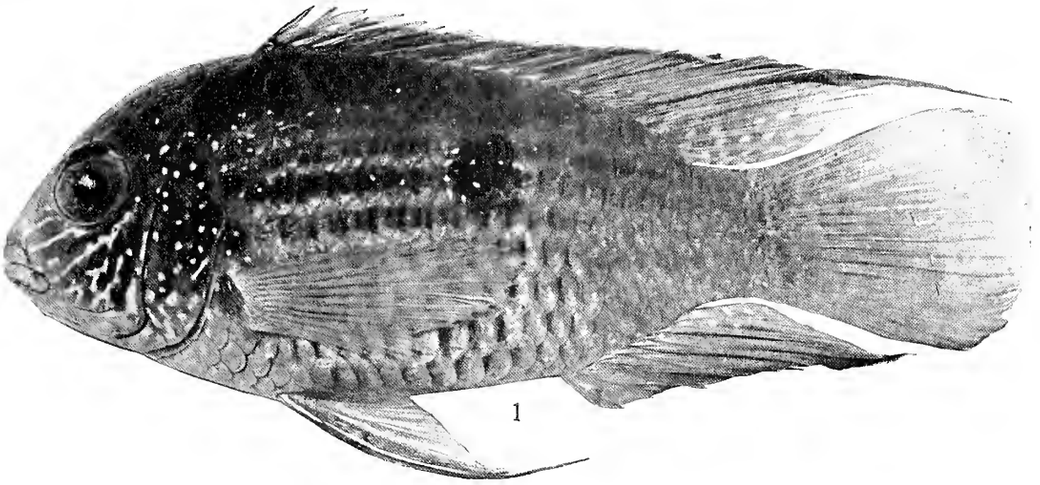
EXPLANATION OF PLATE XXXIII.

FIG. 1. *Æquidens latifrons* (Steindachner). No. 14184, I. U. M., 101 mm. Raspadura.

FIG. 2. *Æquidens rivulatus* (Günther). No. 14193, I. U. M., 175 mm. Naranjito, Ecuador.

FIG. 3. *Cichlasoma atromaculatum* Regan. No. 14155, I. U. M., 145 mm. Istmina.

FIG. 4. *Cichlasoma atromaculatum* Regan. No. 14162, I. U. M., 200 mm. Truando.



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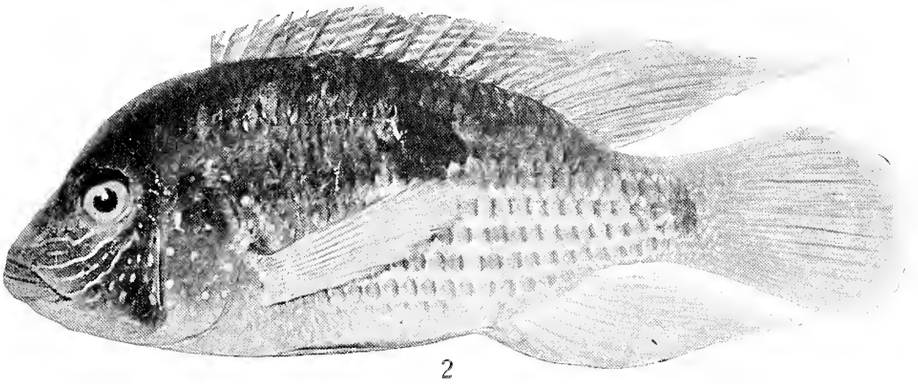

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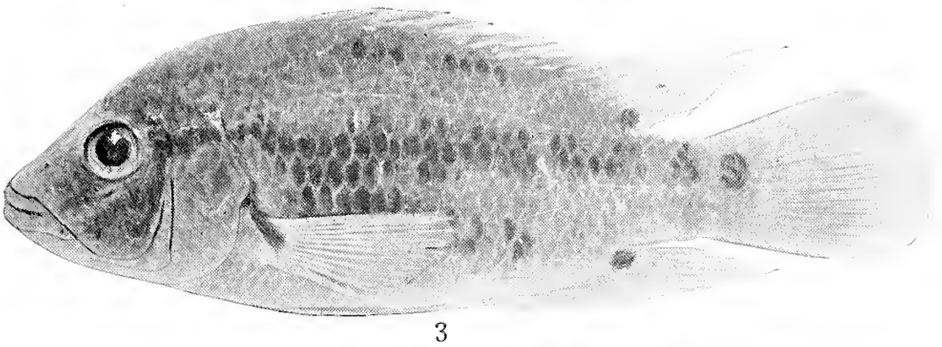

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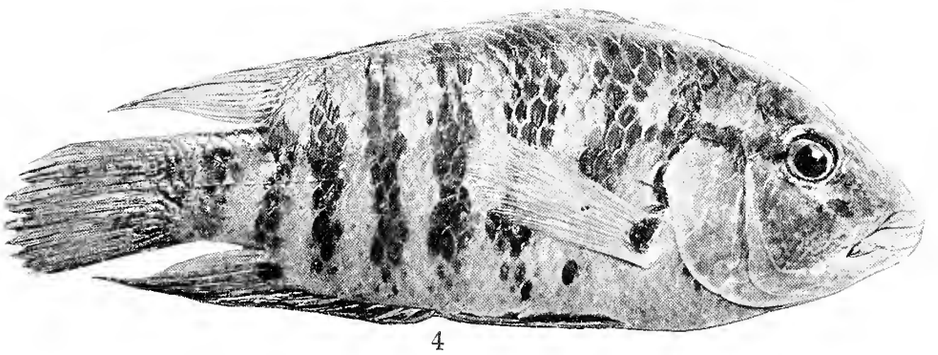


4

Æquidens, Cichlasoma.

EXPLANATION OF PLATE XXXIV.

FIG. 1. *Plecostomus spinosissimus* (Steindachner). No. 13910, I. U. M., ♀, 540 mm. Guayaquil.

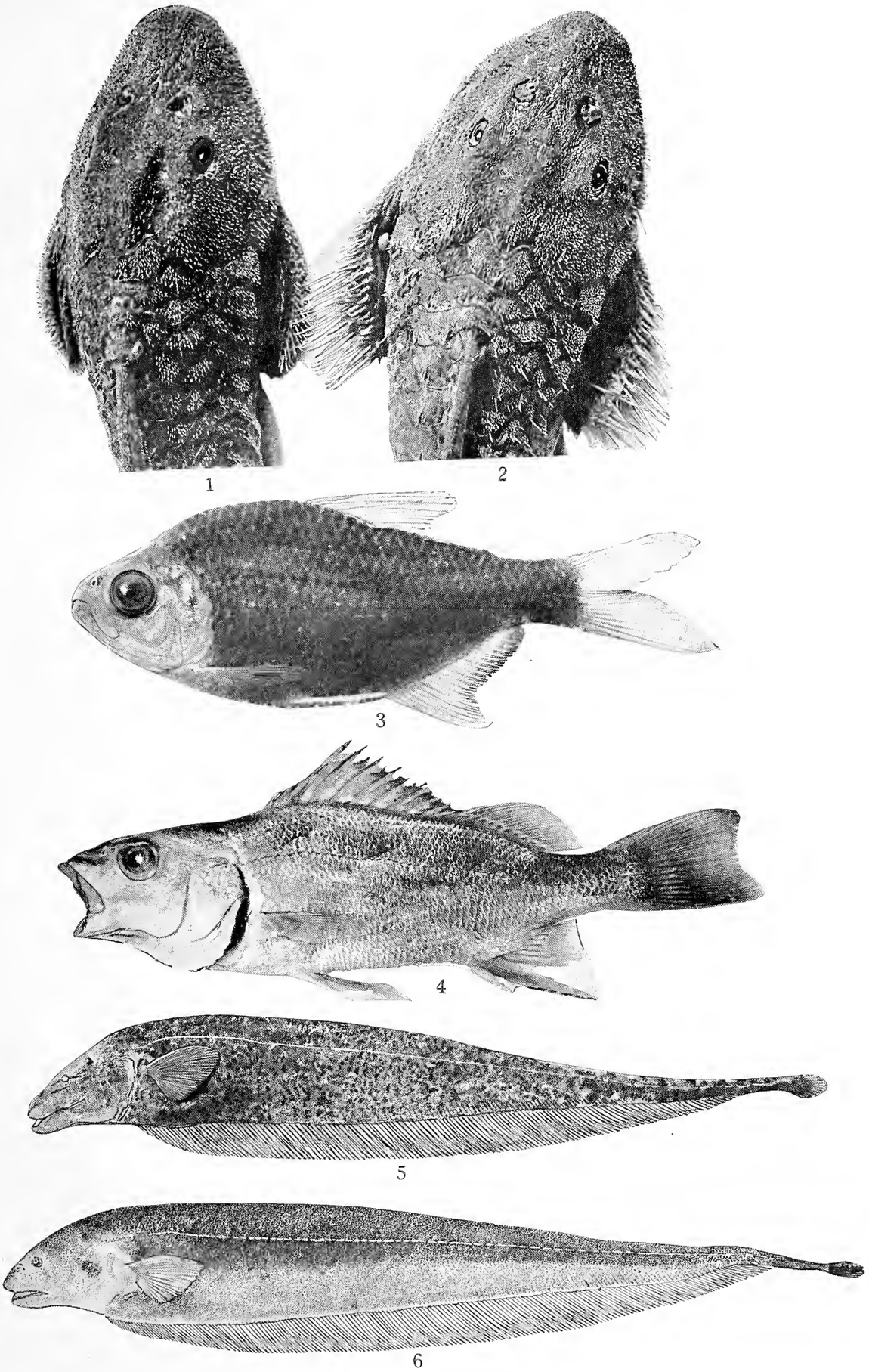
FIG. 2. *Plecostomus spinosissimus* (Steindachner). No. 13910, I. U. M., ♂, 550 mm. Guayaquil.

FIG. 3. *Mœnkhausia metæ* Eigenmann. *Type.* 15026, I. U. M., 61 mm. Barrigon.

FIG. 4. *Pomodasys sinuosus* Eigenmann. *Type.* No. 13892, I. U. M., 161 mm. Rio Patia.

FIG. 5. *Sternarchus rostratus* Meek and Hildebrand. No. 5596a, C. M., 203 mm. Apulo.

FIG. 6. *Sternarchus mariæ* Eigenmann and Fisher. *Type.* No. 5594c, C. M., 201 mm. Girardot.



Plecostomus, Mœnkhausia, Pomodasys, Sternarchus.

EXPLANATION OF PLATE XXXV.

FIG. 1. *Sternarchus leptorhynchus* Ellis. No. 13374, I. U. M., 206 mm. Rio Dagua, Cordova.

FIG. 2. *Sternarchus mariæ* Eigenmann and Fisher. *Paratype.* No. 13375, I. U. M., 271 mm. Apulo.

FIG. 3. *Sternarchus rostratus* Meek and Hildebrand. No. 13377, I. U. M., 289 mm. Apulo.

FIG. 4. *Sternarchus rostratus* Meek and Hildebrand. No. 13378, I. U. M., 175 mm. Cartago.

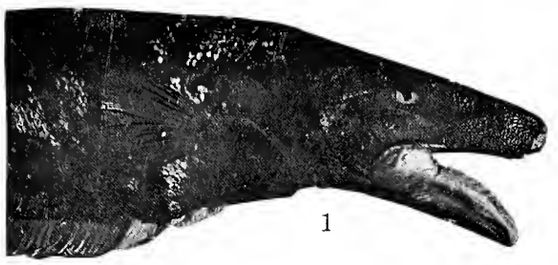
FIG. 5. *Sternarchus rostratus* Meek and Hildebrand. No. 13378, I. U. M., 153 mm. Cartago.

FIG. 6. *Sternopygus macrurus* (Bloch & Schneider). No. 13392, I. U. M., 227 mm. Rio Magui.

FIG. 7. *Sternopygus macrurus* (Bloch & Schneider). No. 13398, I. U. M., 178 mm. Cartago.

FIG. 8. *Sternopygus macrurus* (Bloch & Schneider). No. 13394, I. U. M., 685 mm. Guayaquil.

FIG. 9. *Sternopygus macrurus* (Bloch & Schneider). No. 13394, I. U. M., 800 mm. Guayaquil.



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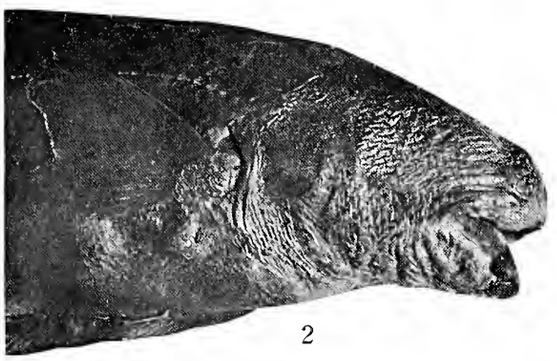

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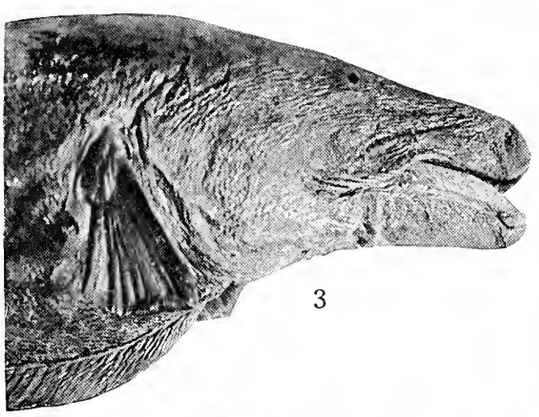

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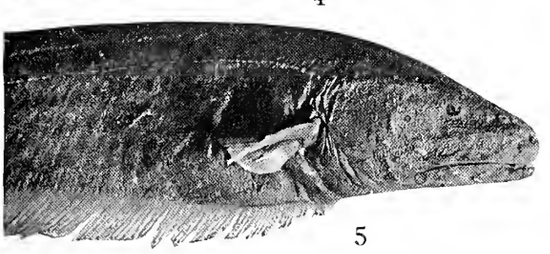

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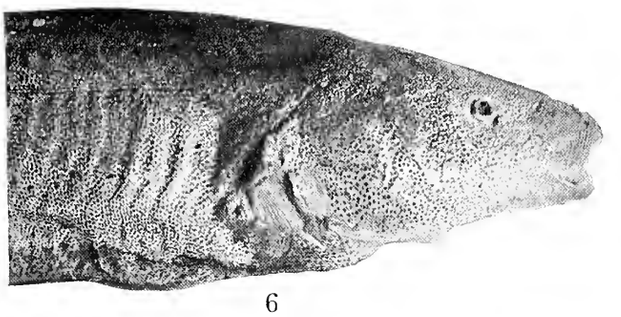

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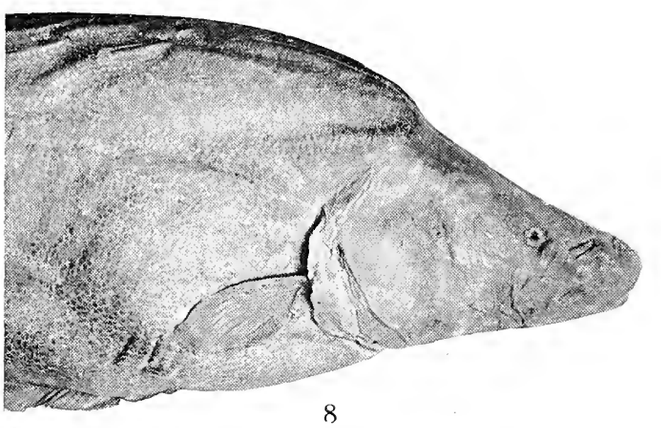

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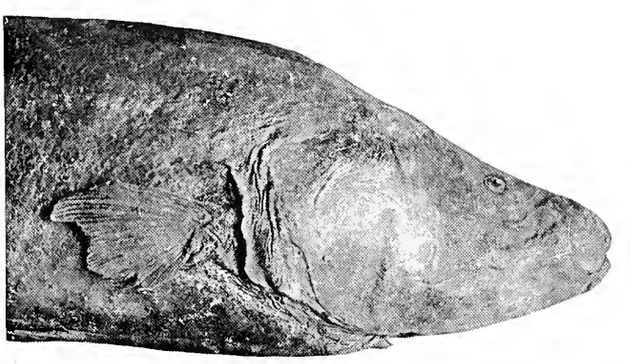

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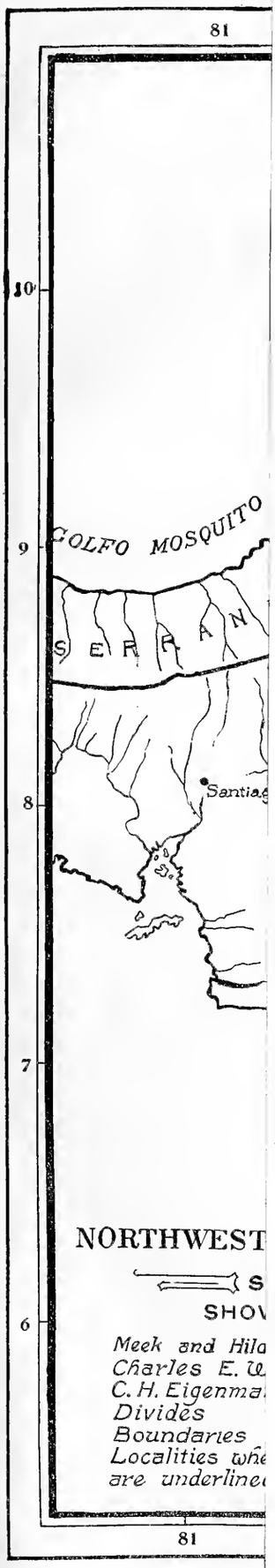
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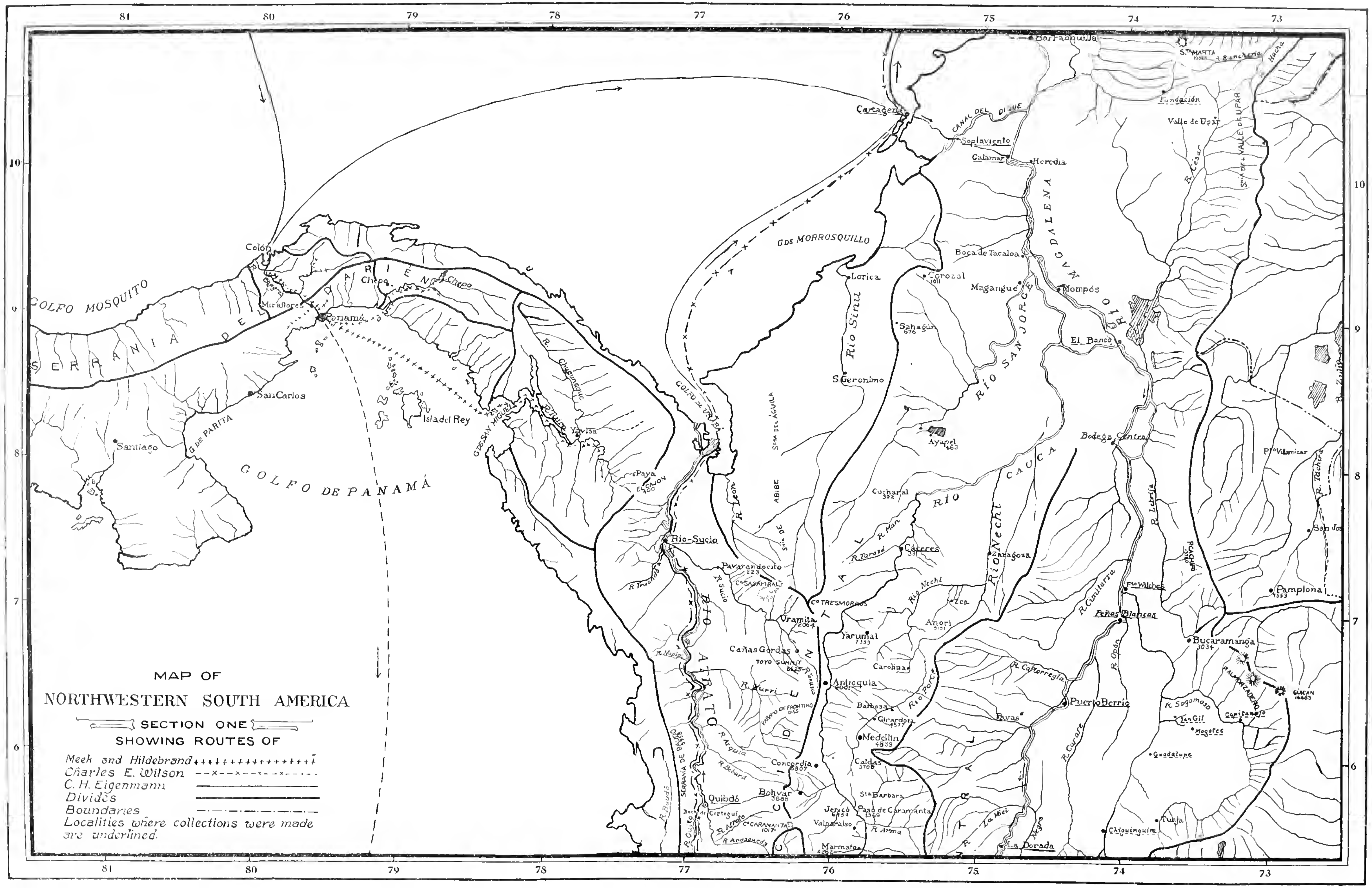
MAP OF
NORTHWESTERN SOUTH AMERICA
SECTION ONE
SHOWING ROUTES OF
Meek and Hildebrand
Charles E. Wilson
C. H. Eigenmann
Divides
Boundaries
Localities where collections were made are underlined.
GOLFO MOSQUITO
SERRANIA DEL DARIEN
GOLFO DE PANAMÁ
G DE PARITA
Colón
Miraflores
Panamá
Chepo
R. Chepo
San Carlos
Santiago
Isla del Rey
G DE SAN MIGUEL
R. Chucunaque
R. Tuira
Yavisa
Paya
EL CAJON 400
GOLFO DE URABA
G DE MORROSQUILLO
Cartagena
Barranquilla
S.TA MARTA
R. Rancheria
Hacha
Fundación
Valle de Upar
R. Cesar
S.RA DEL VALLE DE UPAR
CANAL DEL DIQUE
Soplaviento
Calamar
Heredia
RIO MAGDALENA
Boca de Tacaloa
Corozal 1011
Magangue
Mompós
El Banco
Lorica
Rio Sinu
Sahagún 676
S Geronimo
RIO SAN JORGE
S.RA DEL ÁGUILA
Ayapel 463
Bodega Central
R. Lebrija
P.to Villamizar
R. Táchira
R. Zulia
San José
ABIBE
S.RA DE
R. Leon
Rio-Sucio
R. Truandó
Pavarandocito 223
C.o SASAFIRAL
R. Sucio
C.o TRESMORROS
Uramita 2064
Cucharal 302
RIO CAUCA
R. Man
R. Tarazá
Cáceres 331
Zaragoza
Rio Nechí
Zea
Anorí 5151
Yarumal 7333
Cañas Gordas
TOYO SUMMIT 6625
R. Napipí
RIO ATRATO
R. Murri
PARAMO DE FRONTINO
CORDILLERA OCCIDENTAL
CORDILLERA CENTRAL
Antioquia 2001
Carolina
Rio Porce
Barbosa
Girardota 4577
Medellin 4839
Caldas 5706
Concordia 6807
R. Arquia
R. Bebara
SERRANIA DE BAUDO
R. Baudó
Quibdó
Bolivar 3866
Boca de Certegui
R. Atrato
C.o CARAMANTA 10171
R. Andagueda
R. Quito
Jericó 6454
Paso de Caramanta 1369
Sta Barbara
Valparaiso
R. Arma
Marmato 4232
R. La Miel
Negro
La Dorada
R. Cimitarra
P.to Wilches
Peñas Blancas
R. Opón
R. Cañorregla
Puerto Berrio
Pavas
R. Carare
Pamplona 7553
Bucaramanga 3034
PALMORZADERO
GÜICAN 16463
R. Sogamoso
San Gil
Capitanejo
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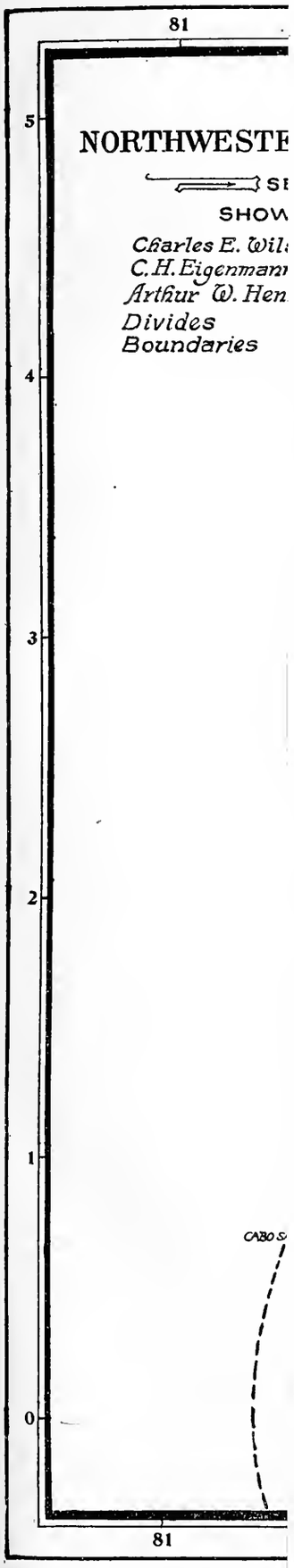
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MAP OF

NORTHWESTERN SOUTH AMERICA

SECTION TWO

SHOWING ROUTES OF

Charles E. Wilson —×—×—

C. H. Eigenmann ———

Arthur W. Henn – – – – –

Divides ———

Boundaries —·—·—·—

81 80 79 78 77 76 75 74 73

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OCEANO PACIFICO

Isla Gorgona

BAHIA DE BUENAVENTURA

CABO SAN FRANCISCO

Esmeraldas

Tumaco

Barbacoas

Buenaventura

Buga

Cali

Caldas

Palmira

Jamundi

Quilichao

Pasto

Tuquerres

Tulcan

Ipiales

Ibarra

Cotacachi

Imbabura

Cayambe

Quito

Popayan

Timbio

Patia

Tablon

Sombrerillos

San Pablo

Mocoa

Neiva

Huila

Pasola Balsa

Alto de Guanacas

Puracé

Tumaco

San Agustin

Isnanché

Tanjubina

Quina Summit

Pereira

Cartago

Zaragoza

Naranjo

Zarzal

La Grande

Barragán

Caicedonia

Sevilla

Tuluá

Buga

Ansermanuevo

Caramanta

Ansermo

Tadó

Condoto

Novita

Istmina

Manizales

Hervéo

Tolima

Ambalema

Honda

Guaduas

Villeta

Facatativa

Bogotá

Chapinero

Usme

Fusagasuga

Girardot

Ibagué

Armero

Chinchiná

Salento

Quindio

Ubaté

Zipaquira

Gachala

Villavicencio

Cáqueza

Cabuyaro

Barrigona

Río Cauca

Río Magdalena

Río Patia

Río Mira

Río Guiza

Río San Pablo

Río Putumayo

Río Aguarico

Río Coca

Río La Plata

R. Esmeraldas

R. Guaillabamba

R. Quinindé

R. Blanco

R. Cayapas

R. Santiago

R. Mataje

R. Mira

R. Chota

R. Ambi

R. Tahuando

R. Mayo

R. Juanambu

R. Pasto

R. Guaitara

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R. Mayasquer

R. Sucio

R. Cali

R. Jamundi

R. Sonso

R. Bugalagrande

R. Tuluá

R. Barragán

R. Frio

R. Cocora

R. Saldoña

R. Coello

R. Totare

R. Opia

R. Combeima

R. Coello

R. Recio

R. Palacé

R. Suaza

R. Yuma

R. Guayabero

R. Ariari

R. Humea

R. Humadea

R. Upia

R. Cusiana

R. Meta

R. Ortegüasa

R. Yari

R. Putumayo

R. Aguarico

R. Coca

Lag. Tunaima

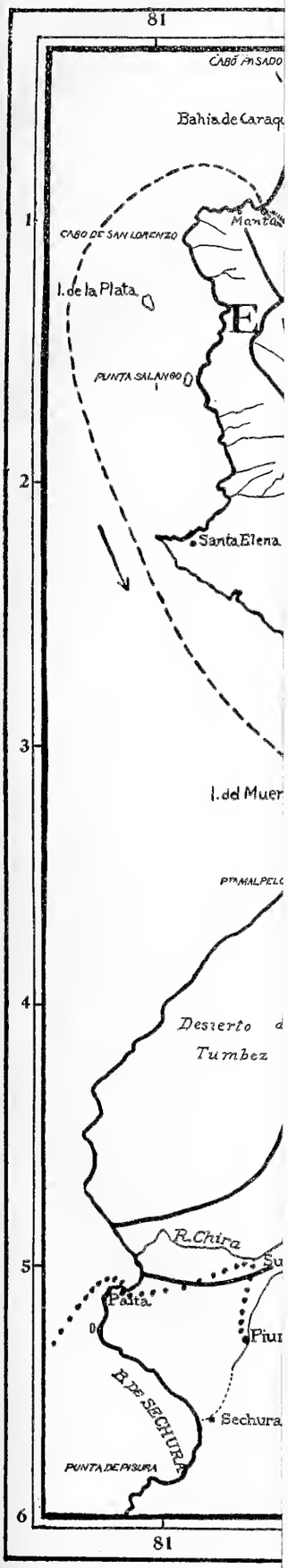
Cord. Central

Cord. Occidental

Cord. Oriental

Sierra Nevada de Cocuy

Sierra Nevada de Sumapaz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CABO PASADO
Bahia de Caraq
CABO DE SAN LORENZO
I. de la Plata
PUNTA SALANGO
Santa Elena
I. del Muer
PTA MALPELO
Desierto
Tumbez
R. Chira
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B. DE SECHURA
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PUNTA DE PISURA
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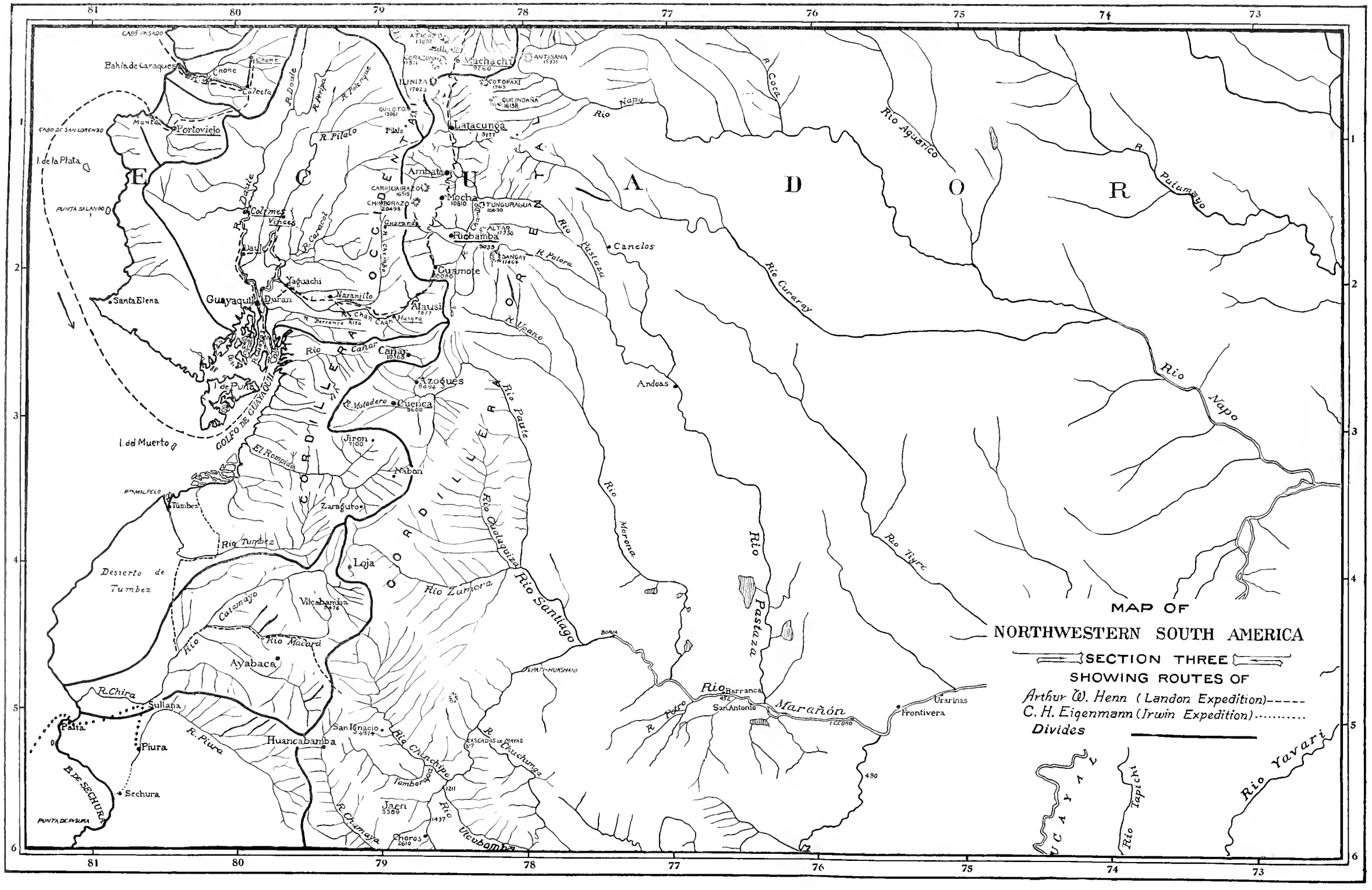
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CABO PASADO
Bahía de Caraques
Chone
Coleta
R. Daule
R. Pripa
R. Palenque
ATACAZO 13692
Machachi 9760
ANTISANA 19335
CORAZON 15571
ILINIZA 17023
S. COTOPAXI 19565
QUILINDAÑA 16138
QUILOTOA 13061
Latacunga 9177
Napo
Rio Coca
Rio Aguarico
R. Putumayo
CABO DE SAN LORENZO
Manta
Portoviejo
R. Pilalo
Pillalo
I. de la Plata
PUNTA SALANGO
Ambato
CARIHUAIRAZO 16515
CHIMBORAZO 20498
Mocha 10810
TUNGURAGUA 16690
Colimes
Vinces
Guaranda
R. Caracol
R. Chanchan
ALTAR 17730
Riobamba 9039
Daule
Rio Pastaza
Canelos
SANGAY 17464
R. Palora
Rio Curaray
Yaguachi
Naranjito
Santa Elena
Guayaquil
Duran
Alausi 7877
R. Chan
R. Chaguarurgo
R. Barranca Alta
Guamote 10080
R. Upano
Rio Cañar
Cañar 10368
Azogues 8494
Andoas
Rio Napo
I. de Puna
GOLFO DE GUAYAQUIL
R. Voladero
Cuenca 8600
I. del Muerto
Jiron 7100
El Rompido
Nabon
Rio Paute
PTA. MALPELO
Tumbez
Zaraguro
Rio Tumbez
Rio Chuchanga
Rio Tigre
Rio Morona
Rio Pastaza
Desierto de Tumbez
Loja
Rio Zamora
Catamayo
Vilcabamba 9476
Rio Macara
Ayabaca
Rio Santiago
BORJA
OLMPATI-HUASHANI
R. Chira
Sullana
Rio Barranca 452
R. Pastaza
Marañón
San Antonio
Frontivera
Urarinas
Paita
Piura
R. Piura
San Ignacio 4974
Huancabamba
Rio Chinchipe
CASCADAS DE MAYAS 617
R. Chuchunga
B. de SECHURA
Sechura
Tambo Grande 1211
Jaen 5389
Rio Utcubamba
R. Chamaya
Chotos 2610
1437
4.90
PUNTA DE PARIÑA
MAP OF
NORTHWESTERN SOUTH AMERICA
SECTION THREE
SHOWING ROUTES OF
Arthur W. Henn (Landon Expedition)-----
C. H. Eigenmann (Irwin Expedition).....
Divides
Rio Yavari
Rio Tapichi

60. Gasteropoda of the Chazy. RAYMOND 1.35
61. Occurrence of Wynnea Americana in Pa. JENNINGS ..... .05
62. Account of Pleistocene Fauna Discovered at Frankstown, Pa. HOLLAND ..... .10
63. Vertebrate Fossils from the Vicinity of Pittsburgh, Pa. CASE ..... .15
64. Illænidæ from the Black River Limestone near Ottawa, Canada. RAYMOND and NARRAWAY.. .20
65. Rhinoceroses from the Oligocene and Miocene of North Dakota and Montana. DOUGLASS.. .25
66. Fossil Horses from North Dakota. DOUGLASS. .30
67. Oligocene Lizards. DOUGLASS ..... .20
68. The Type of Stenomylus gracilis. PETERSON.. .25
69. New Species of Birds from Costa Rica, etc. CARRIKER ..... .10
70. Costa Rican Formicariidæ. CARRIKER ..... .05
71. Vertebrate Fossils from the Fort Union Beds. DOUGLASS ..... .45
72. List of the Lepidoptera of Western Pa., etc. ENGEL 1.25
73. Fauna of Upper Devonian in Montana. Fossils of Red Shales. RAYMOND ..... .60
74. New Species of Procamelus from Upper Miocene of Montana. DOUGLASS ..... .30
75. Sections of the Conemaugh Series between Pittsburgh and Latrobe, Pa. RAYMOND ..... .35
76. List of the Unionidæ of Western Pa. ORTMANN .50
77. Geological Reconnaissance in North Dakota, Montana, and Idaho. DOUGLASS 1.00
78. Botanical Survey of Presque Isle. JENNINGS.. 2.75
79. Sesqui-Centennial (Pittsburgh) Relics. STEWART .45
80. Dromomeryx, New Genus of American Ruminants. DOUGLASS ..... .30
81. Fossils from Glacial Drift and Devonian and Mississippian near Meadville, Pa. MILLARD.. .10
82. New Species of Helodus. EASTMAN ..... .05
83. Charles Chauncey Mellor. HOLLAND..... .15
84. Reports of Expedition to British Guiana, etc. EIGENMANN ..... .50
85. Reports of Expedition to British Guiana, etc. DURBIN ..... .25
86. Odonata of the Neotropical Region, Exclusive of Mexico and Central America. CALVERT... 2.25
87. Deinosuchus hatcheri, a New Genus and Species of Crocodile. HOLLAND ..... .20
88. Reports on Expedition to British Guiana, etc. BLOSSER ..... .15
89. Description of Some New Titanotheres from the Uinta. DOUGLASS ..... .25
90. Annotated List of the Birds of Costa Rica Including Cocos Island. CARRIKER 3.00
91. Geology of the Coast of the State of Alagôas, Brazil. BRANNER ..... .40
92. Fossil Fishes from the Bituminous Shales at Riacho Doce, Alagôas, Brazil. JORDAN ..... .55
93. Ordovician Trilobites, No. II. Asaphidæ from the Beekmantown. RAYMOND ..... .35
94. Ordovician Trilobites, No. III. RAYMOND & NARRAWAY ..... .35
95. Ordovician Trilobites, No. IV. RAYMOND ..... .40
96. Fishes from Irkutsk, Siberia. JORDAN and THOMPSON ..... .30
97. South American Tetrigidæ. BRUNER 1.00
98. Fauna of the Allegheny and Conemaugh Series in Western Pa. RAYMOND ..... .30
99. Ichthyological Survey About the San Juan Islands, Washington. STARKS ..... .75
100. New Species of Pygidium. EIGENMANN ..... .10
101. The Brachiopoda and Ostracoda of the Chazy. RAYMOND ..... .50
102. A New Camel from the Miocene of Western Nebraska. PETERSON ..... .15
103. Skeleton of Stenomylus hitchcocki, etc. PETERSON ..... .15
104. Skeleton of Diceratherium cooki. PETERSON.. .15
105. Carnegie Museum Expedition to Central South America, 1907–1910. HOLLAND ..... .15
106. Report Upon the Expedition of the Carnegie Museum to Central South America. HASEMAN & EIGENMANN ..... .25
107. New Species of Fishes, etc., from Central South America. HASEMAN ..... .50
108. Annotated Catalog of Cichlid Fishes from Central South America. HASEMAN 1.25
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112. South American Acridoidea. I. BRUNER 1.00
113. Species of Hasemania, Hyphessobrycon, and Hemigrammus. ELLIS ..... .25
114. New Characins in the Carnegie Museum. EIGENMANN ..... .30
115. Jurassic Saurian Remains Ingested within Fish. EASTMAN ..... .20
116. Autograph Letter of U. S. Grant to Edwin M. Stanton. HOLLAND ..... .15
117. Albert J. Barr. By W. J. HOLLAND ..... .10
118. Seventeen New Neotropical Birds. TODD ..... .25
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128. South American Locusts (Acridoidea). II. BRUNER ..... .75
129. Revision of the Genus Chæmepelia. TODD..... .85
130. New Genus and Species of Abyssinian Rodents. CHILDS FRICK ..... .20
131. New Titanothere from the Uinta. PETERSON.. .20
132. Small Titanothere from the Lower Uinta. PETERSON ..... .10
133. Osteology of Lasiopyga and Callithrix, etc. SHUFELDT ..... .25
134. New Rhynchocephalian from Solenhofen. GRIER .15
135. Scales of South American Characinid Fishes. COCKERELL ..... .25
136. Skeleton of Platigonus Leptorhinus. PETERSON ..... .10
137. Lichens Collected in the Thunder Bay District, Ontario. R. HEBER HOWE, JR. ..... .10

138. Preliminary List of Fossil Plants in the Roof of the Pittsburgh Coal. GRIER ..... .10
139. Undescribed Remains of the Uinta Titanothere Dolichorhinus. PETERSON ..... .15
140. Triassic Fishes Belonging to the Catopteridæ and Semionotidæ. EASTMAN ..... .15
141. Osteology of Promerycochœrus. PETERSON ... .40
142. Correction of a Generic Name. PETERSON .... .05
143. Skull of Bison Crassicornis. HOLLAND ..... .10
144. Serrasalminæ and Mylinæ. EIGENMANN ..... .50
145. Heads and Tails: Notes on Sauropod Dinosaurs. HOLLAND ..... .15
146. Dipterus Remains from Upper Devonian of Colorado. EASTMAN ..... .10
147. Notes on Tropical American Tettigonoidea (Locustodea). BRUNER 1.65
148. New Species of Tortoise from Jurassic of Utah. GILMORE ..... .15
149. Fauna of Upper Devonian in Montana. HAYNES ..... .45
150. New Sphagebranchus from Bahamas. EIGENMANN ..... .07
151. Marine Fishes from Colombia and Ecuador. WILSON ..... .15
152. Apareiodon, a New Genus of Characid Fishes. EIGENMANN ..... .18
153. New and Rare Fishes from S. American Rivers. EIGENMANN ..... .25
154. Three New Species of Characid Fishes. EIGENMANN & HENN ..... .12
155. The Species of Salminus. EIGENMANN 7
156. South American Pœciliid Fishes. HENN..... .40
157. A New Species of Apatosaurus. HOLLAND 7
158. Birds of the Isle of Pines. TODD ..... .70
159. Reptiles and Amphibians of the Isle of Pines. BARBOUR ..... .20
160. Land and Fresh Water Shells of the Isle of Pines. HENDERSON ..... .20
161. Pelecypoda of the Chazy. RAYMOND ..... .45
162. S. American Crickets, Gryllotalpoidea, and Achetoidea. BRUNER 1.30
163. Preliminary Catalog of N. American Sphæriidæ. STERKI ..... .75
164. Directions for Collecting Sphæriidae and Aquatic Gastropods. STERKI ..... .10
165. Lepidoptera of the Isle of Pines. HOLLAND.... .50
166. Odonata of the Isle of Pines. KAHL ..... .15
167. A Trip to Islands in Lake Erie. GOODRICH.... .15
168. Land-Shells of Islands at Western End of Lake Erie, etc. CLAPP ..... .20
169. Orthoptera of the Isle of Pines. HOLLAND & KAHL ..... .15
170. Obituary Notes. G. A. Link, T. A. Mills, Boyd Crumrine, E. M. Bigelow. HOLLAND ..... .10
171. Two New W. African Rhopalocera. HOLLAND. $0.15
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176. Leptodeira albofusca (Lacépède). GRIFFIN.... .10
177. List of Coleoptera collected on Isle of Pines. HOLLAND & SCHWARZ ..... .15
178. Rhynchota of the Isle of Pines. HEIDEMANN & OSBORN ..... .10
179. Mammals of the Isle of Pines. HOLLAND .... .05
180. Report upon Fossil Material Collected in Cave in the Isle of Pines. PETERSON ..... .10
181. New Species of Fern (Polystichum jenningsi). HOPKINS ..... .10
182. Notes upon the Genus Leucophenga Mik, with Descriptions of New Species. KAHL ..... .30
183. Some Species of Rhamdia, a Genus of S. American Siluridæ. EIGENMANN & FISHER. .15
184. New and Rare Species of South American Siluridæ. EIGENMANN ..... .30
185. List of the Hypopthalmidæ, Diplomystidæ, and some Unrecorded Species of Siluridæ. FISHER. .30
186. A Synopsis of the Saurian Genus *Prionodactylus*. GRIFFIN ..... .05
187. Notes on a Collection of Fishes from Ceylon with Descriptions of New Species. JORDAN & STARKS ..... .35
188. Collection of Fishes from Port Said, Egypt. JORDAN & HUBBS ..... .20
189. A Fossil-bearing Alluvial Deposit in Saltville Valley, Virginia. PETERSON ..... .10
190. Catalog of Collection of Watches belonging to H. J. Heinz. STEWART, HOLLAND, COGGESHALL .....*Paper*, 30 cts.; *boards* .50
191. Contributions to the Natural History of the Isle of Pines: Reprinted from Annals, Vols. VIII–XI, 560 pp., 34 plates, index. Bound in cloth 5.00
192. Material Discovered in the Upper Eocene of the Uinta Basin by Earl Douglass and O. A. Peterson. PETERSON 2.25
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194. On Elephenor, a New Genus of Fishes from Japan. DAVID STARR JORDAN ..... .50
195. A Description of Cypripedium passerinum. JENNINGS ..... .10
196. Obituaries of Charles Rochester Eastman, Andrew Arnold Lambing, Herbert Huntington Smith, and Henry John Heinz .....each .10
197. Saltatorial Orthoptera from S. America and Isle of Pines. BRUNER 1.00
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199. Diplomystus goodi Eastman. HOLLAND ..... .10
200. Mussel Shells in Lake Erie, compared with those of Upper Ohio. GRIER ..... .50
201. Geology of Northeastern Brazil, and Fossil Mammalia. WARING & HOLLAND ..... .75
202. Mugilidæ of Formosa. OSHIMA ..... .25
203. Contriscidæ of Formosa. OSHIMA ..... .10
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VOL. IX NO. 2

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NEOTROPICAL TINGITIDÆ WITH DESCRIPTIONS OF THREE NEW GENERA AND THIRTY-TWO NEW SPECIES AND VARIETIES (HEMIPTERA).

Smithsonian Institution
JAN 16 1923
National Museum

BY

KARL J. DRAKE

PITTSBURGH

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VOL. IX. NO. 2.

NEOTROPICAL TINGITIDÆ† WITH DESCRIPTIONS OF THREE NEW GENERA AND THIRTY-TWO NEW SPECIES AND VARIETIES (HEMIPTERA).*

BY CARL J. DRAKE.

(PLATE XXXIX.)

Through the kindness of numerous friends and co-workers the writer has received during the past few years many specimens of North and South American *Tingitidæ* for study and determination. The present paper, based largely upon specimens in the Carnegie Museum, deals entirely with neotropical species. Thanks are especially due to Dr. W. J. Holland, the Director of that museum, for granting permission to the writer to study the very fine and extensive collection of South American *Tingitidæ*, principally collected in Brazil by the late Herbert H. Smith and his wife. Records have also been taken from specimens in the United States National Museum, the National Museum in Paris, and my own private collection. The drawings have been made by Messrs. W. P. Osborn and A. R. Janson.

* Contributions from the Iowa State College, Ames, Iowa, and the New York State College of Forestry, Syracuse, N. Y.,

† NOTE.—The proper form of the family-name to be applied to the Lace-bugs has been the subject of a lengthy and good-natured correspondence between the author and the editor of this paper. The generic name *Tingis* was first employed in the *Hemiptera* by Fabricius (1803, *Systema Rhyngotorum*, p. 124). It is the Greek name of Tangiers, in Latin *Tingi*, or *Tinge*. The family name derived from the generic name first appears in a Gallicized form "*Tingidites*" employed by Laporte in 1833. Westwood in 1840 used the word under the form "Tingidæ." Amyot and Serville in 1843 employed the Gallicized form "*Tingides*." Stål in 1873 employed the form *Tingitidæ* and was followed by Uhler, Champion, Horvath, Oshanin, Osborn, Drake, and many others. Van Duzee in 1917 in his "Cata-

Genus Phatnoma Fieber (1844).

Phatnoma Fieber, Entomologisehe Monographien, 1844, pp. 30 and 57; Stål, Enumeratio Hemipterorum, III, 1873, p. 117; Champion, Biologia Centrali-Amerieana, Rhynehota, Vol. II, 1897, p. 2. Haplotype: *Phatnoma laciniata* Fieber, from the "East Indies."

1. Phatnoma marmorata Champion.

Phatnoma marmorata Champion, Biol. Centr.-Amer., Rhynehota, II, 1897, p. 3, Pl. I, figs. 1 and 1*a*. Type-locality Panama.

Phatnoma filetia Gibson, Trans. Am. Ent. Soe., XLV, 1919, p. 185. Panama.

Phatnoma spinosa Gibson, *l. c.* Panama.

This species was collected at Chapada, Brazil, by Mr. and Mrs. H. H. Smith. Champion records the insect from Panama. There are no specific differences in the original descriptions of the forms described by Gibson as *P. filetia* and *P. spinosa* from Panama. The types in the United States National Museum have been examined by the writer, and they are both synonyms of *P. marmorata.*

2. Phatnoma varians sp. nov.

Antennal tubercles long, curved inwardly. Antennæ long and slender, the first segment a little longer and thicker than the second, the third segment long, three and one-half times the length of the fourth. Head long, with seven long, stout spines, the median and anterior spines blunt, directed forward, and a little stronger than the others; the median spine considerably

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logue of the Hemiptera of America north of Mexico" employs "Tingididæ" as the family name, citing Laporte as his authority.

It has seemed both to the author and the editor that there should be some deeision reached as to which is the correct spelling of the word.

The fixed rule, in forming family-names in scientific nomenclature, is to suffix the termination "*idæ*" to the *stem* of the word. The name Τίγγις is employed by Strabo in his Geography (Strabo, Geography, Part I, 3, 1, § 140, *Edit. Barrois,* 1815) and he uses the genitive form Τίγγιος. Therefore, in Greek the stem is Τίγγι = *Tingi.* Suffixing "*idæ*" to the Greek stem we would have *Tingiidæ,* after the analogy of *Hesperiidæ,* ete. But this has never been used.

However, seientific nomenelature is *Latin,* not Greek, save as latinized. The Latin adjeetive derived from *Tinge* (Tangiers) is *Tingitanus* (*Cf.* Pomponius Mela, C. Mamertinus, and Valpy's Edition of the Delphin Classics, Vol. LXXXIX, p. 882, where the eommentator upon Pliny's *Historia Naturalis,* Lib. V, 1, 1, says: "*Tingitana pertinet a freto Gaditano ad fines usque Marocani regni.*" This adjeetival form plainly indieates that the Latin root of the noun is TINGIT! Suffixing "idæ" to this root, we have the form employed by Stål, Champion, and many others. It appears to the editor that the word *Tingitidæ* is formed aecording to the best elassic usage. It furthermore has in its favor the weight of authority. The genitive *Tingis* used by Fabrieius, *l.c.,* p. 124, footnote, is plainly a lapsus, and the form *Tingidæ,* based on it by Westwood, is not eorrect. The form *Tingididæ* under any applieation of the rules is plainly ineorreet. If the Latin stem is to be employed (and this is the rule), we have "Tingit," and to this adding "idæ" we have the family-name "Tingitidæ." (*Cf.* Science, N. S., Vol. LVI, pp. 334–5). W. J. Holland.

longer than the two anterior spines. Rostrum reaching a little beyond the apex of the rostral sulcus. Pronotum coarsely and closely punctured, tricarinate, the carinæ distinct and parallel, but non-reticulate. Paranota angularly dilated before the middle as well as in front, becoming narrower behind, the angular anterior dilation ending in a short spine, and composed of three rows of areolæ in front. Scutellum small. Elytra with a distinct clavus as well as costal, subcostal, discoidal, and sutural areas; costal area with four rows of areolæ at the base, two or three at the middle, and three toward the apex, the areolæ not very regularly arranged; discoidal area with the margins curved and strongly raised, a little narrower and considerably shorter than the subcostal area. The costal area exhibits some variations in the arrangement of the areolæ, and also in the numbers of rows of areolæ at the middle.

General color rather dull straminеous, the head and body beneath darker, the elytra with a few small brownish spots on the costal nervures and on the nervelets of the costal area. Antennæ yellowish brown, the first and second segments brownish, the apical half of the fourth fuscous. Legs with the coxæ, trochanters, and femora brownish or nearly fuscous, the tibiæ and tarsi yellowish brown, the tips of tarsi darker.

Length 3 mm.; width 1.8 mm.

French Guiana: two specimens from "Env. de St.–Georges, Oyapock"; and one from Quanary, collected by F. Geay, 1900. *Type:* a female from Env. de St.-Georges, Oyapock, in Paris Museum. *Paratypes:* in Paris Museum and my collection. One specimen from the neighborhood of St.-Georges, Oyapock, differs from the type and paratypes in having the lateral carinæ obsolete and the spines on the head a little shorter. Other characters and color are practically identical with the typical form. This variety is designated as *P. varians unicarinata* var. nov.

Genus Coleopterodes Philippi (1864).

Solenostoma Signoret, Annales de la Société Entomologique de France, 1863, p. 575. (Preoccupied by a genus of fishes, Rafinesque, 1815.)

Coleopterodes Philippi, Stettiner Ent. Zeitung, XXV, 1864, p. 306; Drake, Florida Entomologist, V, 1922, p. 50.

Haplotype: *Coleopterodes* (*Solenostoma*) *liliputiana* Signoret.

3. **Coleopterodes liliputiana** Signoret (Plate XXXIX, fig. 13).

Solenostoma liliputiana Signoret, Ann. Soc. Ent. France, 1863, p. 575, Pl. XIII, fig. 27.
Coleopterodes fuscescens Philippi, Stett. Ent. Zeit., XXV, 1864, p. 306.

A short-winged female, labelled "Chili, Gay, 15–43," is figured. This specimen, from the Paris Museum, is probably one of the series of types. Several other specimens from Chile have been examined and the insect has also been reported from Argentina. The long-winged form is unknown.

Genus Monanthia Lapelletier et Serville (1825).

Monanthia Lapelletier et Serville, Encyclopédie Méthodique, X, 1825, p. 653; VanDuzee, Catalogue of the Hemiptera North of Mexico, 1917, p. 223.

Dictyla Stål, Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar, No. 3, 1874, p. 57.

Logotype: *Monanthia* (*Tingis*) *rotundata* (Herrich-Schæffer).

4. **Monanthia monotropidia** Stål.

Monanthia (*Physatocheila*) *monotropidia* Stål, Rio Jan. Hemip., I, 1860, p. 63; Enum. Hemip., III, 1873, p. 133.

Monanthia monotropidia Champion, Biol. Centr.-Amer., Rhynch., II, 1898, p. 47, Pl. III, figs. 24, 24*a*, and 24*b*.

Specimens of this species are at hand from Cuba, Hayti, Mexico, Guatemala, Panama, Colombia, and Brazil. It is perhaps one of the commonest and most widely distributed species of the genus in tropical America.

5. **Monanthia loricata** Distant.

Monanthia loricata Distant, Ann. Soc. Ent. Belg., XXXII, 1888, p. lxxxiii; Champion, Trans. Ent. Soc. Lond., 1898, pt. 1, p. 64, Pl. III, fig. 11.

Chapada, Brazil, collected by Mr. and Mrs. H. H. Smith. The median carina is less elevated and thicker than in *M. figurata*, a new species, the description of which immediately follows.

6. **Monanthia figurata** sp. nov. (Plate XXXIX, fig. 12).

Head with five, short, porrect spines. Antennæ moderately long, slender; first and second segments about equal in length; third segment slightly more than three times the length of the fourth. Rostrum reaching to the mesosternum. Pronotum very coarsely punctured, tricarinate; median carina thin, moderately raised, the areolæ mostly indistinct; lateral carinæ short, present only on the triangular process, divaricating posteriorly. Elytra faintly constricted beyond the middle, the outer margins nearly parallel; costal area moderately broad, uniseriate, some of the transverse nervures placed close together in pairs; subcostal area triseriate at its widest part. Wings a little shorter than the elytra.

General color fuscous, with lighter markings. Antennæ yellowish brown, the first and fourth segments fuscous. Pronotum with the disc blackish, the collum, median carina, and paranota testaceous, or brownish testaceous; the triangular process reddish brown. Head black, the spines yellowish brown. Elytra fuscous, the areolæ lighter; the costal area brownish testaceous, the areolæ hyaline; body beneath black. Legs with the coxæ and trochanters reddish brown; the femora mostly fuscous or black; the apex of femora, the tibiæ, and the tarsi (the apices of the latter fuscous) yellowish brown or brownish.

Length 2.7 mm.; width .86 mm.

Closely allied to *M. loricata* Distant from Brazil, but separated from it by the smaller size, the narrower and less robust form, and the more elevated median carina.

Eight specimens, Chapada, Brazil. The *type*, a male in Carnegie Museum, is figured. *Paratypes*, males and females, in Carnegie Museum and my collection. The paranotum is similar to that of *M. loricata* Distant. I have six Brazilian specimens of the latter species before me.

7. **Monanthia parmata** Distant.

Monanthia parmata Distant, Ann. Soc. Ent. Belg., XXXII, 1888, p. lxxxiii; Champion, Trans. Ent. Soc. Lond., 1898, pt. 1, p. 64, Pl. III, fig. 12.

Several examples of this insect were taken at Chapada, Brazil, by Mr. and Mrs. H. H. Smith. It is more ovate and robust than the new species, *M. figurata*, described above.

8. **Monanthia c-nigrum** Champion.

Monanthia c-nigrum Champion, Biol. Centr.-Amer., Rhynch., II, 1897, p. 47, Pl. III, fig. 25.

Common in the West Indies, Mexico, and Central America. Specimens are at hand from Hayti, Guatemala, Nicaragua, and Mexico.

9. **Monanthia balli** sp. nov.

General appearance smooth and somewhat shining. Head with two porrect frontal spines. Pronotum smooth, very strongly tumid on the disc, unicarinate, the lateral carinæ entirely wanting; paranota very strongly developed, reflected against the pronotum, contiguous with the median carina. Elytra smooth, shining, slightly longer than the abdomen; costal area moderately wide, uniseriate, the areolæ quite regularly arranged; subcostal area with four or five rows of areolæ at its widest part; discoidal area broadly and deeply rounded along the outer margin at the base, the latter extending deeply in the form of a semi-circular region into the subcostal area. Wings slightly longer than the abdomen.

Head black, the spines brownish. Antennæ testaceous, the fourth segment wanting. Body beneath black, the posterior margin of the thorax whitish. Legs yellowish brown, the tips of the tarsi fuscous. Pronotum mostly fuscous, the collum, and a broad margin of the paranota yellowish brown. Elytra yellowish brown, the nervures of the sutural and most of the discoidal and subcostal areas fuscous, the areolæ whitish, the areolæ of costal area hyaline.

Length 2.56 mm.; width 1.25 mm.

One specimen, a female, from Port au Prince, Hayti. *Type* in my collection. This very distinct species is named in honor of Dr. E. D. Ball, who kindly presented the specimen to me. The very strongly swollen disc of the pronotum and the smooth and somewhat shining appearance will readily separate *M. balli* from any American species in the genus.

Genus Teleonemia Costa (1864).

Teleonemia Costa, Annuario del Museo Zoölogico della Regia Universitá di Napoli, II, 1864, p. 144; Stål, Enumeratio Hemipterorum, III, 1873, pp. 122 and 131.

Amaurosterphus Stål, Hemiptera Fabriciana, I, 1868, p. 92; Enumeratio Hemipterorum, III, 1873, p. 131.
Tingis, subgenus *Americia* Stål, *ibidem*, 1873, p. 131.
Lasiacantha Lethierry et Severin, Catalogue Général des Hémiptères, III, 1896, p. 18 (in part), (*non* Stål).

Logotype: *Teleonemia funerea* Costa.

10. **Teleonemia morio** (Stål).

Tropidocheila morio Stål, Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar, 1855, p. 187.
Laccometopus morio Stål, Rio Jan. Hemip., I, 1860, p. 65.
Teleonemia (*Amaurosterphus*) *morio* Stål, Enumeratio Hemipterorum, III, 1873, p. 131; Champion, Trans. Ent. Soc. Lond., 1898, pt. 1, p. 61, Pl. III, fig. 2.

Taken at Chapada, Brazil, by Mr. and Mrs. H. H. Smith. I have in my collection a specimen determined by Stål.

11. **Teleonemia aterrima** Stål.

Teleonemia aterrima Stål, Enumeratio Hemipterorum, III, 1873, p. 131; Champion, Trans. Ent. Soc. Lond., 1898, pt. 1, p. 62, Pl. III, fig. 3.

This species was described from Colombia. I have four specimens from Marcapata, Peru.

12. **Teleonemia limbata** (Stål).

Tingis (*Americia*) *limbata* Stål, Enumeratio Hemipterorum, III, 1873, p. 131.
Teleonemia limbata Champion, Trans. Ent. Soc. Lond., 1898, pt. 1, p. 61.

Several specimens from Chapada and Corumbá, Brazil, collected by Mr. and Mrs. H. H. Smith.

13. **Teleonemia chapadiana** sp. nov.

Robust, moderately elongate. Pronotum rugulose, narrowed anteriorly, very coarsely punctured, sharply tricarinate, the carinæ rather thick, reticulate, nearly parallel, each composed of a single series of small areolæ; median carina raised anteriorly and forming a small hood-like structure, the latter projecting but very slightly forward; paranota not very broad, strongly reflexed, composed of a single series of moderately large areolæ. Rostrum reaching a little beyond the middle of the mesosternum. Elytra broadly rounded at the apex, very much like *T. variegata* Champion in form; costal area rather broad, composed of a single row of very long areolæ (rectangular or triangular in shape) on the basal portion, biseriate beyond the middle; subcostal area biseriate; discoidal area with four or five rows of areolæ at the widest part, the outer margin curved. The areolæ of the elytra are rather coarse and large, extremely long (for this genus) on the basal portion of costal area and not very regularly arranged. Wings a little longer than the abdomen.

Body beneath, legs, and antennæ fuscous, the last segment of the latter blackish. Pronotum dark yellowish brown, the triangular apex, median carina, paranota, and the anterior (raised)

portion of median carina, yellowish brown. Elytra yellowish brown, some of the nervures marked with fuscous, the areolæ of costal area hyaline and areolæ of the rest of the elytra whitish and opaque.

Length 4.85 mm.; width about 2 mm.

One female specimen, Chapada, Brazil, collected by Mr. and Mrs. H. H. Smith, in the Carnegie Museum. The insect in general appearance somewhat resembles *T. variegata* Champion, but is readily separated from it by the structures mentioned above.

14. **Teleonemia brevipennis** Champion.

Teleonemia brevipennis Champion, Trans. Ent. Soc. Lond., 1898, pt. 1, p. 63, Pl. III, fig. 9.

Peru; one specimen from Marcapata and two from Vilcanota. The species was described from the "Amazons."

15. **Teleonemia hasemani** sp. nov.

Elongate, robust, head with five moderately long spines, the anterior spines with their apices meeting. Antennæ moderately long, rather stout, first segment a little longer than the second; third segment three times the length of the fourth, the latter considerably longer than the first two taken together. Pronotum coarsely punctate, narrowed in front, sharply tricarinate, each carina composed of a single row of narrow, elongate areolæ, the lateral carinæ slightly converging posteriorly; median carina somewhat raised in front, the elevated portion of pronotum projecting angularly in front; paranota narrow, strongly reflexed, mostly contiguous with the dorsal surface of the pronotum, uniseriate, the areolæ quite large. Elytra elongate, gradually widening from the base to about the middle, very broad at the middle and at the apex, slightly constricted beyond the middle, the apices subtruncate; costal area broad, mostly triseriate, the areolæ rather large and not very regularly arranged; subcostal area biseriate; discoidal area large, broad, long, extending beyond the middle of the elytra; the outer margin curved, with six or seven rows of areolæ at its widest part. Wings almost as long as the abdomen. Rostrum reaching to the end of the mesosternum. Length 5.45 mm.; width 2.2 mm.

Legs dark reddish brown. Antennæ dark reddish brown, the basal segment and apical half of fourth, black. Head and body black beneath, the spines testaceous. Pronotum blackish, the carinæ dark reddish brown, the paranota whitish. Elytra with the discoidal, subcostal, sutural (save three cells along the apical margin) areas fuscous; some of the areolæ partly whitish. Costal area testaceous, a broad fascia near the middle, and a broad oblique fascia (continued from sutural area) at the apex fuscous; some of the areolæ along the apical margin of the elytra whitish; the areolæ of testaceous areas subhyaline, and those of fuscous areas very much clouded with fuscous.

Length 5.45 mm.; width 2.2 mm.

Two specimens from Brazil collected by Mr. J. D. Haseman. *Type:* female, from São Antonio de Guaporé, Brazil, July 26, 1909, in Carnegie Museum. *Paratype:* with antennæ broken, in my collection from Rio Guaporé, near Forto Principé,

Brazil, Aug. 26, 1909. This species may be separated from *T. albomarginata* Champion by the more robust form, shorter antennæ, narrower paranota, the broad, transverse fascia near the middle of costal area, the much less elevated carinæ, and the hood.

T. chilensis (Reed) differs from *T. hasemani* in having much broader paranota, strongly raised carinæ, a moderately large hood, and the elytra broadest at the apex.

16. **Teleonemia simulans** sp. nov.

Moderately long, robust. Antennæ rather short, moderately pilose, the first segment a little longer than the second, the third segment a little more than three times the length of the fourth. Rostrum reaching a little beyond the meso-metasternal suture. Hood larger and the carinæ more strongly foliaceous than in *T. chilensis;* lateral carinæ constricted at the middle, each composed of a single row of large areolæ; median carina strongly raised, biseriate and slightly more than twice as high as the lateral carinæ on the disc, uniseriate behind. Paranota formed as in *chilensis*. Hood moderately large, projecting slightly over the base of the head. Elytra broad, very broad in front of the middle and at the apex, and strongly constricted between, subtruncate at the apex; costal area rather broad, unevenly reticulated, mostly biseriate (some places triseriate); subcostal area biseriate, the areolæ rather large; discoidal area reaching beyond the middle of the elytra, composed of four rows of areolæ at its widest part. Wings about as long as the abdomen.

General color-pattern quite similar to *T. chilensis*, but the markings a little lighter and with a broader transverse band in front of the middle of the elytra. Elytra testaceous, the transverse bands (near the middle and at the apex) broad and of a fuscous color; discoidal and sutural (mostly fuscous) areas marked with brown or fuscous. The areolæ of costal area, except in fuscous bands, iridescent and nearly hyaline (one or two cells on each side clouded with fuscous), areolæ of subcostal and discoidal areas opaque whitish.

Length 4.3 mm.; width 2.26 mm.

Very similar in general appearance and color-pattern to *T. chilensis* (Reed), but easily distinguished from it by the shorter antennæ, the strongly arched median carina, and the much smaller size.

One specimen from El Gran Chaco, "Bords du Rio Tapenaga, Colonia Florencia, S. A.," in my collection.

17. **Teleonemia chilensis** (Reed).

Cantacader chilensis Reed, Revista Chileña de Historia Natural, IV, 1900, p. 180.
Teleonemia chilensis Drake, Florida Entomologist, Vol. V, 1922, p. 50.

Brazil, Argentina, and Chile. This species seems to be quite widely distributed in South America. The elytra are considerably constricted beyond the middle, and very broad a little in front of the middle and a little broader still at the apex. The costal area contains a broad, transverse, fuscous fascia a little in front of the middle; the areolæ are irregular in size and ar-

ranged in two (some places three) irregular rows. The paranota are strongly reflexed, rather strongly produced, projecting almost upright, the outer margin narrowly rounded. Pronotum tricarinate, each carina composed of a single row of rather large areolæ, the lateral carinæ constricted at the middle. Hood moderately large, the height and length about equal.

18. **Teleonemia albomarginata** Champion.

Teleonemia albomarginata Champion, Biol. Centr.-Amer., Rhynch., II, 1898, pp. 36 and 43, Pl. III, figs. 18 and 18*a*.

Champion records this insect from Panama and the Amazons. I have specimens before me from Guatemala, Venezuela, Brazil, and Peru.

19. **Teleonemia triangularis** (Blanchard).

Tingis triangularis Blanchard, in D'Orbigny, Voyage en Amérique, etc., VI (2), 1843, p. 219, Pl. XXIX, fig. 9.

Teleonemia (*Amerieia*) *albilatera* Stål, Enumeratio Hemipterorum, III, 1873, p. 131.

Teleonemia triangularis Champion, Biol. Centr.-Amer., Rhynch., II, 1897, p. 43. (Footnote on synonymy.)

Several specimens have been examined from Brazil and one specimen labelled "Bolivie, Chiquitos, D'Orbigny, 1834." The latter is probably one of Blanchard's series of types, and is in a good state of preservation.

Genus Eurypharsa Stål (1873).

Eurypharsa Stål, Enumeratio Hemipterorum, III, 1873, pp. 122, 123; Champion, Biol. Centr.-Amer., Rhynch., II, 1897, p. 44; Trans. Ent. Soc. Lond., 1898, p. 63. (Notes on synonymy.)

Haplotype: *Eurypharsa* (*Tingis*) *nobilis* (Guerin).

20. **Eurypharsa phyllophila** sp. nov.

Head armed with five moderately long spines. Pronotum narrowed anteriorly, very coarsely punctured, sharply tricarinate, the carinæ rather indistinctly reticulate; lateral carina slightly diverging posteriorly; median carinæ becoming more strongly raised and areolate anteriorly. Paranota not very broad, slightly reflexed, mostly biseriate, triseriate at the middle. Hood a little longer than high, projecting very slightly over the base of the head, very narrow, the sides very steep and roof-like. Antennæ moderately long, the first segment a little longer and thicker than the second, the third slightly curved and a little more than three times the length of the fourth. Rostrum reaching to the middle of the mesosternum. Elytra very broadly expanded, nearly three times as wide as the pronotum, subtruncate at the apex, very broadly and roundly expanded at the base and slightly rounded towards the tip; subcostal area narrow, biseriate, the areolæ small; costal area very broad, widely, irregularly, and rather unevenly reticulate, composed of numerous irregular rows of areolæ; discoidal area very long, composed of several irregular rows of small areolæ.

Head black, the spines yellowish brown. Antennæ and legs blackish fuscous. Body be-

neath dark fuscous, slightly tinged with red, the rostral laminæ and bucculæ yellowish brown. Pronotum reddish fuscous, the paranota, carinæ, and hood yellowish brown. Elytra yellowish brown, the discoidal and subcostal areas, and a broad transverse band near the apex fuscous; costal area along the basal three-fifths very broadly margined with fuscous, the areolæ (except in fuscous region) hyaline.

Length 6.1 mm.; width 4.5 mm.

Type: a male specimen from the Rio Guaporé, near Forto Principé, Brazil, collected August 25, 1909, by J. D. Haseman, in the Carnegie Museum. In addition to the structural characters, the color of the costal area, not entirely margined with fuscous, distinguishes this insect at once from any species described in the genus.

Genus Amblystira Stål (1873).

Amblystira Stål, Enumeratio Hemipterorum, III, 1873, pp. 120 and 129; Champion, Biol. Centr.-Amer., Rhynch., II, 1897, p. 29; Trans. Ent. Soc. Lond., 1898, pt. 1, p. 61.

Haplotype *Amblystira pallipes* Stål, from Brazil.

21. **Amblystira morrisoni** sp. nov.

Narrow, elongate. Pronotum coarsely punctate, strongly swollen on the disc, unicarinate, the median carina distinct, but not strongly raised, the lateral carinæ wanting. Head short, furrowed in the middle, the frontal spines entirely wanting, the posterior spines represented by short tubercular-like processes. Elytra slightly constricted beyond the middle, rounded at the tip; costal area almost entirely absent, represented by an extremely narrow, almost obsolete carina-like process; subcostal area with three to four rows of areolæ at its widest part; discoidal area not reaching the middle of the elytra, the outer margin distinctly rounded and enlarged (extending into subcostal area) at the base. Rostrum reaching to the metasternum. Bucculæ not contiguous in front.

Head black, the posterior tubercular-like spines testaceous. First and second antennal segments testaceous, the others wanting. Pronotum fuscous, the median carina, median portion of collum, and posterior process testaceous. Elytra testaceous, a broad transverse band, extending from the inner margin of discoidal area to outer margin of elytra, fuscous; the sutural area partly imbrowned. Body black beneath. Legs testaceous, the tips of tarsi fuscous.

Length 2.5 mm.; width .75 mm.

Two specimens, collected four miles east of San Domingo City, Rep. San Domingo, West Indies, July 22, 1917, by Mr. Harold Morrison. *Type*, No. 25,280 U. S. N. M., a male. The obsolete costal area distinguishes this species at once from other members of the genus.

22. **Amblystira nyctalis** sp. nov.

Antennæ longer than in *A. silvicola* sp. nov., the third segment one and one-third times the length of the fourth. Elytra slightly expanded beyond the base, slightly constricted beyond the

middle, feebly serrate along the lateral margins, the costal area uniseriate to behind the middle and biseriate at the widest part; subcostal area quadriseriate at its widest part; discoidal area with the outer margin nearly straight, with four rows of areolæ at its widest part, distinctly angulate, but not raised at the apex, the areolæ moderately impressed. Rostrum reaching to the end of the mesosternum. Wings almost as long as the elytra.

General color rather dull jet-black, the enlarged part of costal area testaceous, the distal portion of sutural area dark fuscous. Areolæ mostly black, the areolæ of testaceous region of costal area subhyaline, the areolæ of fuscous portion of sutural area mostly fuscous. Other characters quite similar to those of *A. silvicola*.

Length 2.85 mm.; width 1 mm.

Two specimens, one from Chapada and the other from Entre Rios, Brazil, collected by Mr. and Mrs. H. H. Smith. *Type*, a male from Chapada, in the Carnegie Museum. *Paratype*, without head and pronotum, in my collection. The longer antennæ and the mostly black areolæ of elytra distinguish *A. nyctalis* from *A. silvicola* sp. nov. *A. opaca* Champion has the pronotum unicarinate and *A. maculata* Van Duzee seems to be quite differently colored.

23. **Amblystira silvicola** sp. nov. (Plate XXXIX, fig. 6).

Pronotum narrowed anteriorly, closely and quite coarsely punctate, rugulose, tricarinate, the lateral carinæ slightly converging posteriorly and rather indistinct on the disc. Antennæ moderately long, slender; first and second segments about equal in length; third long and slender, a little less than twice the length of the fourth, the latter much longer than the first two taken together. Elytra considerably longer than the abdomen, broadly rounded at the tip, the outer margin serrate; costal area narrow at the base, becoming wider towards the apex, entirely uniseriate, the areolæ small on the basal portion and moderately large at the widest part, or biseriate at the widest part; subcostal area with five rows of areolæ at its widest part; discoidal area rather short, the outer margin nearly straight, with four rows of areolæ at its widest part, the apex angulate and distinctly raised. Wings longer than the abdomen.

Head and pronotum black, somewhat shining. Body beneath black. Elytra mostly black; the distal portion of sutural area dark fuscous, the widest part of costal area testaceous, the small areolæ of the black portion of the elytra opaque whitish, of the testaceous part of costal area subhyaline, and of the distal and fuscous portion of the sutural area clouded with fuscous around the borders, the centers pale. Antennæ whitish or testaceous, the distal three-fourths of the apical segment dark fuscous. Legs whitish or testaceous, the tarsi fuscous.

Length 3 mm.; width 1.1 mm.

Six specimens: three from Rio Machupo, Bolivia (near Rio Guaporé), collected July 29, 1909, by J. D. Haseman; one specimen from Rio Guaporé (near Forto Principé), Brazil, July 20, 1920, collected by Haseman; one specimen from Entre Rios, Brazil, collected by Mr. and Mrs. H. H. Smith; one specimen from bank of Demerara River, two miles from Georgetown, British Guiana, collected Sept. 22,

1916, by Mr. Harold Morrison. *Type*, a male from Rio Machupo, Bolivia, July 29, J. D. Haseman, in the Carnegie Museum. *Paratypes* in Carnegie Museum, National Museum, and my collection. The *type* has the antennæ and legs whitish, the tarsi and distal three-fourths of the last antennal segment fuscous; the widest part of the costal area is biseriate. Some of the paratypes have the antennæ and legs darker and the costal area entirely uniseriate. One specimen has the costal area biseriate on one side and uniseriate on the other. This species seems to differ from *A. pallipes* Stål in the narrower costal area and the differently colored elytra.

24. **Amblystira marginata** sp. nov. (Plate XXXIX, fig. 7).

Head, pronotum, and body beneath black. Elytra black, the costal area whitish testaceous. Antennæ moderately long, flavo-testaceous, the fourth segment black and moderately hairy; first segment a little thicker and longer than the second; third segment two and one-third times the length of the fourth, the latter longer than the first and second taken together. Rostrum reaching between the intermediate coxæ. Legs yellowish brown, the tarsi fuscous. Pronotum coarsely punctured, narrowed anteriorly, tricarinate, lateral carinæ distinct, but not strongly raised, non-reticulate, slightly diverging anteriorly; median carina a little more elevated, non-reticulate, slightly raised at the collum. Elytra broadest at the middle, the areolæ of subcostal and discoidal areas very small and punctiform; costal area moderately broad, mostly uniseriate, biseriate at the widest part, the areolæ moderately large, and set in a little from the outer margin; subcostal area broad, five or six rows of areolæ at the widest part; discoidal area short, broad, five to six rows of areolæ at the widest part; sutural area broad, the reticulations becoming larger towards the tip.

Length 3.1 mm.; width 1.2 mm.

Three specimens, taken at Paraiso, Canal Zone, Panama, Feb. 11, 1911, by Dr. E. A. Schwarz. *Type* (figured) No. 25,279 in U. S. National Museum; *paratypes* in National Museum and my collection. The flavo-testaceous costal area of the elytra distinguishes this insect at a glance from any species in the genus hitherto described.

Genus Nyctotingis gen. nov.

Antennæ long, rather slender, quite widely separated at the base; first segment longer and slightly thicker than the second, the third very long and slender. Antenniferous tubercles well developed, moderately prominent. Bucculæ closed in front. Coxæ quite widely separated; rostral channel deep, uninterrupted, rather wide, the rostral laminæ strongly foliaceous. Head with five small spines, the spines arranged as in related genera. Rostrum reaching to the tip of the rostral sulcus. Metasternal orifices distinct. Pronotum quite strongly tumid on the disc, narrowed anteriorly, coarsely punctate, unicarinate. Paranota represented by a very narrow, non-reticulate, carina-like ridge. Hood small, formed by the raised collum and

median carina. Wings present. Elytra broad, considerably longer than the abdomen; discoidal area large, reaching beyond the middle of the elytra; costal area broad, the subcostal area long and narrow.

Type of genus, *Nyctotingis osborni* sp. nov., in the Carnegie Museum. This genus is perhaps most closely allied to *Teleonemia* Stål, from which it may be readily separated by the long and more slender antennæ, which are also much more widely separated at the base. It differs from *Leptoypha* Stål in the characters cited above and also in having the disc of the pronotum more swollen, longer elytra, etc.

25. **Nyctotingis osborni** sp. nov. (Text-figure No. 1).

Pronotum somewhat shining, very coarsely punctate, narrowed anteriorly, nearly truncate in front, transversely swollen through the disc, sharply unicarinate; the carina finely reticulated, raised in front, and thus forming a small hood-like structure. Head with short spines, the median spine appressed and the anterior ones converging. Antennæ very long, the first segment a little more swollen and about twice the length of the second, the third segment about three times the length of the fourth. Rostral laminæ and bucculæ well developed, the rostrum reaching to the apex of the rostral sulcus. Elytra broadly expanded, broadly rounded at the apex, the outer margin finely double-serrate; costal area quite broad, the areolæ moderately large, with eight or nine irregular rows of areolæ; discoidal area strongly elevated, long, reaching beyond the middle of the elytra, composed of several irregular rows of small areolæ at the widest part; subcostal area nearly perpendicular, mostly triseriate.

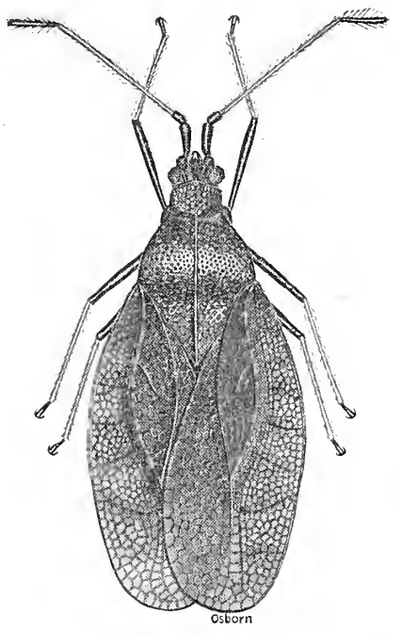


Fig. 1. *Nyctotingis osborni* gen. et sp. nov.

Head, eyes, pronotum, body beneath, including rostral laminæ and bucculæ, black. Elytra black, except the costal area, which is fuscous. Areolæ clouded with black, except those in costal area, which are fuscous. Legs black, the tibiæ reddish brown. Antennæ with the first, second, and fourth segments black, the third reddish brown.

Length 4.43 mm.; width 2 mm.

One female specimen (*type*) from Chapada, Brazil, collected by Mr. and Mrs. H. H. Smith, in the Carnegie Museum.

Genus Tigava Stål (1860).

Tigava Stål, Rio Jan. Hemipt., I, 1860, p. 63; Champion, Biol. Centr.-Amer., Rhynch., II, 1897, p. 32; Champion, Trans. Ent. Soc. Lond., 1898, pt. 1, p. 61.

Haplotype: *Tigava præcellens* Stål.

26. **Tigava notabilis** sp. nov. (Plate XXXIX, fig. 9).

Elongate and slender. Head smooth, with three very short, blunt spines, the median spine semi-erect and the latero-posterior spines (one on each side) appressed to the head. Antennæ very long and slender, the first and fourth segments subequal in length, each about five times as long as the second; third segment very long, a little more than three times the length of the fourth. Rostrum reaching a little beyond the prosternum. Pronotum coarsely punctate, the posterior triangular portion becoming distinctly reticulate posteriorly and with a large cell at the apex, tricarinate, each carina distinct, but non-reticulate. Paranota very narrow, carina-like, non-reticulate. Elytra long and narrow; costal area extremely narrow, carina-like, without trace of areolæ; subcostal area mostly biseriate, triseriate at the apex of discoidal area; discoidal area mostly triseriate, the areolæ slightly larger than those of subcostal area; sutural area broad, the areolæ becoming larger towards the apex and along posterior margin. Wings considerably longer than the abdomen.

General color yellowish brown, with brown and fuscous markings. Head reddish brown, the spines testaceous. Antennæ brown, the first and second segments reddish brown, the fourth segment fuscous. Pronotum testaceous, with a light or dark, broad, brownish streak between the carinæ. Elytra testaceous, a large portion of discoidal and sutural areas brown or fuscous, three or four areolæ near the apex hyaline. Legs brownish, the tips of femora, tibiæ, and tarsi fuscous. Body beneath dark fuscous.

Length 5 mm.; width 1 mm.

The very narrow carina-like paranota and costal area of the elytra, each without areolæ, distinguish *T. notabilis* at once from any other known species in the genus.

Sixteen specimens from Chapada, Brazil, taken during the months of April, May and November, by Mr. and Mrs. H. H. Smith. *Type*, male, in Carnegie Museum. *Paratypes* in Carnegie Museum and my collection.

27. **Tigava jansoni** sp. nov. (Plate XXXIX, fig. 8).

Moderately long, slender. Antennæ long, slender; first segment about three and a half times the length of the second; third segment a little more than three times the length of the fourth, the latter shorter than the first two taken together. Head tumid in front, with five spines; latero-posterior spines long, extending to the basal segment of the antennæ; median spine long, porrect, considerably longer than the anterior spines. Rostrum reaching to the mesosternum. Pronotum narrowed anteriorly, coarsely punctured, tricarinate, each carina distinctly raised, but non-reticulate. Paranota carina-like, non-reticulate. Elytra long, constricted a little beyond the middle; costal area very narrow, slightly widened posteriorly, uniseriate, somewhat reflexed anteriorly, the areolæ very small; subcostal area mostly biseriate, triseriate at the widest part, the areolæ a little smaller than those of discoidal area, the latter triseriate at its widest part; sutural area broad, the areolæ becoming larger distally.

General color yellowish brown, with brown and fuscous markings. Antennæ testaceous,

the basal segment dark reddish brown, the fourth mostly fuscous. Legs testaceous, the tips of tarsi brown. Head and median spines dark reddish brown, the other spines testaceous. Pronotum brownish. Elytra testaceous, eight or ten transverse nervures of costal area and most of discoidal area fuscous; sutural area partly clouded with brown or fuscous. Body beneath black, the rostral laminæ and bucculæ testaceous.

Length 3.7 mm.; width .68 mm.

Two specimens from Chapada, Brazil, collected by Mr. and Mrs. H. H. Smith. *Type* (figured), a male, in Carnegie Museum. This insect is very distinct from the described species in the genus, but very closely related to *T. mollicula* sp. nov. described below. The species is named in honor of Mr. A. R. Janson.

28. **Tigava mollicula** sp. nov.

Antennæ rather long, slender; first segment long, a little shorter than in *T. jansoni* sp. nov., not quite two and one-half times the length of the second; third segment very long, three times the length of the fourth. Head with five spines, somewhat enlarged about the base of the median spine; posterior spines decumbent, reaching to the base of the antennæ; median spines rather long, reaching to the middle of the first antennal segment; anterior spines about half as long as the median spines. Rostrum reaching to the metasternum. Pronotum coarsely punctate, becoming reticulate on the posterior portion, tricarinate; each carina thin, distinctly raised, composed of a single row of indistinct areolæ; paranota narrow, composed of a single row of very small areolæ. Elytra as in *T. jansoni*, the costal area slightly broader. Wings considerably longer than the abdomen.

General color yellowish brown, with brown and fuscous markings. Antennæ testaceous, the basal segment brown, the apical segment mostly fuscous. Head brown, the posterior spines testaceous. Pronotum yellowish brown, some of the nervures of triangular process partly fuscous. Elytra yellowish brown, about ten or twelve transverse nervures in costal, most of discoidal and part of sutural areas clouded with brown and fuscous. Body beneath blackish.

Length 3.8 mm.; width .7 mm.

Allied to *T. jansoni*, but differs from it in having shorter antennæ, a longer rostrum, broader (uniseriate) paranota, and more strongly raised carinæ.

Two specimens from Chapada, Brazil, taken by Mr. and Mrs. H. H. Smith. *Type*, female, in Carnegie Museum. *Paratype*, antennæ broken, in my collection.

Genus Tingis Fabricius (1803).

Tingis Fabricius, Systema Rhyngotorum, 1803, p. 124.

Monanthia Fieber, Entomologische Monographien, 1844, p. 38 (in part).

Logotype: *Tingis* (*Cimex*) *cardui* (Linnæus).

Subgenus Tingis (Fabricius) Horvath, 1906.

Monanthia subgenus *Platychila* Fieber, Die Europäischen Hemiptera, 1861, p. 119.

Subgenus *Tingis* Horvath, Annales Historico-Naturales Musei Nationalis Hungarici, Vol. IV, 1906, pp. 67 and 71.

Logotype of subgenus, *Tingis* (*Cimex*) *cardui* (Linn.).

29. **Tingis americana** sp. nov. (Plate XXXIX, fig. 11).

Moderately large, broadly ovate, moderately clothed with short, fine pile. Antennæ moderately long; first segment slightly thicker and a little longer than the second; third segment slenderest, one and two-third times the length of the fourth. Pronotum coarsely punctate, narrowed anteriorly, distinctly depressed back of the collum, tricarinate, each carina distinctly raised on the disc and non-reticulate, more raised posteriorly and reticulate; the lateral carina converging posteriorly; paranota moderately broad, faintly reflexed, biseriate in front, uniseriate behind, the areolæ large and hyaline, the outer margin nearly straight. Elytra broad, broadly rounded at the tip; costal area broad, triseriate, the areolæ large and hyaline; subcostal area uniseriate; discoidal area broad, extending considerably beyond the middle of the elytra, with a slightly raised, longitudinal, adventitious nervure between the outer margin and the middle. Wings almost as long as the elytra. Head with four slender, blunt, moderately long spines, the median spine obsolete, the antenniferous tubercles rather long, blunt, and slightly curved. Rostrum reaching a little beyond the prosternum.

Head dark brown or blackish, the eyes blackish, the spines brownish or testaceous, the fine hairs whitish. Antennæ with the first and second segments dark brown, the third testaceous, the fourth fuscous. Pronotum brown, the depressed area back of the collum black, the pile whitish or pale yellowish brown. Elytra yellowish brown, four to six transverse nervures of costal area and one or two spots in discoidal area brown or fuscous. Body beneath dark brown, the thorax darker. Legs dark brown, the tibiæ and tarsi, except tips, lighter.

Length 2.72 mm.; width 1.6 mm.

Four specimens, Chapada, Brazil, collected by Mr. and Mrs. H. H. Smith. *Type* a female (figured) in the Carnegie Museum. *Paratypes* in Carnegie Museum and my collection. This species seems to belong to the Palæarctic genus *Tingis* Fabr., subgenus *Tingis* Fabr., and is the first record of the occurrence of this genus in America. Several American species have been described and placed in the genus *Tingis*, but they belong in other genera and have been incorrectly placed in the genus *Tingis*.

Genus Neotingis gen. nov.

Pronotum coarsely punctate, transversely swollen on the disc, somewhat narrowed in front, tricarinate, the lateral carina becoming obsolete anteriorly. Collum distinct. Hood wanting. Paranota present. Bucculæ broad, long, closed in front. Rostrum reaching a little beyond the prosternum. Rostral laminæ widely separated. Rostral groove uninterrupted, closed behind. Metasternal orifice indistinct. Head long, with two long spines (one on each side of the median line) in front; median spine wanting; posterior spines represented by short ridge-like spines appressed to the head. Antenniferous tubercles rather stout, long. Eyes small, not very promi-

nent. Antennæ slender, moderately long; first segment a little thicker and longer than the second; third very long and slender; fourth swollen on the distal half. Wings present. Elytra broad, considerably longer than the abdomen, the discoidal almost reaching to the middle of the elytra.

Type of genus, *Neotingis hollandi*, sp. nov. In general appearance this species, although it belongs to the *Tingitini*, greatly resembles the genus *Phatnoma* Fieber of the *Cantacaderini*.

30. **Neotingis hollandi** sp. nov. (Plate XXXIX, fig. 5).

Head slightly rugulose, the anterior spines very long, slender, reaching almost to the end of the first antennal segment, the tips meeting. Antennæ moderately long, slender, the third segment about three times the length of the fourth, the latter considerably swollen on the distal half. Rostrum reaching to the middle of the mesosternum. Pronotum very coarsely and closely punctate, the lateral carinæ distinct on the triangular portion; the paranota moderately broad, strongly and angularly produced antero-laterally in front. Wings much longer than the abdomen. Elytra broad, broad-oval in outline; costal area broad, triseriate at the base and apex, biseriate in the middle, the areolæ large and not very regularly arranged; subcostal area broad, with five rows of areolæ at its widest part; subcostal area moderately large, with four rows of areolæ at its widest part, angulate at the apex, the outer boundary distinctly curved.

General color yellowish brown, the swollen part of fourth antennal segment and tips of tarsi fuscous. Reticulations marked here and there with brown, the areolæ mostly hyaline. Body beneath black, the genital segments somewhat reddish.

Length 2.84 mm.; width 1.6 mm.

Type (figured), a female from Chapada, Brazil, in the Carnegie Museum, collected by Mr. and Mrs. H. H. Smith. The species is named in honor of Dr. W. J. Holland, who has taken a very active interest in South American insects.

Genus Atheas Champion (1898).

Atheas Champion, Biol. Centr.-Amer., Rhynch., II, 1898, p. 44; Heidemann, Bull. Buffalo Society of Natural Sciences, IX, 1909, p. 231; Van Duzee, Cat. Hemip. Amer. North of Mexico, 1917, p. 222.
Logotype: *Atheas nigricornis* Champion.

31. **Atheas elongata** sp. nov. (Plate XXXIX, fig. 1).

Very elongate, narrow. Pronotum coarsely punctate, slightly narrowed anteriorly, tricarinate, the carinæ only slightly raised on the disc, the lateral carinæ slightly diverging anteriorly. Paranota very narrow, linear, composed of a single series of tiny areolæ. Head longer than broad, the anterior and posterior spines rudimentary, the median spine obsolete. Antennæ moderately long, the first segment not quite twice as long as the second; third segment a little more than two and a half times the length of the fourth; fourth segment shorter than the first and second conjoined, moderately swollen and clothed with a few long hairs towards the tip. Rostral laminæ nearly parallel, the rostrum reaching to the middle of the mesosternum. Elytra elongate, narrow; costal area very narrow, uniseriate; the areolæ very small; subcostal area not twice as wide as the costal area, biseriate; discoidal area very long, reaching beyond the middle of the elytra, the outer margin nearly straight, with five rows of areolæ at its widest part.

General color testaceous. Head black, the rudimentary spines testaceous. Pronotum dark fuscous, the apex of triangular portion, paranota, the anterior end of the lateral carinæ, and central portion of the collum testaceous. Elytra testaceous. Antennæ dark brownish black, the third segment becoming slightly lighter towards the tip. Legs dark brown. Body beneath brownish black, the thorax almost black.

Length 3 mm.; width .68 mm.

Two specimens. *Type* (figured) from Chapada, Brazil, in the Carnegie Museum. *Paratype*, from the same locality, in my collection. The latter has one of the antennæ wanting. This species is very distinct and can not be easily confounded with any described species in the genus.

Genus Acysta Champion (1898).

Acysta Champion, Biol. Centr.-Amer., Rhynch., II, 1898, p. 46.

Logotype: *Acysta integra* Champion.

32. **Acysta brasiliensis uniseriata** var. nov. (Plate XXXIX, fig. 10).

Differs from *A. brasiliensis* Drake, Florida Entomologist, Vol. V, No. 3, 1922, pp. 42 and 43, from Pará, Brazil, in having a little shorter antennæ and a little broader discoidal area; the costal area is composed of one complete row of areolæ and a few extra areolæ at its widest part. Other characters and color about the same as in the typical form. The pronotum and portions of the elytra, as in the typical forms, usually covered with a whitish exudation.

Length 2.67 mm.; width 1.1 mm.

Three specimens from Chapada, Brazil, collected by Mr. and Mrs. H. H. Smith. The *type*, is a female in the Carnegie Museum, (figured). *Paratypes* in the Carnegie Museum and my collection. In *A. brasiliensis* the costal area of the elytra is composed of two complete rows of areolæ and the outer margin of the discoidal area is perhaps a little straightened. The typical form and the variety are almost identical in size (through a typographical error the dimensions of the former, *l. c.*, p. 42, are too large and erroneously given), distinctly hairy on the pronotum and elytra, and with two prominent, raised points on each elytron.

Corycera gen. nov.

Head somewhat tumid in front, the anterior and median spines replaced by stout, blunt, finger-like processes. These finger-like structures are very prominent and are directed forward. The posterior spines are short. Hood wanting. Pronotum tricarinate. Bucculæ closed in front. Metasternal orifices distinct. Other characters as in *Gelchossa* Kirkaldy (*Leptostyla* of Stål). Except for the finger-like horns, the species have the general appearance of *Atheas* of Champion. Two species are described below. The type of the genus, *Corycera comptula* sp. nov., is in the Carnegie Museum.

33. **Corycera comptula** sp. nov. (Plate XXXIX, fig. 3).

Pronotum narrowed anteriorly, closely punctate, slightly rugulose, considerably swollen on the disc, sharply tricarinate, the lateral carinæ slightly converging posteriorly, the median carina a little more elevated than the lateral carinæ; collum distinct, composed of two quite regular rows of very small cells; paranota narrow, long, uniseriate, the areolæ small. Head considerably swollen in front, the horn-like processes long, thick, cylindrical, reaching a little beyond the first antennal segment, the median a little shorter than the others, and its tip reaching but very slightly beyond the end of the first antennal segment. Posterior spines short, appressed, extending almost to the middle of the eyes. Antennæ long, slender, first segment considerably thicker and about twice as long as the second; third segment slightly more than two and one-half times the length of the fourth, the latter longer than the first and second taken together. Rostrum reaching almost to the end of the mesosternum. Elytra considerably longer than the abdomen, broadly rounded at the tips, slightly constricted beyond the middle; costal area rather narrow at the base, considerably wider towards the apex, uniseriate, the areolæ moderately large beyond the discoidal area; subcostal area moderately broad, with four rows of areolæ at its widest part; discoidal area not reaching to the middle of the elytra, moderately large, strongly raised at the tip, with four rows of areolæ at its widest part, the outer margin slightly rounded. Wings a little shorter than the elytra.

Body beneath, head, eyes, spines, and horn-like processes black. Antennæ pale testaceous, the basal segment ferruginous, the distal half of the fourth fuscous. Pronotum black, the paranota and the tip of triangular process flavous. Legs yellowish brown, the tips of tarsi fuscous. Elytra blackish fuscous; the costal area flavous, most of the transverse nervures on the basal half fuscous.

Length 2.72 mm.; width .9 mm.

Two specimens from Chapada, Brazil, taken by Mr. and Mrs. H. H. Smith. *Type* (figured), a male in the Carnegie Museum; *paratype* (female) in my collection.

34. **Corycera rugulosa** sp. nov.

Head with the anterior finger-like projections smaller and shorter than in *C. comptula*, not reaching the end of the first antennal segment, the median horn-like process a little thicker and slightly longer than other two. Pronotum more rugulose, more strongly swollen on the disc, and the paranota narrower than in *C. comptula;* tricarinate, the lateral carinæ only slightly raised on the disc, becoming almost obsolete anteriorly. Elytra rather coarsely reticulated; subcostal area mostly triseriate, the areolæ larger than in *C. comptula;* discoidal area not raised at the apex, triseriate at the widest part, the areolæ about equal in size to those of subcostal area. The elytra dark fuscous, but not as blackish as in *C. comptula*. Other characters and color very much like those of *C. comptula*.

Length 2.55 mm.; width about .9 mm.

Resembles at first sight the foregoing species, *C. comptula*, but separated from it by the shorter horn-like projections on the head, the more tumid and rugulose pronotum, and the coarser and larger reticulation of the elytra.

The *type* (female) from Chapada, Brazil, is in the Carnegie Museum.

Genus Leptopharsa Stål (1873).

Leptopharsa Stål, Enumeratio Hemipterorum, III, 1873, pp. 122 and 126; Champion, Biol. Centr.-Amer., Rhynch., II, 1897, p. 21.

Logotype: *Leptopharsa elegantula* Stål.

35. **Leptopharsa illudens** sp. nov.

Head with the anterior and median spines much reduced, the anterior ones sometimes wanting, the posterior spines rather long and appressed. Antennæ long, the first segment twice the length of the second; third segment a little more than twice the length of the fourth, the latter considerably longer than the first two conjoined. Rostrum reaching slightly beyond the prosternum, the rostral laminæ widely separated on the metasternum. Pronotum closely punctate, narrowed anteriorly, tricarinate; lateral carinæ parallel, slightly less raised than the median carina, the areolæ very tiny, almost obsolete; median carina raised anteriorly, the areolæ tiny; hood very small, formed largely by the raised median carina, transverse, projecting slightly in front. Paranota narrow, mostly biseriate, the outer margin nearly straight. Elytra rather narrow, considerably longer than the abdomen, the outer margins nearly parallel, broadly rounded at the tip; costal area moderately broad, biseriate, the areolæ quite regularly arranged; subcostal area narrow, biseriate, the areolæ small; discoidal area rather broad, with five or six rows of areolæ at its widest part, the outer margin slightly rounded. Wings considerably longer than the abdomen.

Pronotum brown or fuscous, the paranota, apex of triangular process, hood and carinæ whitish. Elytra entirely whitish or with the discoidal area brown, the sutural area partly embrowned and the subcostal area testaceous. Head brown or fuscous, the spines whitish. Antennæ with the first and second segments brown or dark brown, the fourth (save small basal portion) fuscous, the third brown and gradually becoming testaceous towards the apex. The third antennal segment shows considerable variation in the amount of brown and testaceous color. In the *type* it is mostly brown and only about the distal fourth somewhat testaceous. Legs testaceous, the tips of tarsi fuscous. Body beneath dark brown or blackish.

Length 3 mm.; width 1 mm.

Very closely allied to *L. elegantula* Stål of South America, but separated from it at once by the narrower and biseriate costal area of the elytra. The median carina, as in *L. manihotæ* n. sp., is raised anteriorly, and the hood is much reduced and only a little higher than the median carina.

Five specimens from Jamaica and Porto Rico. *Type*, a female from Mandeville, Jamaica, collected by E. P. Van Duzee, April 1906, in my collection. This specimen is labeled, "*Atheas nigricornis Champ. det. Van Duzee*," and is perhaps the insect referred to in "Notes on Jamaican Hemiptera," Bull. Buffalo Soc. Nat. Hist., Vol. VIII, No. 5, 1907, p. 22, as *A. nigricornis*. It is not at all like my cotype of Champion's *A. nigricornis*. Three *paratypes* from the Porto Rico Experiment Station, collected by A. W. Bartell, July 23, 1902; one *paratype* from San

Pedro de Mocoris, Rep. Dom., July 15, 1917 (336), by Harold Morrison, in National Museum. The *paratypes* are a little lighter in color than the *type* and are perhaps somewhat teneral.

36. **Leptopharsa longula** sp. nov. (Plate XXXIX, fig. 4).

Elongate, moderately broad. Head smooth, armed with five spines, the median spine rather short, blunt and porrect; the posterior spines very long, slender, nearly prostrate. Antennæ long and slender; first segment four times the length of the second; third segment very long, nearly three times the length of the fourth, the latter a little longer than the first two conjoined. Pronotum rather coarsely punctate, tricarinate, each carina thin and composed of a single row of very small areolæ, the lateral carinæ parallel. Paranota moderately broad, slightly reflexed, mostly biseriate, the outer margin nearly straight, rounded at the anterior and posterior ends. Hood small, transverse, projecting a little in front. Rostrum reaching to the mesosternum, the rostral channel very narrow on the pro- and mesosternum, widely separated on the metasternum. Elytra very long, faintly constricted beyond the middle; costal area rather broad, composed of two rows of areolæ; subcostal area narrow, biseriate; discoidal area not quite reaching the middle of the elytra, the outer margin nearly straight, with five rows of areolæ at its widest part. Wings considerably longer than the abdomen.

Head brown, the spines testaceous. Antennæ with the first and second segments dark brown or fuscous, the third segment testaceous, the fourth, save a small basal portion, fuscous. Pronotum brown, the carinæ, paranota and apical portion of triangular process testaceous. Elytra brown, the costal area testaceous, the sutural area partly clouded with fuscous. Legs testaceous, the tips of tarsi darker.

Length 3.52 mm.; width .55 mm.

Two specimens from Chapada, Brazil. *Type*, figured, a female in the Carnegie Museum. *Paratype*, antennæ wanting, in my collection.

37. **Leptopharsa manihotæ** sp. nov.

Form and size about the same as *L. longula*, the antennæ shorter, the first segment three times the length of the second, the third segment a little less than two and one-half times the length of the fourth. Posterior spines on the head shorter than in *L. longula*. Pronotum rather coarsely punctate, the median carina distinctly raised in front, projecting slightly over the base of the head, the raised collum and median carina forming a small hood-like structure. In *L. longula* the hood is much higher than the median carina. Other characters, except the punctiform reticulations of subcostal and discoidal areas, very much like those in *L. longula*.

Head blackish or fuscous, the eyes dark reddish. Pronotum fuscous, the carinæ, paranota, apex of triangular process, and anterior margin of collum light testaceous. Elytra fuscous, the costal area testaceous, the sutural area partly fuscous. Areolæ of paranota and costal area hyaline, of sutural area hyaline or subhyaline. Body beneath black. Legs pale brown, the tips of tarsi fuscous. Antennæ with first, second, and fourth (save small basal portion) segments fuscous, the third pale brown.

Length 3.5 mm.; width .52 mm.

Very much like *L. longula* n. sp., but easily separated from it by the punctiform areolæ of the subcostal and discoidal areas, the distinctly raised median carina in front, and the almost obsolete hood.

Three specimens, Trinidad, B. W. I. *Type*, female No. 25,305, in U. S. Nat. Mus. *Paratypes* in Nat. Mus. and my collection. This species feeds and breeds upon cassava, *Manihot* sp.

Genus Gelchossa Kirkaldy (1904).

Leptostyla Stål, Enumeratio Hemipterorum, III, 1873, pp. 120 and 125; Champion, Biol. Centr.-Amer., Rhynch., II, 1897, p. 11; Van Duzee, Cat. Hemip. Amer. North of Mexico, 1917, p. 218; McAtee, Bull. Brooklyn Ent. Soc., Vol. XII, No. 3, 1917, pp. 55–64.

Gelchossa Kirkaldy, The Entomologist, XXXVII, 1904, p. 280.

Logotype: *Gelchossa* (*Tingis*) *oblonga* (Say).

The genus *Leptostyla* was first established by Paolo Lioy, 1864, *Atti dell' Istituto Veneto*, 3a Ser., T. IX, p. 1350 (I Ditteri distribuiti secondo un nuovo methodo di classificazione naturale), for a genus of *Muscidæ* (Diptera) and has priority over *Leptostyla* Stål, 1873 (Hemiptera). In view of the foregoing fact, *Gelchossa* was proposed by Kirkaldy in 1904, and replaces the preoccupied name *Leptostyla* Stål (*Hemiptera, Tingitidæ*).

38. **Gelchossa albocosta** sp. nov. (Plate XXXIX, fig. 2).

Pronotum narrowed anteriorly, rugulose, coarsely punctured, tricarinate, the lateral carinæ diverging slightly posteriorly, the median carina slightly more elevated on the collum. Paranota rather narrow, uniseriate. Rostrum not quite reaching the middle of the mesosternum. Antennæ rather long and slender, the first segment a little thicker and distinctly longer than the second; third segment long, more than two and one-half times the length of the fourth. Elytra constricted beyond the middle; costal area moderately wide, uniseriate, the areolæ hyaline; subcostal area mostly triseriate, the areolæ about equal in size to those of discoidal area; discoidal area quadriseriate at the widest part, the outer margin slightly rounded; sutural area rather broad, the areolæ becoming larger posteriorly. Wings almost as long as the elytra. Head with the latero-posterior spines long, contiguous with the surface of the head; median spine very short and almost obsolete; anterior spines moderately long, their apices meeting.

Head black, the posterior spines yellowish. Antennæ testaceous, the distal two-thirds of fourth segment blackish. Pronotum black, the triangular portion fuscous, the paranota whitish. Elytra fuscous, the costal area whitish. Body beneath black. Legs testaceous, the tips of tarsi brownish.

Length 2.27 mm.; width .82 mm.

One specimen (*type*, male) from Chapada, Brazil, collected by Mr. and Mrs. H. H. Smith, in the Carnegie Museum.

39. **Gelchossa magnifica** sp. nov.

Paranota enormously developed, very long and broad, nearly semiglobose, strongly constricted at the middle of the outer margin and extending high over and above the sides of the pronotum, composed of several rows of areolæ, the areolæ rather large and irregular in size. Pronotum coarsely punctate, unicarinate. Hood rather large, ovoid, higher than long, not quite as highly elevated as the paranota, a few short spines on the nervures, the sides slightly compressed. Median carina enormously developed posteriorly, very highly arched behind, united to the median nervure of the hood a little above the base of the hood. Paranota and median carina armed with short spines on their margins. Lateral carinæ entirely wanting. Rostrum reaching almost to the end of the rostral sulcus. Head largely concealed by the hood, the posterior spines obsolete, the anterior spines moderately long and directed downwards. Antennæ long and slender, sparsely setose; third segment slightly more than three times as long as the second, the latter short; third segment very long, slightly more than twice the length of the fourth, the latter longer than the first two segments conjoined. Elytra long and divergent, widening from the base, with a double row of short spines along the outer margin, not broadly rounded at the tip, the tumid elevations very strongly inflated and large; costal area very broad, with four or five rows of large areolæ at its widest part, the areolæ becoming larger distally.

General color testaceous, with brownish markings. Body beneath dark reddish brown or fuscous. Areolæ of paranota considerably clouded with brown. Pronotum brown, usually covered with a whitish exudation. Median carina with a large fuscous area. Elytra testaceous, the apical areolæ, forming an oblique cross-band, partly clouded with fuscous. Areolæ subhyaline. Antennæ testaceous, the first two and apical segments usually brownish. Legs yellowish brown. The color of paranota and elytra varies somewhat in different specimens.

Length 5 mm.; width 3.2 mm. (through tumid elevations).

Twelve specimens from Chapada, Brazil. *Type*, a female from Chapada, collected by Mr. and Mrs. H. H. Smith, in the Carnegie Museum. *Paratypes* in Carnegie Museum, Paris Museum, and my collection.

Genus Leptobyrsa Stål (1873).

Leptobyrsa Stål, Enumeratio Hemipterorum, III, 1873, pp. 119 and 123; Champion, Biol. Centr.-Amer., Rhynch., II, 1897, p. 25; Berg, Hemiptera of Argentina, 1884, p. 135.

Haplotype: *Leptobyrsa steini* Stål.

40. **Leptobyrsa elegantula** sp. nov. (Text-figure 2*b*).

Broad; head smooth, shining, armed with five long, slender spines. Antennæ moderately long, clothed with numerous, long, projecting hairs; first segment a little thicker and a little more than twice as long as the second; third segment almost twice as long as the fourth, the latter considerably longer than the first and second conjoined. Pronotum rather closely punctured, unicarinate, the carina distinct but only feebly raised; hood wanting; posterior triangular portion greatly abbreviated, leaving a large triangular area exposed between the elytra, and excavated at the middle. Paranota strongly and somewhat arcuately produced in front, almost reaching

to the apex of the second antennal segment, with two rows of areolæ (one very large cell at the anterior margin bordered with from five to seven smaller cells) in front, and diminishing to one or two small cells at the posterior end. Elytra with the tumid elevations poorly developed, almost obsolete, the margins of paranota and elytra with rather long, slender spines; costal area composed of four or five rows of areolæ; subcostal and discoidal areas not distinctly defined. Wings rudimentary. Rostrum reaching almost to the intermediate coxæ.

General color yellowish brown, the poorly developed tumid elevations partly clouded with fuscous. Areolæ hyaline. Body beneath brown or yellowish brown. Antennæ uniform yellowish brown; in some specimens the first and second segments are brown.

Length 3.8 mm.; width 2.7 mm.

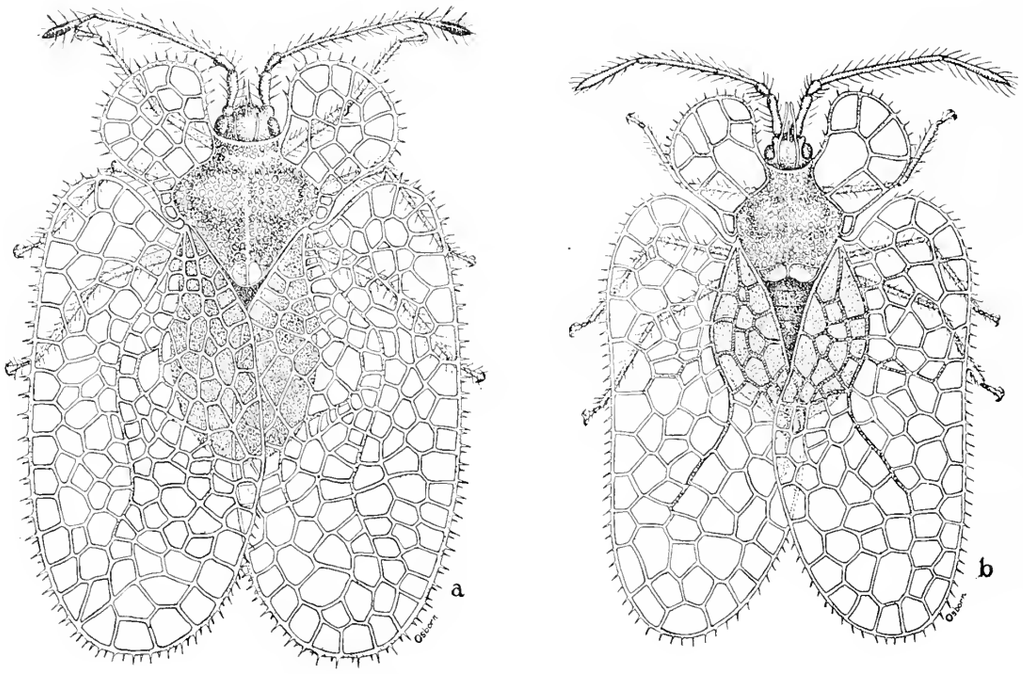


Fig. 2. *a*, *Leptobyrsa splendida* Drake, sp. nov.
b, *Leptobyrsa elegantula* Drake, sp. nov.

Ten specimens; nine from Chapada, Brazil (H. H. Smith), and one (*paratype* in Paris Museum) labeled "*Brazil.*" *Type* (male from Chapada) in the Carnegie Museum. *Paratypes* in Carnegie Museum and my collection.

41. **Leptobyrsa splendida** sp. nov. (Text-figure 2*a*).

Broad, almost rectangular in outline. Head smooth, shining, armed with five long, slender spines. Rostrum reaching a little beyond the middle of the mesosternum. Antennæ moderately long, clothed with numerous long, projecting hairs; first segment slightly more than twice the length of the second; third segment a little less than twice the length of the fourth. Pronotum coarsely punctured, unicarinate, the carina distinct, but only feebly raised (in a de-

pressed groove on the disc); posterior triangular portion fully developed, ending in a broad apex. Paranota strongly and arcuately produced in front, a little broader and the areolæ smaller than in *L. elegantula* sp. nov. Paranota and elytra armed with moderately long, slender spines on the outer margins, the elytra with an additional suberect row of spines. Elytra with moderately large reticulations; tumid elevations faintly developed, nearly flat; costal area with three or four rows of areolæ; discoidal and subcostal area not plainly differentiated.

General color yellowish brown. Eyes black. Antennæ yellowish brown, the distal half of fourth segment fuscous. Body beneath brownish.

Length 4.1 mm.; width 3.18 mm.

Allied to *L. elegantula* n. sp., but differs in having smaller reticulations, broader paranota and in the well developed triangular portion of the pronotum.

Two specimens. *Type*, a female (figured), from Chapada, Brazil, in the Carnegie Museum. *Paratype*, S. Antonio, Province de Bahia, Brazil, in my collection. *L. splendida* and *L. elegantula* are not easily confused with *L. steini* Stål from Brazil.

42. **Leptobyrsa decora** sp. nov.

Moderately broad. Head with five long and very slender spines; anterior spines projecting a little forward, shorter than the first antennal segment; median spine porrect, a little longer than the first antennal segment; posterior spines very long, very slender, appressed to the surface of the head. Antennæ moderately long, slender, clothed with numerous, long, projecting hairs; the first segment twice as long as the second, the third very long and slender. Rostrum reaching to the metasternum. Pronotum tricarinate, the carinæ strongly foliaceous; lateral carina arch-like, parallel, a little more strongly raised towards the front, each composed of two or three large cells and a small cell in front; median carina strongly arched at the middle, composed of a single row of large areolæ. Hood higher than long, not very broad. Paranota long, broad, moderately reflexed, the outer margin slightly rounded, biseriate, the outer row of areolæ large. Elytra broad, the tumid elevations well developed, somewhat rounded, each deeply constricted on the inner side; costal area broad, triseriate at its widest part, the areolæ large. Margins of elytra and paranota finely serrate, clothed with a few long, fine hairs; the nervures with a few erect hairs. Wings poorly developed. Legs moderately hairy.

Testaceous, a few of the nervures of carinæ, paranota, and tumid elevation fuscous. Head and body brown, the median and anterior spines dark brown, the posterior spines whitish. Antennæ yellowish brown, the fourth segment wanting. Legs yellowish brown, the tips of tarsi fuscous.

Length 3.85 mm.; width 2.25 mm.

Allied to *L. medocina* Pennington, but distinguished from it by the higher and narrower hood, the more foliaceous median carina, the larger areolæ, the smaller tumid elevation, and the more widely separated tips of the elytra.

Three specimens: two from Lacumbre, Colombia, alt. 6600 feet, June 2, 1914, by Mr. H. S. Parish; and one specimen (antennæ broken and wings damaged)

from Ber. San Pedro and Colaisaco, Ecuador, collected on a yellow flowering leguminous herb, Jan. 7, 1911, by Mr. C. H. Townsend.

Type, a male from Colombia, in my collection. *Paratype* from Ecuador in National Museum.

43. **Leptobyrsa ardua** sp. nov.

Hood twice as long as high, strongly projecting forwards, not as highly elevated as in *L. decora* and *L. medocina*. Head, save the sides, concealed by the hood, with five very slender, long spines, clothed with long, projecting hairs; first segment a little thicker and twice the length of the third; third segment slightly curved, about three and a half times the length of the fourth. Rostrum reaching to the metasternum. Paranota broad, mostly biseriate, triseriate at the anterior margin, the areolæ large, shaped as in *L. medocina*. Carinæ strongly foliaceous; lateral carinæ parallel, arch-like, composed of three large cells; median carina highest a little in front of the middle, uniseriate. Wings much reduced. Elytra broad, the areolæ large, the tumid elevations similar in form, but larger than in *L. medocina* and *L. decora;* costal area mostly triseriate, quadriseriate at the widest part, the areolæ large. Margins of paranota and elytra (here and there an extra submarginal row) armed with slender, not very long spines. The nervures with a few erect spines. Legs moderately hairy. Color quite similar to *medocina*.

Length 5 mm.; width 2.9 mm.

Akin to *L. decora* and *L. medocina*, but separated at once by the much longer and less elevated hood and the costal area which contains four rows of areolæ at its widest part.

Two specimens from Brazil. *Type*, male from Province of Minas Geraes, Brazil (alt. 1100 meters), collected by E. R. Wagner, and in my collection. The pronotum above and on the sides is moderately clothed with rather long yellowish white hair. There are also a few scattered, erect spines on the nervures of the elytra, hood, and paranota. In the *paratype* from San Paulo, the costal area of elytra is composed of three rows of areolæ on one side (at widest part) and of four rows on the other side.

Genus Dicysta Champion (1897).

Dicysta Champion, Biol. Centr.-Amer., Rhynch., II, 1897, p. 5; Drake. Annals Carnegie Museum, XIII, 1922, pp. 269–273.

Haplotype: *Dicysta vitrea* Champion.

44. **Dicysta sagillata** sp. nov.

Head, except eyes, concealed from above by the hood, with two short, converging spines in front. Antennæ long and slender, the first segment two and one-half times the length of the second, the third a little curved, slightly more than twice the length of the fourth. Paranota moderately reflexed, moderately long and broad, the outer margin rounded, with three rows of areolæ at its widest part, the areolæ moderately large. Hood rather large, projecting a little in front

of the head. Median carina strongly inflated at the posterior end, the posterior margin of the latter rounded and the anterior margin slightly concave; the non-inflated portion of the median carina composed of a single large cell, the dorsal nervure of this cell runs obliquely downward from the summit of the posterior inflated portion and joins the median nervure of the hood a little above its base. Elytra abruptly widened at the base and then gradually widening posteriorly, the tips divaricating and not as broadly rounded as in *D. braziliensis;* tumid elevations quite large and long, the outer margin highly elevated and rounded, inner margin broadly compressed at the middle and sloping obliquely towards the median line; costal area broad, mostly triseriate, quadriseriate at its widest part, the areolæ large. The margins of the paranota and elytra armed with a double row of almost obsolete spines. Wings much longer than the abdomen.

General color testaceous; the nervures of the hood, inflated portion of median carina, and posterior portion of the tumid elevation fuscous, the areolæ lightly infuscated; the areolæ of the rest of the elytra, paranota, and the large cell of non-inflated portion of median carina, hyaline. Body beneath black, the rostral laminæ and sides of thorax dark testaceous. Legs testaceous, the tarsi fuscous. Antennæ testaceous, the distal portion of the fourth segment fuscous.

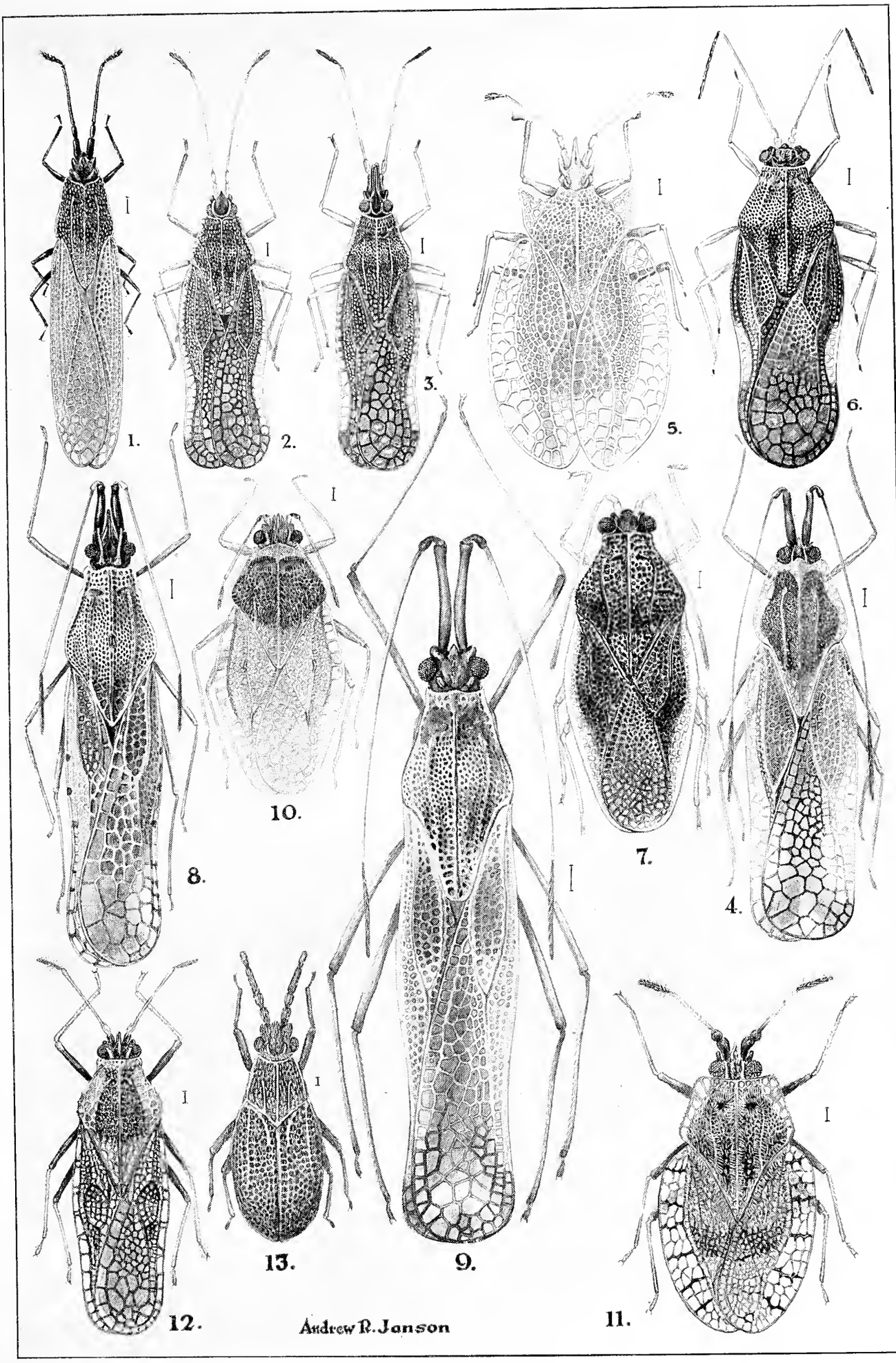
Length 3.5 mm.; width 2 mm.

Very much like *D. braziliensis* Drake in general appearance, but easily distinguished from it by the more abruptly widened elytra at the base, the large tumid elevations of the elytra and shorter, broader and more rounded paranota.

Three specimens, Porto Bello, Panama, March 12, 1911, collected by Dr. E. A. Schwarz. *Type*, a female, No. 25,366 U. S. Nat. Mus. *Paratypes* (somewhat damaged) in National Museum and my collection. This species belongs to the group of *Dicysta* containing *D. vitrea* Champion, *D. hollandi* Drake and *D. braziliensis* Drake; it is most closely related to the latter species, but readily separated from it by characters given above.

EXPLANATION OF PLATE XXXIX.

FIG. 1. *Atheas elongata* sp. nov. (p. 367).
FIG. 2. *Gelchossa albocosta* sp. nov. (p. 372).
FIG. 3. *Corycera comptula* gen. et sp. nov. (p. 369).
FIG. 4. *Leptopharsa longula* sp. nov. (p. 371).
FIG. 5. *Neotingis hollandi* gen. et sp. nov. (p. 367).
FIG. 6. *Amblystira silvicola* sp. nov. (p. 361).
FIG. 7. *Amblystira marginata* sp. nov. (p. 362).
FIG. 8. *Tigava jansoni* sp. nov. (p. 364).
FIG. 9. *Tigava notabilis* sp. nov. (p. 364).
FIG. 10. *Acysta braziliensis uniseriata* var. nov. (p. 368).
FIG. 11. *Tingis americana* sp. nov. (p. 366).
FIG. 12. *Monanthia figurata* sp. nov. (p. 354).
FIG. 13. *Coleopterodes liliputiana* Signoret (p. 353).



NEOTROFICAL TINGITIDÆ.

60. Gasteropoda of the Chazy. RAYMOND 1.35
61. Occurrence of Wynnea Americana in Pa. JENNINGS ..... .05
62. Account of Pleistocene Fauna Discovered at Frankstown, Pa. HOLLAND ..... .10
63. Vertebrate Fossils from the Vicinity of Pittsburgh, Pa. CASE ..... .15
64. Illænidæ from the Black River Limestone near Ottawa, Canada. RAYMOND and NARRAWAY.. .20
65. Rhinoceroses from the Oligocene and Miocene of North Dakota and Montana. DOUGLASS.. .25
66. Fossil Horses from North Dakota. DOUGLASS. .30
67. Oligocene Lizards. DOUGLASS ..... .20
68. The Type of Stenomylus gracilis. PETERSON.. .25
69. New Species of Birds from Costa Rica, etc. CARRIKER ..... .10
70. Costa Rican Formicariidæ. CARRIKER ..... .05
71. Vertebrate Fossils from the Fort Union Beds. DOUGLASS ..... .45
72. List of the Lepidoptera of Western Pa., etc. ENGEL 1.25
73. Fauna of Upper Devonian in Montana. Fossils of Red Shales. RAYMOND ..... .60
74. New Species of Procamelus from Upper Miocene of Montana. DOUGLASS ..... .30
75. Sections of the Conemaugh Series between Pittsburgh and Latrobe, Pa. RAYMOND ..... .35
76. List of the Unionidæ of Western Pa. ORTMANN .50
77. Geological Reconnaissance in North Dakota, Montana, and Idaho. DOUGLASS 1.00
78. Botanical Survey of Presque Isle. JENNINGS.. 2.75
79. Sesqui-Centennial (Pittsburgh) Relics. STEWART .45
80. Dromomeryx, New Genus of American Ruminants. DOUGLASS ..... .30
81. Fossils from Glacial Drift and Devonian and Mississippian near Meadville, Pa. MILLARD.. .10
82. New Species of Helodus. EASTMAN ..... .05
83. Charles Chauncey Mellor. HOLLAND..... .15
84. Reports of Expedition to British Guiana, etc. EIGENMANN ..... .50
85. Reports of Expedition to British Guiana, etc. DURBIN ..... .25
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MEMOIRS

OF THE

CARNEGIE MUSEUM

VOL. IX NOS. 3-4

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By W. J. HOLLAND

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4. THE OSTEOLOGY OF DOLICHORHINUS LONGICEPS DOUGLASS, WITH A REVIEW OF THE SPECIES OF DOLICHORHINUS IN THE ORDER OF THEIR PUBLICATION

By O. A. PETERSON

Smithsonian Institution
DEC 16 1924
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MEMOIRS

OF THE

CARNEGIE MUSEUM

Vol. IX. No. 3.

THE SKULL OF DIPLODOCUS[1]

By W. J. Holland, *Director Emeritus of the Carnegie Museum.*

(Plates XL–XLIII.)

Introductory.

When I received an invitation to contribute a short article to the Williston Memorial Volume, there was immediately recalled to my mind a day in the summer of the year 1899, when with Dr. S. W. Williston as my guest I sat and chatted with him through the early morning hours on the shady side of a shack in the bad-lands of Wyoming. I had gone thither to oversee the work which was being done by my assistants in recovering the remains of a specimen of *Diplodocus*, which is now one of the many ornaments of the Gallery of Paleontology in the Carnegie Museum. Replicas of this skeleton are to be found in many of the

[1] Shortly after the death on August 30, 1918, of Professor Samuel Wendell Williston, a movement to bring out a memorial volume in his honor was initiated. A committee composed of some of the most eminent paleontologists in both hemispheres was formed. Dr. W. K. Gregory of the American Museum of Natural History in New York became the Secretary. Important papers were submitted by a number of the leading paleontologists of Europe and America. When the papers had been collected and everything was ready for publication, the National Academy of Sciences in Washington, who had been requested to take the matter under their auspices, declined for unexplained reasons to act. The various manuscripts which had been collected were returned by Dr. Gregory to their authors with the request that when publishing the same a note should be made that the paper had been originally intended to form a chapter in the Williston Memorial Volume. This note is written in compliance with this request. *W. J. Holland.*

museums of foreign lands. As Williston and I sat and talked, he grew reminiscent. He told me that he had been the original discoverer of the material upon which Professor Othniel C. Marsh had founded his description of the genus *Diplodocus*.

As I recall the story, Williston detected the earliest known remains of the animal at the well known locality, near Felch's Ranch, not far from Canyon City, Colorado, in the year 1877. The spot is one, where Williston subsequently worked, and where for a couple of years parties from the Carnegie Museum at a later date carried on extensive excavations. Williston told me that at the time of his first visit to the spot he lived in fear of hostile Indians, who were not far away, and that he worked rapidly and hurriedly, taking up what came to hand and hastily boxing and shipping the material as it was recovered from the matrix. He told me that, had it not been for his fear of being made the target of bullets at any moment, he might have secured much more of the skeleton than he did on the occasion of his first visit to the place. The parts which he obtained, now in the Peabody Museum of Yale University, were one of the posterior limbs and portions of the tail. The structure of the chevrons of the tail led Professor Marsh to coin the generic name, which he gave to the reptile.[2] Subsequently on the occasion of later visits to the same spot Williston and the late M. P. Felch found much other material, probably pertaining to the same individual, as well as to other individuals of the same genus. But all of this material was more or less fragmentary.

This early discovery by my friend, Dr. Williston, of the type of the genus *Diplodocus* seems to me to make it appropriate that I should take as my theme something bearing upon the anatomy of the genus, which he was the first to unearth.

Since 1877 our knowledge of the reptiles belonging to the genus *Diplodocus* has been greatly enlarged. Passing over the important discoveries which were made by parties working under Dr. Henry Fairfield Osborn at Como Bluff, Wyoming in 1897[3], and the still more extensive discoveries made by the Carnegie Museum near Sheep Creek, Laramie County, Wyoming, in the years 1899 and 1900, upon which more or less full accounts have already been published,[4] it is worthy of note that among the collections obtained at the quarry discovered and

[2] *Diplodocus* from διπλόος = *double;* and δοκός, ἡ = *beam*, or *rafter*. Compare Matthew, VII, 5: Ὑποκριτά, ἔκβαλε πρῶτον τὴν δοκόν ἐκ τοῦ ὀφθαλμοῦ σου—"Thou hypocrite, cast out first from thine own eye the *beam*."

[3] Osborn, H. F., Memoirs A.M. N. H., Vol. I, No. 5, pp. 191–214, plates XXIV–XXVIII.

[4] Hatcher, Memoirs C. M., Vol. I, No. 1, pp. 1-63, plates I–XIII.
Holland, W. J., *l. c.*, Vol. II, No. 6, pp. 225–278, plates XXIII–XXX, etc., etc.

opened under my direction near Jensen, Uinta County, Utah, are several specimens of the skull belonging to this genus, three of which have been freed from the matrix and which possess much interest. A brief account of these skulls, with appropriate illustrations, appears in the following pages.

Earlier Accounts of the Skull of Diplodocus. The first description of the skull of this genus was given by Professor Marsh in Part VII of the series of papers published by him under the title: "Principal Characters of American Jurassic Dinosaurs." It appeared under the subtitle "On the Diplodocidæ, a New Family of the Sauropoda" and may be found in the *American Journal of Science,* Ser. III, Vol. XXVII, pp. 160–168, 1884, accompanied by Plates III and IV. This account was subsequently reproduced (1896) in the *Sixteenth Annual Report of the U. S. Geological Survey,* Part I, pp. 175–179, Plates XXV–XXVI.

The material upon which Professor Marsh founded his description and figures of the skull is still preserved in the United States National Museum (U. S. N. M., Nos. 2672 and 2673). It was collected by Williston and Felch, near Canyon City. The writer of these lines is very familiarly acquainted with these specimens, as they were with the greatest courtesy loaned to the Carnegie Museum at the time when the latter institution was engaged in preparing a replica of *Diplodocus* to be presented to his Majesty, King Edward VII. At that time, although we possessed an almost complete skeleton of a single individual, we did not have a skull in its entirety. The only remains representing the cranium of the animal in our collection consisted of what was at that time believed to be the posterior part of the skull of a rather small individual, recovered by W. H. Utterback in Wyoming, in the year 1902 (C. M. Acc. No. 662 (22)). Employing the anterior portion of the skull belonging to the United States National Museum (No. 2673) which is entirely freed from the matrix and the occipital portion of the skull in our own possession we effected a restoration of the skull, conformed to Professor Marsh's original description. In the light of recent discoveries we have reason to congratulate ourselves upon the general accuracy of this restoration. A full account of these matters may be found in the *Memoirs of the Carnegie Museum*, Vol. II, pp. 227–246, where the material we used is fully described and figured.

There is also given in the paper just cited a posterior and lateral view of a skull of *Diplodocus* preserved in the American Museum of Natural History in New York (A. M. N. H., No. 969). This is a restoration made by Mr. Adam Hermann, at that time the Chief Preparator in the Paleontological Laboratory of that Museum, working under the supervision of Dr. Henry Fairfield Osborn. The

externally visible portions of this skull are to a considerable extent modelled in plaster according to the figures given by Professor Marsh.

For a number of years the only material upon which an exact knowledge of the structure of the cranium and lower jaws of the genus *Diplodocus* was based was the material referred to in the preceding account. I may say in passing that the occipital portions of the cranium employed by me in my restoration in the light of recent studies is found to be doubtfully referable to *Diplodocus longus* Marsh. It is not, however, necessary to here go into details upon this point. I will refer to the matter again in this paper. Professor J. B. Hatcher and I were fully in accord at the time in attributing this fragment to the genus *Diplodocus*, with which it was found to agree after a comparative study of the papers and figures of Marsh. There are, however, certain small, but very decided differences, which point to at least specific non-identity. All of the material we had at our command was more or less defective, but there was enough to decipher with much certainty the principal characteristics of the skull. In fact it is rather astonishing to see how Professor Marsh with the somewhat crushed and broken material preserved in the United States National Museum was able to almost exactly restore the features of the skull, now that practically perfect and almost uncrushed specimens are available for comparison.

THE NATIONAL DINOSAUR MONUMENT.

In the fall of the year 1908 the writer visited his associate, Mr. Earl Douglass, who had been sent by him to explore the Eocene deposits of the Uinta Basin. At the time of my visit Mr. Douglass was located at a place known as "Well No. 2" near Bonanza on the stage-road leading from Dragon to Vernal, Utah. Far away on the northwestern horizon could be seen the snow-capped ranges of the Uinta Mountains. A study of the maps of Hayden's Survey showed certain areas to be designated as "Jurassic," and therefore likely hunting-grounds for the remains of dinosaurs. In fact Mr. O. A. Peterson as early as 1892, while collecting for the American Museum of Natural History, in whose employment he was at that time, had found some fragmentary remains of dinosaurs in the vicinity of Jensen on the Green River. Mr. Douglass also before my arrival had made an excursion to the region of Blue Mountain near the point where the Green River cuts through the Uinta range, and had discovered some flotsam and jetsam of dinosaurian material in the ravines. Orders were given that the team and wagon, a supply of water, and provisions should be made ready, and one bright morning, just as

the sun was rising over the desert and arid plains, the writer accompanied by Mr. Douglass, who acted in the capacity of teamster, friend, and philosopher, began a tour of investigation. We took our way over "Dead Man's Bench" toward the distant mountains. The interesting events of that long and somewhat trying journey, for the most part under a burning sun, may be passed over. A week was spent in exploring. It suffices to say that enough was seen to convince the writer that a diligent and painstaking search for dinosaurian remains would be richly rewarded. Accordingly in the following year (1909) Mr. Douglass was instructed, when returning to Utah, to remove his camp from the Uinta Basin to the foothills near the Green River on its right bank above the little Mormon hamlet, known as Jensen, and begin a systematic investigation of the exposures of the Morrison or Atlantosaurus Beds, which we had detected at that place. He was at first greatly discouraged, but was finally rewarded by the discovery in September, 1909, at an elevation of about a mile above sea-level, of the bed of an old river, tilted up at an angle of about 60° with the horizon. In the sandbars of this ancient stream, now turned into sandstone, were the petrified remains of numerous dinosaurs, many of them, as the result proved, consisting of skeletons not greatly dislocated, The first skeleton recovered was that of the huge beast. which, eclipsing the *Diplodocus* in size, the writer has had the pleasure of naming *Apatosaurus louisæ* in honor of Mrs. Andrew Carnegie,[5] a step which Mr. Carnegie laughingly approved, because he said: "She is the most important member of the firm." This great skeleton, as it stands alongside that of *Diplodocus carnegiei*, excites the wonder of multitudes.[6]

At the time Mr. Douglass and I began our work the land had not been thrown open to settlement. We were carrying on our explorations under a permit given to us by the authority of my good friend, Mr. James Rudolph Garfield, the then Secretary of the Interior. Some years afterward the land was thrown open to settlement. To avoid being made to pay tribute to some adventurer, who might see fit to file a claim to the barren acres upon which we were carrying on our work, I instructed Mr. Douglass to file a claim under the existing laws. He accordingly filed a claim under the provisions of the law granting citizens of the United States the right, under certain conditions, to take up land for mining and quarrying purposes. Some very learned subordinate in the Department of the Interior,

[5] Annals Carnegie Museum, Vol. X, 1916, pp. 143–145.

[6] A monographic account of the osteology of *Apatosaurus* is being prepared by the writer, all the illustrations having been drawn, and it is hoped that it may shortly be published.

passing the claim under review, decided that "fossil bones," mentioned by Mr. Douglass in his application, are not "mineral," and our request to be granted title to the land was disallowed. I have always been puzzled to know, since this formal decision was rendered, where in the realm of material things to put silicified bones. If they do not come within the category of mineral substances, what are they? On one occasion I called the attention of the late Franklin K. Lane, Secretary of the Interior, who was paying a visit to the Carnegie Museum, to this decision. He had no reply to make, but grew very red in the face, and "looked foolish," as the boys say. However, there are always by the orderings of a kind Providence ways in which to accomplish laudable purposes. I appealed to my friend, Dr. Charles D. Walcott, the Secretary of the Smithsonian Institution, to help me in my perplexity, and he pointed out that in the year 1906 the Congress of the United States had passed "An Act for the Preservation of American Antiquities," and he proposed under the provisions of this Act, which seemed to be somewhat elastic, that the little tract of barren ground, where we had been digging for fossil bones, should be set apart by presidential proclamation as a "national monument." To cut a long story short, this was done, and under date of October 4, 1915, the land was set apart by President Wilson as "The National Dinosaur Monument." Permission under the "Rules and Regulations" was given to the Director of the Carnegie Museum to continue the work, which had already been carried on by him and his associates for the preceding six years, and we were freed from the constant fear, which had haunted us, of being compelled to submit to the exactions of some wandering sheep-herder or so-called "Homesteader," either of whom might have taken up the land under existing constructions of the law, without our being able to prevent it, and then turned about and demanded rental for the treeless ground.

The quarry near Jensen has yielded a good deal of material, some of it excellent, some of it fairly good, some of it of but little value. The matrix is sandstone of varying degrees of hardness. The bone-bearing strata are only reached by a great deal of "uncovering," which is expensive and tedious. The advantage of the location is the fact that the remains found here are in many cases discovered to be lying in very nearly the positions in which they were originally deposited millions of years ago. It is possible in many cases to determine the relationship of the bones of the skeletons as they are found. They have not been as much scattered and jumbled together, as is the case in many localities where dinosaurian remains are abundant. This fact has in the main persuaded us to persist, as long

as we have, in carrying on our work at this point. However, there is not always continuity of location in the bones of specimens. One of the skulls, of which I am about to speak in detail, illustrates the latter assertion. The most perfect skull was found entirely apart from any other skeletal material. It was imbedded in a layer of very soft sandstone disassociated from any other fragments. It is designated in the Departmental Catalog of the Carnegie Museum as No. 11,161. The second skull, No. 3,452, is closely articulated with the cervical vertebræ, the occipital condyle being in juxtaposition with the cup of the atlas, thus settling beyond the shadow of a doubt the fact that the skull attributed to the genus *Diplodocus* really belonged to it, which is not the case with some other genera of the sauropod dinosaurs, which have been reconstructed by students from widely scattered material, in fact so widely scattered, as to leave a great doubt in the minds of careful students whether mistakes have not been made in the association of the skulls with the other material. The third skull, representing a very small individual, bears the Departmental No. 11,255.

SKULL OF DIPLODOCUS LONGUS Marsh.

(Carnegie Museum, No. 11,161.)

This skull is undoubtedly the most perfect specimen of a skull pertaining to the genus *Diplodocus*, which up to the present time has been obtained.

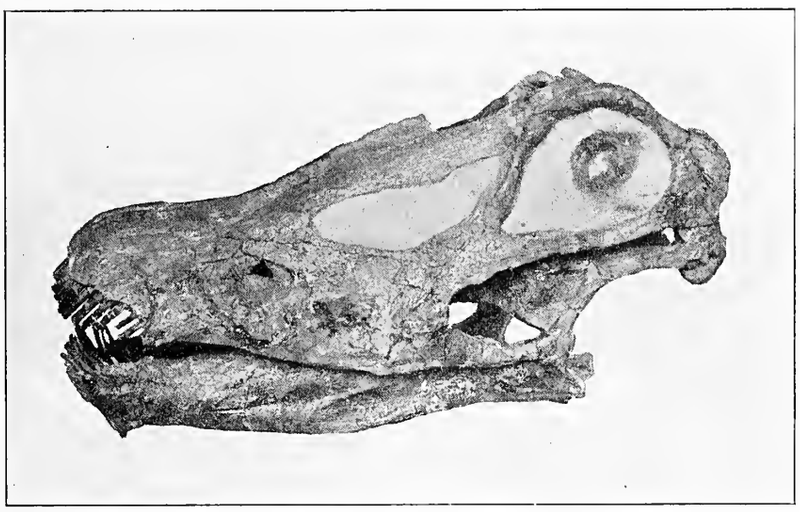

FIG. 1. Photograph of left side of skull of Diplodocus. (C. M. No. 11,161.)

It was found at the western extension of the quarry opened by the Carnegie Museum on the eminence, to which the writer has been in the habit of referring

in his publications as "Dinosaur Peak." The skull was found apart, not closely associated with any other remains. It was imbedded in a layer of soft white sandstone.

Vertically the skull has apparently sustained no crushing whatever. Laterally it has sustained a little crushing, so that the right side is slightly compressed and not quite symmetrical, a fact which is shown in the figures given on the plates.

The skull is somewhat smaller in size than the skull employed by Professor Marsh in preparing his account of the type of the genus, the material for which was obtained from the Morrison beds near Canyon City, Colorado.

So far as the writer is aware, Professor Marsh in his writings gave no exact measurements of any of the material relating to the skull of his *Diplodocus longus*, and simply states that the figures published in the American Journal of Science, Vol. XXVII, 1884, Plate III, figs. 1–3, are "one-sixth natural size." This would give a length from the anterior margin of the premaxillaries to the occiput of about 570 mm. In the restoration of the skull made by the writer and Mr. A. S. Coggeshall, which has been used in the Carnegie Museum and in all the replicas of the skeleton of *Diplodocus*, the length is approximately 590 mm. The restored skull at the American Museum of Natural History, for a cast of which we are indebted to the Trustees of that institution, measures approximately 560 mm. from the occiput to the anterior margin of the premaxillaries. The length of the skull which we are here considering (Carnegie Museum No. 11,161) is 520 mm. from the anterior margin of the premaxillaries to the occiput. The skull (Carnegie Museum No. 3,452) is considerably smaller, measuring only 450 mm. in length, measured in the same way. The third skull which is reasonably perfect (Carnegie Museum No. 11,255) is the smallest in our possession.

We have in our possession a skull (Carnegie Museum No. 11,162) found associated with the skeleton of *Apatosaurus louisæ* Holland, which is thoroughly diplodocine in its features and particularly in its dentition. At moments I have been almost inclined to regard this skull as belonging to *Apatosaurus* (See Annals Carnegie Museum Vol. IX, pp. 273–277; Vol. X, p. 143). In its length it exceeds all the diplodocine skulls thus far discovered, being 640 mm. in length. The association with the other skeletal remains of *Apatosaurus* (*Brontosaurus*) of the skull, attributed by Marsh to that genus, has seemed to me to have been rather arbitrary, though it may be that he was right. Had he opened the quarry at The National Dinosaur Monument and found the skull of which I am speaking, re-

moved only a few feet from the anterior end of the cervical vertebræ, I very much question whether he would not have assigned this skull to the remainder of the skeleton which was *in situ*.

We have in our possession fragments of other diplodocine skulls, of which I shall not here speak, as they have not as yet been freed from the matrix and prepared for careful examination.

The skull (No. 11,161) which forms the immediate subject of consideration is fully adult. This is revealed by the more or less perfect coössification of the different bones of which it is composed. So complete is this coössification that in a number of cases it is almost impossible to detect the lines of union between the different elements. The sutures are, however, in most cases decipherable, and agree in the main with other material which has been studied.

The Eye.—One of the remarkable features of this skull, which has not been found in any other specimen, is the preservation on the right side of considerable portions of the sclerotic wall of the eye. This is clearly shown in Fig. 1, and on Plate XL. A careful microscopic examination of what remains of the eye does not appear to reveal any sclerotic plates, such as are found in many of the reptilia and birds. The membrane appears to have been continuous and almost homogeneous in its structure, the tissue consisting of fibres arranged in circular (?) layers surrounding the pupil of the eye. I have entirely failed to detect after careful examination any sclero-skeletal plates.

Dentition.—Professor Marsh in his account of the material before him stated that the premaxillary bone was provided with four teeth and that the maxillaries were each provided with nine teeth. This was absolutely true of the specimens, (Nos. 2672 and 2673 U. S. N. M.) upon which he founded his description of the skull, and is also true, so far as the premaxillaries are concerned, of the specimen preserved in the American Museum of Natural History. However, in the case of the present specimen (Carnegie Museum No. 11,161) there is interpolated a large tooth which emerges at the commissure of the premaxillaries. There apparently was some malformation and dislocation of the teeth of the premaxillaries during the life-time of the animal. The number of teeth in the supra-maxillaries is evidently variable, as I have elsewhere pointed out (See Memoirs of the Carnegie Museum, Vol. II, p. 240). There are ten teeth in the right maxillary of the specimen preserved in the American Museum of Natural History and eleven in the left maxillary of that specimen. In the specimen before us there are ten teeth in the left maxillary and eleven in the right maxillary. From the foregoing state-

ments it is clearly seen that the number of teeth in the upper jaws is not definitely fixed in number. They may range in the maxillaries from nine to eleven, and possibly even more.

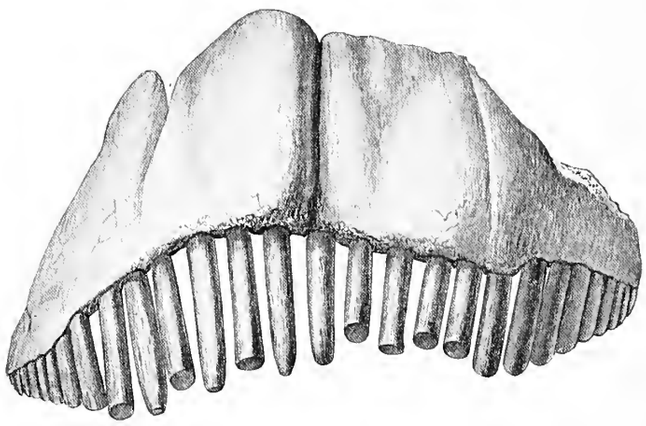

FIG. 2. Anterior view of the teeth of Diplodocus, (C. M. No. 11,161.) One-half nat. size.

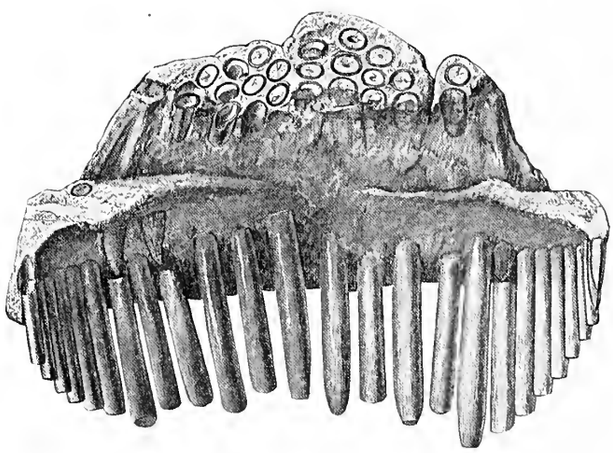

FIG. 3. Posterior view of teeth of Diplodocus, (C. M. No. 11,161), showing successional teeth above.

At the time that the skull (No. 11,161) was being removed from the matrix the anterior portion was accidentally broken away from the rest of the specimen. Before restoring the fragment to its place, I had two drawings of it carefully made by Mr. Sydney Prentice, our accomplished draughtsman, who, by the way, was a former pupil at the University of Kansas of Professor S. W. Williston. One of these drawings (Fig. 2) gives an excellent view of the anterior portion of the skull showing the dentition as it appears in a frontal view. The other drawing (Fig. 3), gives a view of the same fragment viewed from behind. The latter is interesting, inasmuch as it shows the successional teeth in the sockets in which they were

formed, and from which they issued continuously in order to replace teeth which were worn out or lost. These curious reptiles throughout life were constantly teething. The anterior portions of the premaxillaries and maxillaries as well as of the dentary must have been more or less abundantly supplied with nutritive material for the development of teeth. A vegetative process was continuously going on at the anterior extremities of both upper and lower jaws. The teeth, though somewhat firmly fixed in the alveoli, were weak, easily lost, and quickly replaced.

An interesting phenomenon reveals itself in the teeth represented in figures 2 and 3. In these figures the teeth are shown to be worn off at almost right angles to their axes. This is especially visible in the case of the older teeth, while the newer teeth, which are longer than the older teeth, only begin at their extremities, to show signs of this wearing off, but on the same plane and at the same angle with their axes, as the older teeth. As the axes of the teeth in the upper and lower jaws are placed at an obtuse angle in relation to each other it seems to the writer quite impossible to think that this wear is due to attrition between the teeth in the upper and lower jaws. The teeth contained in the lower jaw are much smaller than those in the premaxillaries and supero-maxillaries, and in the skull which we are considering do not show evidence of having been brought into opposition with the teeth of the upper jaw. The teeth of the lower jaw are exceedingly small and weak, having half the diameter (in many cases less than half the diameter) of the teeth in the upper jaw, and the wear which is noticeable upon their crowns does not suggest that it could have been produced by friction against the teeth in the upper jaw. In fact the wear apparent upon the lower teeth is on a plane more or less opposite to that shown upon the upper teeth and not parallel with it. In the small skull (Carnegie Museum No. 11,255) the teeth are, so far as visible, sharply pointed and show no signs of transverse wear.

The teeth appear to the writer to have been organs of prehension rather than of mastication. They were "nippers" adapted to seizing the objects upon which the animal fed, or "scrapers," dental rakes, in which the upper set were mainly functional as shown by their size and wear.

The question naturally arises in what way the peculiar wear of these teeth was brought about. The view, originally propounded by Marsh, that these creatures were herbivorous, feeding upon soft succulent vegetation, has long been held. It is conceivable that such vegetation in the form of algæ and aquatic plants growing in water on the surfaces of rocks may have been the food of these creatures, and the wear of the teeth, of which I have been speaking, may have

been produced by scraping upon the surfaces of the stones to which the plants were attached. In the *American Naturalist*, Vol. XLIV, 1910, p. 282, I suggested that these animals might have fed upon the starchy material contained in the trunks of cycads which were abundant in their time. It is possible that the very singular wear of the teeth might have been produced by constant attrition against the hard inner surfaces of the walls of the trunks of the cycads, which may have been ripped open by the great claws of the fore feet, as I suggested. However, Dr. G. Tornier (Bericht d. Senkenberg. Naturf. Ges., 42, 1911, p. 113) followed by Richard Sternfeld, in a German popular magazine, "Aus der Natur," has made the suggestion that these creatures fed upon animal food, Tornier says 'fishes;' Sternfeld says 'freshwater bivalves.' Tornier maintains that they were not herbivorous, but dug up their food from the beds of streams. *Quien sabe*? It is conceivable that these teeth might have been employed for the purpose of seizing shell-fish which the creatures scraped out of the beds of streams, along the margins of which their remains have hitherto always been found. In Fig. 4 I give an outline drawing of the manner in which the *Diplodocus* might have seized

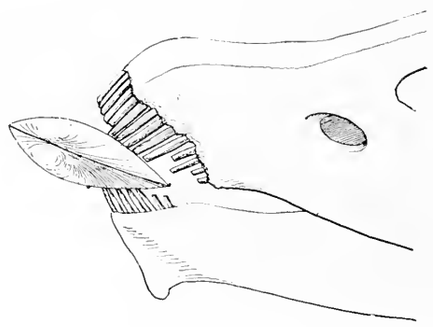

Fig. 4. Jaws of Diplodocus seizing a mussel.

a bivalve in his jaws. Upon the supposition that the animal fed upon mussels, which he must have swallowed whole, the wear of the teeth might be explained by such a habit. *Naiades* are indeed more or less abundant in the sandstones and clays whence the remains of *Diplodocus* have been taken. It is, however singular that where skeletons have been found *in situ* no shells have been discovered massed together where the stomach of the reptile might be supposed to have been located. We have uncovered several skeletons of these creatures with the vertebræ and ribs in place and I have always instructed Mr. Douglass, who has had supervision of the work in the field, to search for gizzard-stones and any detritus which might throw light upon the contents of the viscera of the animals. So far, however, he has not reported to me any accumulation of the valves of

pelecypods or other mollusks detected as lying between or near the ribs of any of the specimens which have been unearthed. There is thus so far no confirmation of Tornier's theory, nor, I may say for that matter, of Professor Marsh's statement that these creatures were herbivorous. I confess finding myself compelled to announce myself as an agnostic, so far as the mode in which these creatures obtained their food and the nature of their aliment is concerned. I am not in the least prepared on this point to dogmatize.

The order in which the teeth succeeded each other is a subject of inquiry, which in the light of the material before me leads to a query as to the correctness of the figure given by Professor Marsh in the American Journal of Science, Vol. XXVII. On Plate 4, Fig. 3, he gives a diagrammatic drawing of the teeth of the maxillary of *Diplodocus longus*, which has often been reproduced in text-books. The large skull in our possession found associated with the remains of *Apatosaurus* (Carnegie Museum No. 11,162) shows an abrasion on the anterior

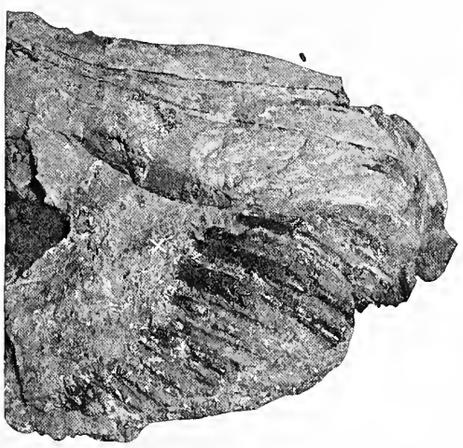

Fig. 5. View of anterior end of right upper jaw of diplodocine skull (C. M. No. 11,162) at X showing successional teeth overlapping teeth in front.

portion of the right maxillary revealing the successional teeth in such a way as to suggest that the manner of succession was different from that indicated by Professor Marsh in his figure to which reference has just been made. In the figure given by Marsh the distal end of tooth No. 2 is shown *underlapping* the proximal end of tooth No. 1. In our specimen (Carnegie Museum No. 11,162) the successional teeth are shown with their distal ends *overlapping* the proximal ends of the anterior teeth. A careful and critical examination of the teeth in our specimen, No. 11,161, likewise reveals the fact that the successional teeth as they advanced *overlapped* and *did not underlap* the teeth which are on the point of being lost in this specimen. Several of the teeth, which are almost worn out, show the points

of their successors overlapping their proximal portions which have been already partly absorbed. (See Fig. 3). It is also quite plain in some cases that the successional tooth immediately followed the one preceding it, without any tendency to overlap. As the tooth in front was worn away and became obsolescent, the tooth following it pressed upon its proximal extremity and as this was gradually absorbed the successional tooth invaded its degenerating substance, (a familiar phenomenon in the case of mammalian teeth). This is shown on Fig. 6, at *a*,

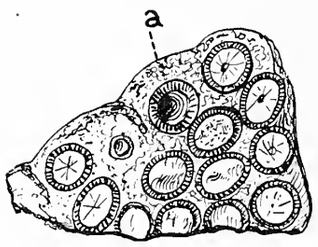

Fig. 6. Showing at *a* that the successional tooth has invaded the cavity of this tooth.

where the proximal end of a tooth about to be shed is shown with the cup-shaped cavity formed in it by the point of the tooth which was immediately succeeding it.

The Palatal Region of the Skull.—Little has hitherto been known of the palatal region of the crania of the sauropods. A reference to the figure of this region of the skull of Diplodocus given by Professor Marsh (See "*Dinosaurs of North America*," Sixteenth Annual Report of the United States Geological Survey, 1894–95, p. 177, fig. 27) which is herewith reproduced, (Fig. 7) shows how very

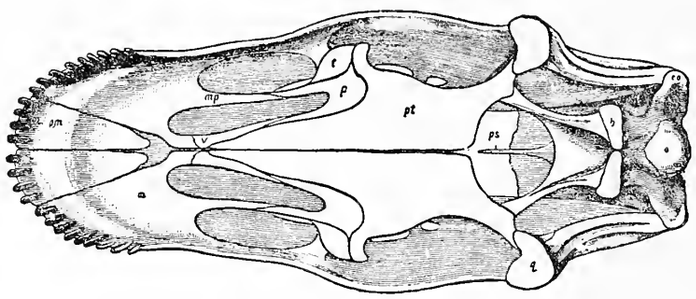

Fig. 7. Reproduction of palatal view of skull given by Professor Marsh. Sixteenth Ann. Rep. U. S. Geol. Surv. p. 177. (Fig. 27.)

shrewdly Professor Marsh with the more or less crushed and broken material, which he employed, and which is still preserved at the United States National Museum, succeeded in a general way in interpreting the osteology of this portion of the skull. The late Dr. Theodore N. Gill informed me a number of years ago, when I was preparing my paper, "The Osteology of Diplodocus" (Memoirs Carnegie Museum Vol. II, pp. 225–278), that Professor Marsh in order to facilitate

examination had separated, so far as it was possible to do so, the component elements of the skulls in the United States National Museum (U. S. N. M. Nos. 2672 and 2673). These specimens when returned to the Geological Survey by Professor Marsh were more or less composed of the disassociated portions, which were subsequently reassembled at the Museum and mounted, as they may now be seen, and as they were at the time when I wrote my paper.

In their present condition it is difficult to obtain satisfactory views of the palatal region of these skulls. The outline given by Professor Marsh approximately agrees in many respects with what is shown in plates XLI and XLII of the present article. There are, however, a number of features in the skull, which we are considering, which reveal points which are not brought out in Professor Marsh's somewhat diagrammatic drawing of this aspect of the skull. ("Dinosaurs of North America," Sixteenth Annual Report U. S. G. S., 1894–95, p. 177, Fig. 27), (See Fig. 7). To these points I desire in the following paragraphs to briefly call attention.

The specimen (Carnegie Museum No. 11,161) is, so far as the writer is aware, the only specimen in existence, which gives an approximately clear view of the entire palatal region of the skull of Diplodocus. The matrix in which this skull was imbedded, as has already been stated, was very soft sandstone. In the interior of the skull the sand which had filled it was very loosely compacted, so that it was possible without much risk to gently remove it without fracturing the very thin and delicate bones, which form the inner walls and supports of the facial region of the skull. However, in the anterior portion, in the region of the paired vomerine bones and the palatines there has been some crushing and there is difficulty in clearly making out some of the sutures.

The Pterygoid and Palatine Bones.—Professor Marsh in his description of this region says: "The palate is very high and roof-like, and composed chiefly of the pterygoids, as shown above in Fig. 27. The basipterygoid processes are elongate, much more so than in the other genera of Sauropoda."

"The pterygoids have a shallow cavity for the reception of these processes, but no distinct impression for a columella. Immediately in front of this cavity the pterygoids begin to expand, and soon form a broad, flat plate, which stands nearly vertical. Its upper border is thin, nearly straight, and extends far forward. The anterior end is acute and unites along its inferior border with the vomer. A little in front of the middle a process extends downward and outward, for union with the transverse bone. In front of this process, uniting with it and with the transverse bone, is the palatine."

The foregoing description by Professor Marsh in many respects is not open to criticism. In Fig. 8 I give a cross-section through the skull made on a plane inclining from the anterior extremity of the quadrate bone through the anterior

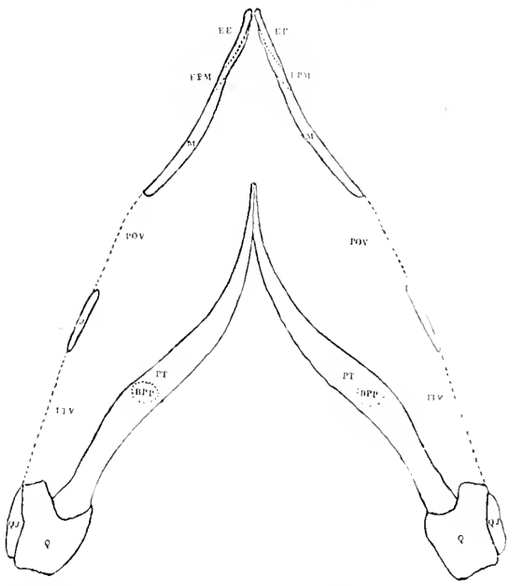

Fig. 8. Section through skull extending from quadrate bone at anterior extremity through the anterior border of the narial opening. BPP, Point where basipterygoid processes unite with back of pterygoids; EE thin plates of bone (prenarials) overlapping the posterior ends of the inner extensions of the premaxillaries; EPM, inner extensions of the premaxillary bones; ITV, infratemporal vacuity; J, jugal; M, maxillary; POV, preorbital vacuity; PT, pterygoid; Q, quadrate; QJ, quadratojugal.

border of the narial opening, which confirms the statement of Marsh that the palate is "high and roof-like and composed chiefly of the pterygoids." This is absolutely true of the posterior portion of the palatal region. His description of the basipterygoid processes is not open to any criticism. It is, however, I think open to question whether the pterygoid extends as far forward as is represented in his figure. He says "The anterior end" [of the pterygoid] "is acute and unites along its inferior border with the vomer." After a very critical examination of the specimen before me I am inclined to think that the acute anterior projection of the palatal complex, which unites according to Marsh with the vomer, may belong to the palatine. It is difficult, owing to the condition of the skull (Carnegie Museum No. 11,161), to trace the sutures with exactness, but there is a strong suggestion in what is visible that the palatine bone possessed a greater extent than is attributed to it by Professor Marsh. He says of the palatine: "The palatine is a small semi-oval bone fitting into the concave anterior border of the pterygoid, and sending forward a slender process for union with the small palatine process of the maxillary."

In Fig. 9 at *pl.* is shown the infero-proximal end of the palatal bone, as it appears in the specimen before us, and at *pl. p.* the process of the same, which unites with *p. p. m.*, the palatal process of the maxillary. According to Marsh the union of the palatal bone with the pterygoid should take place on the dotted line marked in this figure *x-y*. But I have a strong suspicion that the palatine entered more largely into the composition of the anterior part of the roof of the mouth, and that instead of terminating along the line *x-y*, it extended inwardly

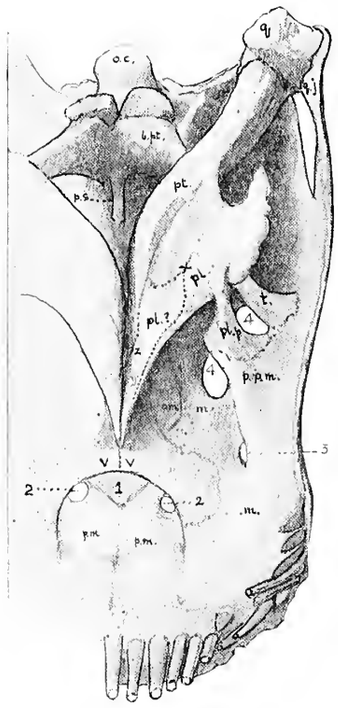

FIG. 9. View from in front looking into the skull of *Diplodocus* (C. M. No. 11,161) along the axial line of the skull, which has been turned upside down, so as to show its inferior aspect. (Lead-pencil sketch by W. J. Holland). *b.pt.*, basipterygoid process; *m.* maxillary; *o. c.* occipital condyle; *pl.*, palatine bone; *pl.*?, inward extension of palatine, not shown by O. C. Marsh, but surmised by author to exist; *pl. p.*, palatine process for union with *p. p. m.*, palatine process of maxillary; *p. m.* premaxillary; *p. s.*, parasphenoid; *pt.*, pterygoid; *q.*, anterior end of quadrate; *q. j.*, quadratojugal; *t.*, transverse bone; *v. v.*, prevomer; 1. matrix lying between vomerine arch and premaxillaries; 2. anterior foramina between maxillaries and premaxillaries; 3. posterior end of large mesial foramen (*Cf* Mem. C. M., Vol. II, p. 240); 4. preorbital vacuity.

as well as anteriorly to a much larger extent than is indicated by Marsh and formed the thin acutely projecting portions of the roof of the mouth, which Marsh apparently interpreted as anterior projections of the pterygoids. In the specimen of the skull which we are studying there is much to suggest that the palatine coösifies with the pterygoid at the line marked in Figs. 9 and 10 as x-z, and that

it may even have extended still further backward, as far as the line marked in Fig. 10 as x-z′. I am not prepared to absolutely negative the correctness of Professor Marsh's figure and scanty description, nevertheless, after a careful examination of the material before me, I am strongly inclined to think that Professor Marsh erred in restricting the boundaries of the palatine bone, as he has done.

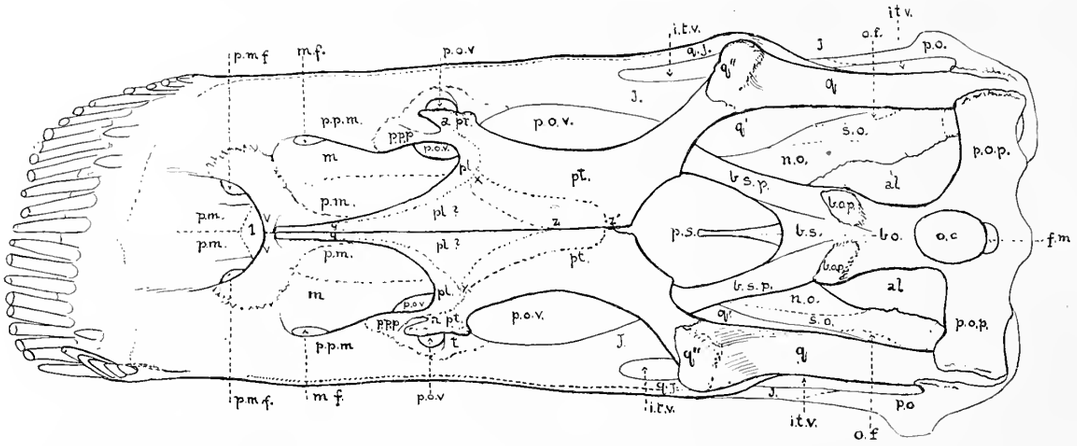

Fig. 10. Outline of basal view of skull of Diplodocus. *al.*, alisphenoid; *a. pt.*, anterior lower end of pterygoid; *b. o.*, basioccipital; *b. o. p.*, basioccipital process; *b. s.*, basisphenoid; *b. s. p.*, basipterygoid process; *f. m.*, foramen magnum; *i. t. v.*, infratemporal vacuity; *j.*, jugal; *m.*, maxillary; *m. f.*, mesial foramen of maxillary; *n. o.*, narial opening; *o. c.*, occipital condyle; *o. f.*, orbital vacuity; *pl.* and *pl?*, palatine; *p. m.*, premaxillary; *p. m. f.*, premaxillar foramina; *p. o. v.*, preorbital vacuity; *p. o. p.*, paroccipital process; *p. p. m.*, palatal plate of maxillary; *p. p. p.*, anterior lateral process of palatine coössifying with *p. p. m.*; *p. s.* parasphenoid; *q.*, quadrate; *q′.*, ascending flat inner platelike extension of quadrate; *q″*, anterior articular surface of quadrate; *qj.*, quadratojugal; *s. o.*, supraorbital; *t.*, transverse; *v. v.*, prevomer; *x-y*, inner boundary of palatine as suggested by Professor Marsh; *x-z*, inner boundary of palatine as suggested by the author; with *x-z′*, possible further inner extension of posterior boundary of palatine suggested by the author. 1. vacuity filled with matrix interposed between prevomer and premaxillaries.

There appears, as I write, to be in the specimen before me (Carnegie Museum No. 11,161) much to suggest the view just expressed and that the palatine is found to correspond more nearly in its extent and outline with what we know of this element in many other reptiles.

The Vomer.—Professor Marsh says: "The vomer is a slender triangular bone, united in front by its base to a stout process of the maxillary, which underlaps the ascending process of the premaxillary. Along its upper and inner border it unites with the pterygoid, except at the end, where for a short distance it joins a slender process from the palatine. Its lower border is wholly free."

In the specimen before us the bone which Marsh designates as the vomer is clearly revealed, but its position and outline is somewhat different from that given by Professor Marsh in his figure ("*Dinosaurs of North America*," Fig. 27)

(See Fig. 7 of this paper) to which we have been referring. The vomer consists of two paired bones which form the postero-inferior boundaries of an arch which underlies an opening at this point between the re-entering portions of the maxillaries, which, as Marsh says, "underlap the ascending processes of the premaxillaries." In the specimen before me this opening has a depth at the middle of at least fifteen millimeters, by which space the premaxillaries at the middle line are separated from the maxillaries. Professor Marsh's statement that the vomer "along its upper and inner border unites with the pterygoid, except at the end where for a short distance it joins a slender process from the palatine", which in the previous paragraph he had described as "a small semi-oval bone sending forward a slender process for union with the small palatine process of the maxillary," seems to plainly reveal a defect in his description of the palatine, and accords with what I have already stated to be my surmise as to the form of the palatine bone. If my interpretation of the structure of the palatine is correct, and in a general way I think it is, the paired vomers (prevomerine bones) unite posteriorly with the palatine (not with the pterygoids, as Marsh says). Figs. 9 and 10 and Plate XLI, Fig. 2, show the location and contour of these paired prevomerine bones as they appear in the specimen which we are studying. At their outer extremities they are broadly expanded and flattened plates, which are adnate upon the lower surfaces of the maxillaries. These plates are in part what Marsh interpreted as "a stout process of the maxillary." The "stout process of the maxillary" of Marsh is in fact largely composed of the widened and flattened ends of the prevomerine bones. Concerning this element of the skull it is well to consult R. Broom *"On the Structure and Affinities of Udenodon,"* P. Z. S., 1901, II, p. 184, where this careful observer points out that in the reptiles generally the *parasphenoid* should be called the vomer, and functions as such, "while the anterior paired element, usually regarded as the 'vomer,' but which is the homologue of the dumbbell-shaped bone in *Ornithorhynchus*, may be called the 'anterior vomer' or by the name I have elsewhere[7] proposed for convenience, the 'prevomer.' "

The Posterior Region of the Skull.—In my paper upon "The Osteology of Diplodocus" (Mem. Carn. Mus., II, 1906, pp. 225–278) I undertook with such light as I then possessed, to give a detailed account of the fragment of a skull (Carnegie Museum No. 662 (22)) upon which we had in part founded the restoration of the posterior part of the skull of Diplodocus, used in preparing replicas of the animal for presentation to various foreign museums. I had ex-

[7] Broom, R. "On the Homology of the Palatine Process of the Mammalian Premaxillary," Proc. Linn. Soc. of New South Wales, X, 1895, p. 484.

amined this fragment very carefully and had discussed its features with Dr. O. P. Hay and a number of other eminent students of reptilian anatomy both at home and abroad, and they all had in the main agreed with the correctness of my interpretation of the various component elements, so far as these are capable of being determined without breaking up the specimen.

After my paper had appeared, Dr. O. P. Hay through the United States National Museum requested and obtained permission to re-examine the fragment, and subsequently published in Science, N. S., Vol. XXVIII, p. 517, a communication, in which he announced his dissent in some particulars from my interpretation of the osteology of this fragment. To his critique I in part replied in the same volume of Science, at p. 644. In my reply I admitted that very possibly I had fallen into some errors and stated, that, when the time for a leisurely and careful re-examination of the subject might arise, I would again revert to the subject, so far as it relates to the interpretation of the bones forming the cerebral walls of the skull. The opportunity for such a revision has at last come, and with the material before me I am in position in part to confirm the correctness of some of Professor Hay's criticisms, though there are others in which I am not as yet able to concur with him.

Before proceeding further I wish at this point to renew attention to the fact, to which I have already incidentally alluded in the present paper, that the fragment which I carefully figured in my Memoir (*l. c.* Figs. 4–10) reveals some well-defined differences from the basal portion of the skull (Carnegie Museum No. 11,161, as well as all other skulls of Diplodocus recently re-examined by me. One of the most noticeable differences is the fact that the anterior projection of the bone which I called the "presphenoid" (Dr. Hay says I should have called it the *parasphenoid*) lies on the same plane as the basisphenoid, and might be interpreted as a very short anterior prolongation of the latter. In the skull, Carnegie Museum No. 11,161, the parasphenoid originates at a point about 30 mm. higher up than the projection in the skull of C. M. 662 (22) and is a long, slender bone directed forward and upward into the narial cavity on a quite different plane from the bone illustrated in the figures of the fragment given in my paper to which reference has been made. This bone thus corresponds far more closely to what we know of the parasphenoid from the figure given by Professor Marsh in his cut (*Dinosaurs of North America*, p. 177, Fig. 27). In the text Marsh does not mention the parasphenoid. In the specimen No. 662 (22) this bone is lost. In the specimen No. 662 (22) the lower surface of the exoccipital processes is very deeply excavated, or hollowed out anterio-posteriorly, which is not the

case in the specimen No. 11,161, where these surfaces are antero-posteriorly convex. This difference I regard as being at least specific. There is also to be pointed out the fact that in the fragment No. 662 (22) there is no fontanel on the upper surface of the skull in the parietal region, as is also the case in our skull, No. 3,452, while in skull No. 11,161 such a fontanel is quite apparent, as also in Carnegie Museum No. 11,162, in the specimens in the National Collection, and as is shown in the case of the restoration of the specimen in the American Museum of Natural History (No. 969). Having based our restoration of the posterior part of the skull upon Specimen No. 662 (22) we have shown no fontanel at this point, but on Plate XLI of the present paper this opening is clearly shown as it exists in Carnegie Museum No. 11,161. Whether the presence or absence of such a fontanel is due to age, or not, may be open to question. It is positively lacking in specimen No. 662 (22) and 3,452. This combination of differences leads me to think that this specimen, (662 (22)), though otherwise thoroughly diplodocine in character, may well represent a species of the genus different from that with which we are mainly dealing in this paper, (Carnegie Museum No. 11,161), which specimen I refer provisionally to *Diplodocus longus* Marsh.

In honor of Professor O. P. Hay I venture to call the specimen Carnegie Museum 662 (22) *Diplodocus hayi* (holotype) trusting that the learned Doctor will not take exception to this act of mine. It may be distinguished from the other species of the genus by the points to which I have called attention in the preceding paragraph, and it is well figured in my paper on the "*Osteology of Diplodocus*" Memoirs Carnegie Museum, Vol. II, text-figures 4–10, Fig. 4, having been reproduced in Abel's "*Die Stämme der Wirbeltiere*," page 609, figure 477.

The Superoccipital.—Dr. Hay takes exception to my interpretation of the superoccipitals while at the same time stating that my interpretation of the exoccipitals is correct. He states in regard to the superoccipital, "in all reptiles this bone, by virtue of its epiotic element, takes an essential part in the formation of the internal ear, containing, as it does, the posterior semicircular canal. It must, therefore, come into contact with the exoccipital and the proötic not far above the fenestra ovalis. The three bones concerned are, in the Pittsburgh specimen and all others known, thoroughly coössified and the sutures are nearly effaced. However, the writer believes that the suture between the supraoccipital and exoccipital starts about 25 mm. above the fenestra ovalis and runs outward and backward to a notch in the hinder border of the post-temporal fossa. In Dr. Holland's figure 5 this suture would start from the suture ascending at the left of the letters *ex. o.*, at the upper border of the postfrontal bone and run backward

just below these letters, and end under the bone *sq.*" The point made by Dr. Hay, as here quoted, is well taken by the writer after a thorough re-examination of specimen 662 (22) and more especially after a critical examination of the same region of the skull in specimen No. 11,161. The presence of the posterior portion of the superoccipital where it is shown on a rear view of the skull, (Memoirs Carnegie Museum, Vol. II, p. 235, Fig. 6), is approved by Dr. Hay in his article and is confirmed by specimen No. 11,161. I failed to recognize the lateral extension of this bone running under the squamosal and reappearing at its lateral extremities to form a portion of the inner wall of the supratemporal fossæ. Dr. Hay was not positive in his statement of the external limitations of this bone at this point, but, so far as the new specimen No. 11,161 is concerned, it seems that there is confirmation of his view, especially when the supratemporal fossa of the left side of No. 11,161, is critically examined. The suture between the superoccipital and exoccipital is rather distinctly shown in this specimen, but lies somewhat further down than on the line suggested by Dr. Hay, coössifying with the exoccipital below the middle of the supratemporal fossa, where also the hind margin of the proötic is clearly seen overlapping the inner surface of the exoccipital at this point. Where these bones, the superoccipital, the proötic, and the exoccipital, converge in our specimen No. 11,161 is found, I think, the fenestra ovalis near the base of the supratemporal fossa.

As to my interpretation of some of the smaller foramina, to which Dr. Hay takes exception, I may say that our specimen, No. 11,161, does not reveal as clearly as the fragment No. 662 (22), a number of the smaller foramina, which I endeavored to interpret, and I am therefore not ready for the present either to accept or reject Dr. Hay's suggestions, I am not prepared to unhesitatingly coincide with Dr. Hay's suggestion that the trilobate foramen which appears near the commissure of the proötic and the alisphenoid (it is only partially shown in my Fig. 5, Memoirs Carnegie Museum, Vol. II, p. 233, being in part concealed by the downward projection of the postorbital bone) might be interpreted as the fenestra ovalis in specimen No. 662 (22). According to Dr. Hay, if I understand him correctly, this opening in his opinion might have served both as the exitus for the facial nerve (trigeminal opening) and as the fenestra ovalis. I called it the trigeminal foramen. The opening, which I designated as the fenestra ovalis, which is near the above-mentioned trilobate opening, Dr. Hay dubiously asserts may have been the exitus of the ninth pair of nerves, and that the tenth pair escaped through the foramen which I designated with the numerals IX. Unfortunately the specimen No. 11,161, does not allow of the exploration of the

foramina at these points. However, by peering through the opening of the orbit the outer walls of the cranium are partially visible in this specimen and in Fig. 11 I give a somewhat diagrammatic outline of the bones, as they appear in the skull, together with the foramina which on this view are visible. In our specimen No. 11,161, at the point where the proötic coössifies with the downward and outward extension of the superoccipital and the exoccipital, as I have already observed, there appears to be a foramen (concealed in Fig. 11) which in my judgment is the fenestra ovalis. In specimen 662 (22) there is apparently a very small opening corresponding in location with the fenestra ovalis in specimen No. 11,161. The trigeminal foramen is where I placed it in my figure 5, and where it also appears to be in the specimen No. 11,161.

The Parietals.—It is worthy of record that the parietal bones in specimen No. 11,161 near the median line of the skull are shown to have a somewhat more forward extension than is shown in the figures I gave of the fragment No. 662 (22). They form in part the lateral boundaries of the vacuity shown at this point in skull No. 11,161.

Orbitosphenoid.—In Fig. 11 at *o. sph.* is shown the orbitosphenoid which in specimen No. 11,161 is very well preserved and to a considerable extent forms the rear wall of the orbital cavity. It was no doubt more or less cartilaginous in

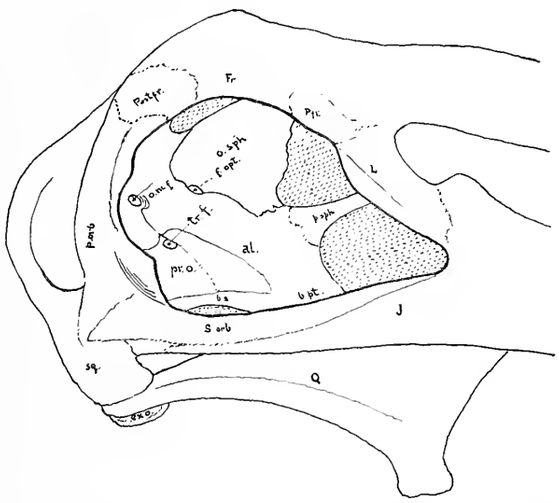

FIG. 11. Side view of posterior region of skull of Diplodocus (C. M. No. 11,161) looking into orbital opening, which is defined by heavy line. *al.*, alisphenoid; *b. pt.*, basipterygoid process; *b. s*,. basisphenoid; *exo.*, exoccipital; *f. opt.*, foramen opticum; *Fr.*, frontal; *J.*, jugal; *L.*, lachrymal; *o. m. f.*, oculomotor foramen (?); *pr. o.*, proötic; *o. sph.*, orbitosphenoid; *P. fr.*, prefrontal; *p. orb.*, postorbital; *p. sph.*, parasphenoid; *Q.*, quadrate; *S. orb.*, suborbital; *sq.*, squamosal; *tr. f.*, trigeminal foramen. The dotted areas indicate vacancies or unremoved matrix.

its structure, and is preserved in this specimen in the same way as is the sclerotic membrane of the eye.

The Posterior Articulation of the Quadrate.—Specimen No. 11,161 and specimen No. 3,452 in our collection show very plainly that the proximal end of the quadrate is firmly wedged in between the exoccipital and a thin downward lateral projection of the squamosal. There is here an overlapping by the proximal end of the suborbital. This feature is perhaps best shown in specimen No. 3,452, where a slight disarticulation in this region has taken place, without injury to the bones, so that the lines of union at this point are clearly brought into view.

The Premaxillary Process.—In my paper (Memoirs Carnegie Museum, Vol. II, p. 238), I said: "Ranging backward from the premaxillaries, located between the maxillaries, are the two long slender bones, which Professor Marsh interprets as backward prolongations or processes of the premaxillaries, but which may be regarded as lateral ethmoids. These bones on the median line of the skull unite to form a raised ridge, which is higher in front than behind. At the anterior point of commissure the bones widen outwardly somewhat and terminate in blunt, outwardly obliquely truncated ends, which are raised above the level of the premaxillaries and maxillaries. There are at this point two moderately large foramina, one on either side, the purpose of which is yet to be determined, but which correspond more nearly in location to the nares as ordinarily found in the reptilia than any other openings in the skull."

This paragraph calls for radical modification in the light of the new material. It appears that the long backward projections of the premaxillaries from the openings of the foramina, to which allusion has been made in the foregoing quotation, are overlapped on either side by long narrow bones which on their anterior edges unite about half way between the above mentioned foramina and their posterior extremities on the median line. I spoke of these bones as the "lateral ethmoids" following the analogies of the skull of fishes. Perhaps it would be better to call these long slender bones prenarials. Their location is shown on Plate XLI, Fig. 1. They are visible in our specimen No. 11,161, also appear in the large skull No. 11,162, and are quite distinctly visible in our specimen No. 11,255. (See Plate XLIII).

It is worthy of remark that the skull of Diplodocus in many respects suggests ornithic features and that it is widely different in many respects from the skulls of the Crocodilia, the Testudinata, and the Lacertilia, with all of which comparison has been made.

SKULL (No. 3452) ARTICULATED WITH THE CERVICALS.

A figure of this skull and the cervicals associated with it is given on Plate XL, Fig. 2. The specimen is highly interesting because of the immediate association of the skull with the cervicals. It establishes beyond a doubt that no mistake has been made in associating with the vertebræ which belong to Diplodocus the skull hitherto consistently attributed to that genus. In this specimen the occipital condyle of the skull lies almost within the cup of the atlas, and the seven following cervicals are found lying near by as they are represented on the plate.

SKULL (No. 11,255).

A view of the right side of this skull is given on Plate XLIII. It is, so far as the writer is aware, the smallest skull representing the genus, which has thus far been discovered. It has been strongly crushed laterally, and much of the occipital region, including a small portion of the occipital condyle, is missing.

The length of the skull from the rear of the occipital condyle to the anterior margin of the infra-maxillaries is only 290 mm. While in part defective, this skull agrees in most respects with the others we have studied, but differs noticeably, as has been already observed, in having all the teeth sharply pointed, and showing no traces of transverse wear. The sutures are fairly well defined, and show nothing essentially different from what has been observed in the other skulls which have been studied. The prenarials are plainly revealed as separate elements.

Great credit should be given to Mr. L. S. Coggeshall and Mr. S. Agostini for the extremely skilful manner in which they succeeded in freeing from the matrix the skulls belonging to the Carnegie Museum which are mentioned in the foregoing pages.

Carnegie Museum

Sept. 1, 1921.

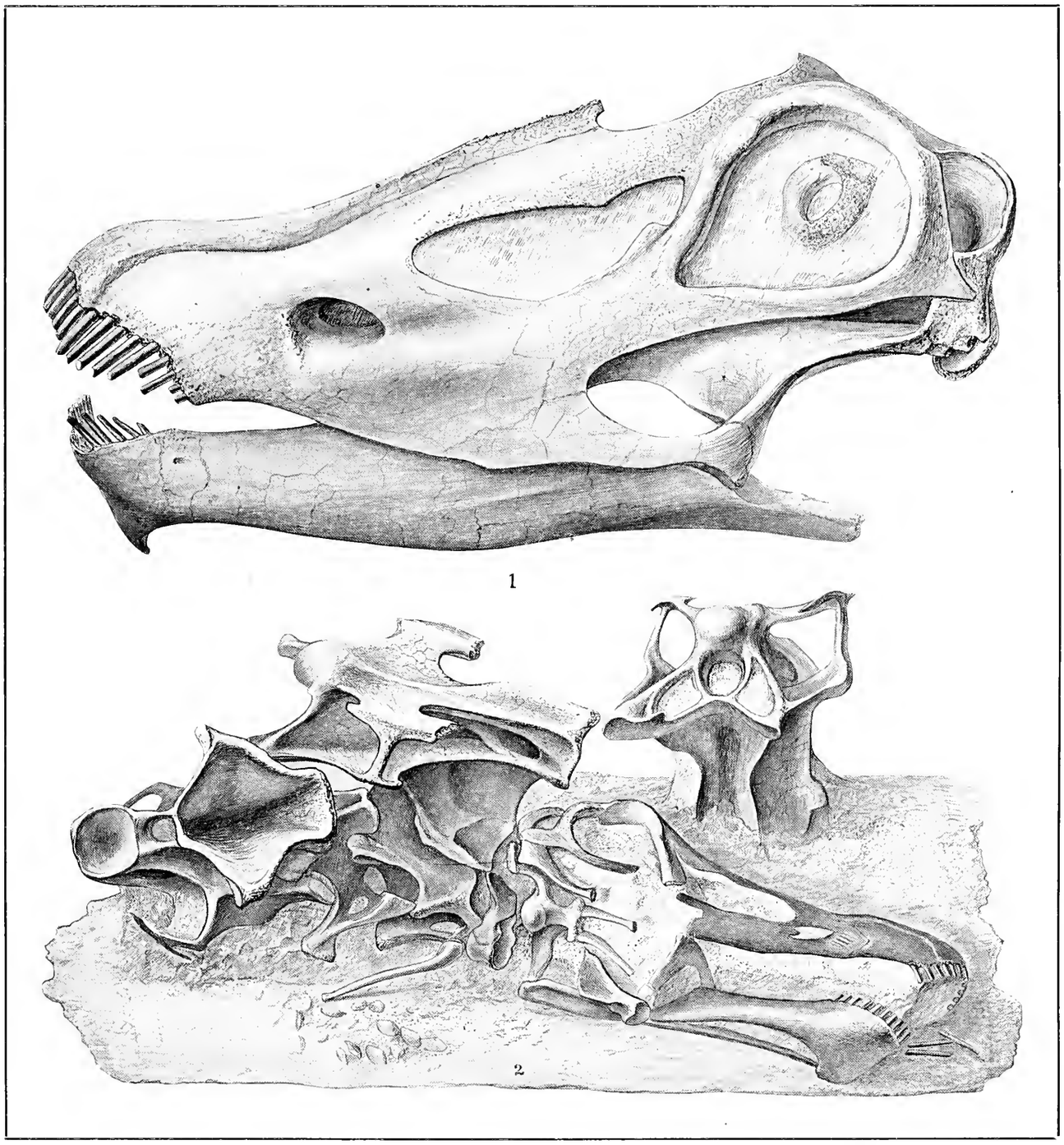

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Fig. 1. View of left side of skull of Diplodocus, C. M. No. 11,161, showing remnants of eye-ball in place. Three-tenths nat. size.

Fig. 2. Skull and cervical vertebræ of Diplodocus, C. M. No. 3452. One-fifth nat. size.

(From wash-drawings made by Sydney Prentice)

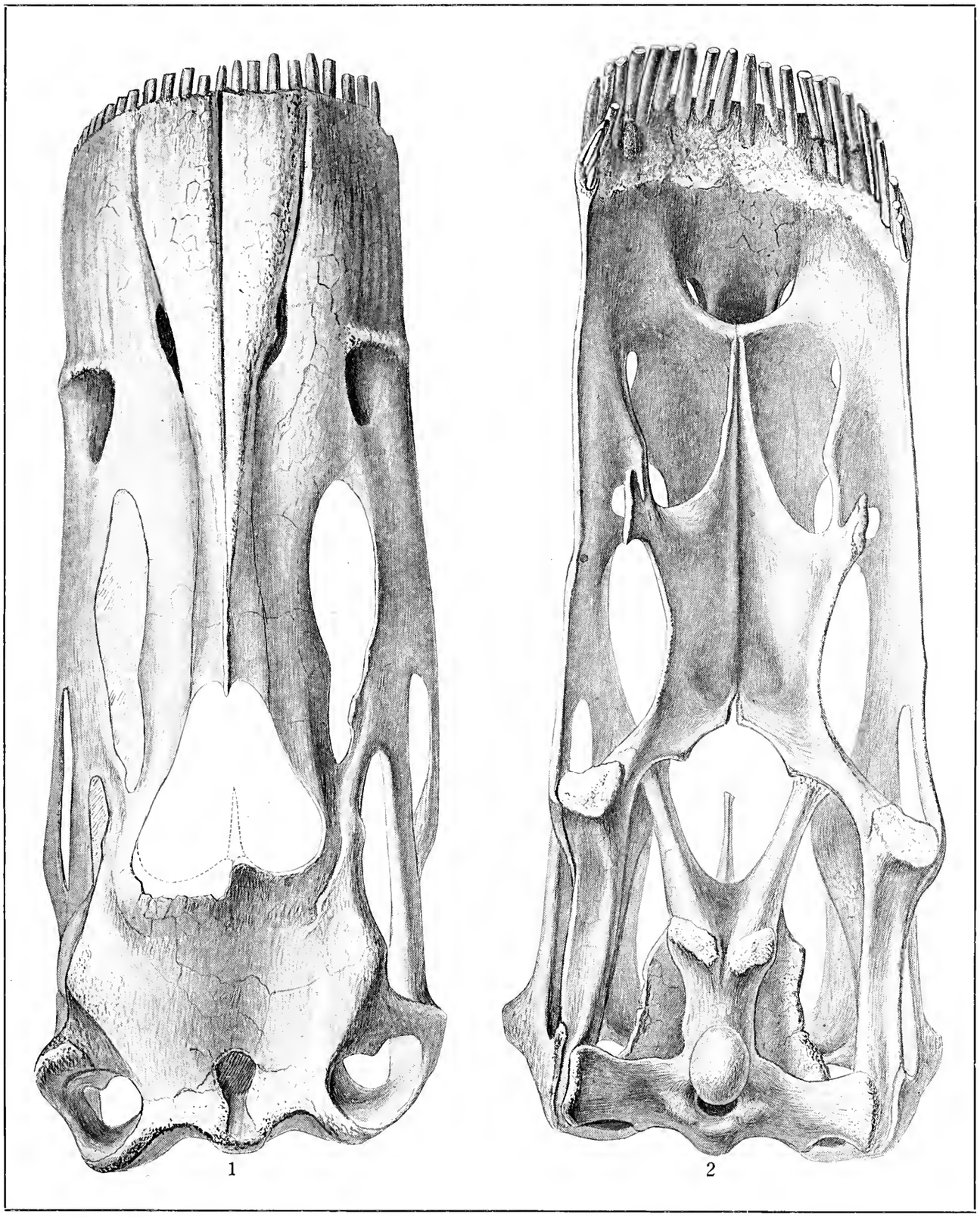


FIG. 1. Superior view of outer surface of skull of Diplodocus, C. M. No. 11,161. Two-fifths nat. size.
FIG. 2. Palatal view of skull of Diplodocus, C. M. No. 11,161. Two-fifths nat. size.

(From wash-drawings made by Sydney Prentice)

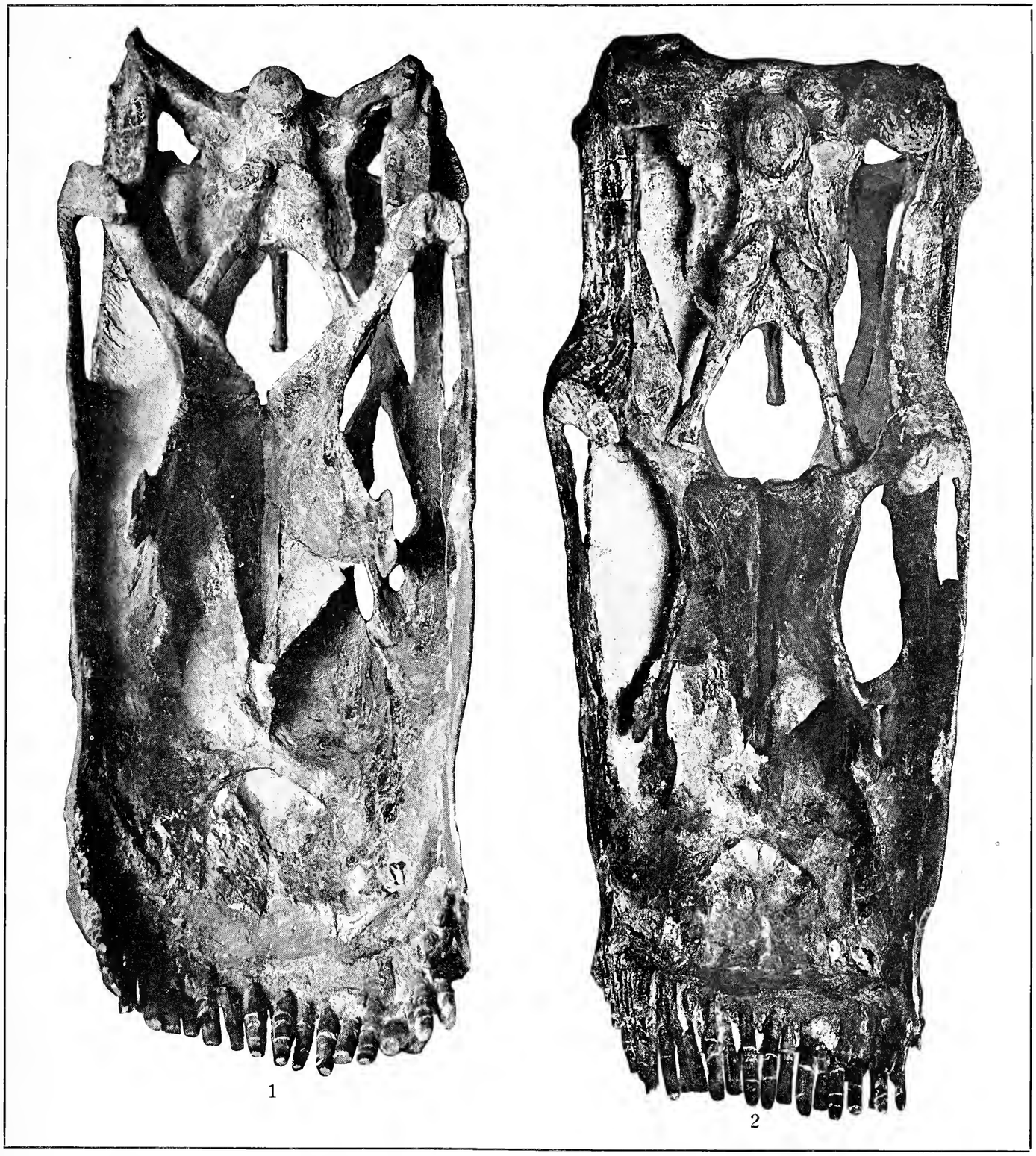


FIG. 1. Photograph of palatal view of skull of Diplodocus, C. M. No. 11,161, about one-third nat. size. The view is taken looking down into the skull at an angle of about 45° with the axis. Illumination from the left.

FIG. 2. Photograph of palatal view of skull of Diplodocus, C. M. No. 11,161, about one-third nat. size. The view is taken directly from above perpendicularly to axis of skull. Illumination from the right hand side.

Skull of Diplodocus. C. M. Cat. Vert. Fossils, No. 11,255. Three-fifths nat. size.

MEMOIRS

OF THE

CARNEGIE MUSEUM

VOL. IX. NO. 4.

OSTEOLOGY OF DOLICHORHINUS LONGICEPS DOUGLASS, WITH A REVIEW OF THE SPECIES OF DOLICHORHINUS IN THE ORDER OF THEIR PUBLICATION.

BY O. A. PETERSON.

(PLATES XLIV–LVII)

In the year 1913 Mr. Earl Douglass of the Staff of the Carnegie Museum made a fortunate discovery of remains of the genus *Dolichorhinus* in the Upper Eocene near the head of a small stream running from the west through Wagonhound Canyon to the White River in northeastern Utah. The outcrop of bones (See figs. 1 and 2) occurred in the face of a cliff, twenty feet from the base and

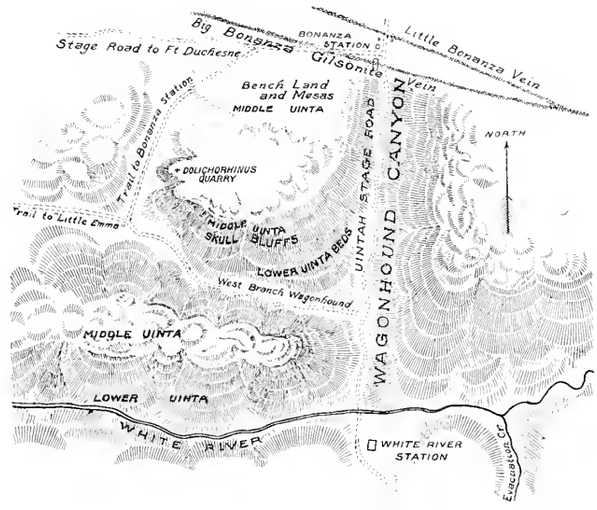


FIG. 1. Sketch-map showing the location of the quarry where Mr. Douglass obtained much of his material representing *Dolichorhinus*. Scale: 2 cm. = 1 mile.

fifteen feet from the top. The bone-bearing stratum was located in the lower portion of the Middle Uinta (Horizon B). In order to secure the material Mr. Douglass blasted off the top of the cliff until the layer of bones was reached. Then by means of excavations, such as are ordinarily employed in like cases, the material was taken out in the form of large and small blocks of sandstone in which the bones remained imbedded. One of these blocks contained very nearly the entire skeleton of a specimen of *Dolichorhinus longiceps* Douglass, which is now exhibited in the Gallery of Fossil Mammals in the Carnegie Museum. The sandstone is very hard and refractory, and much credit is due to Mr. S. Agostini for the patient and skilful manner in which he labored to extricate the bones from

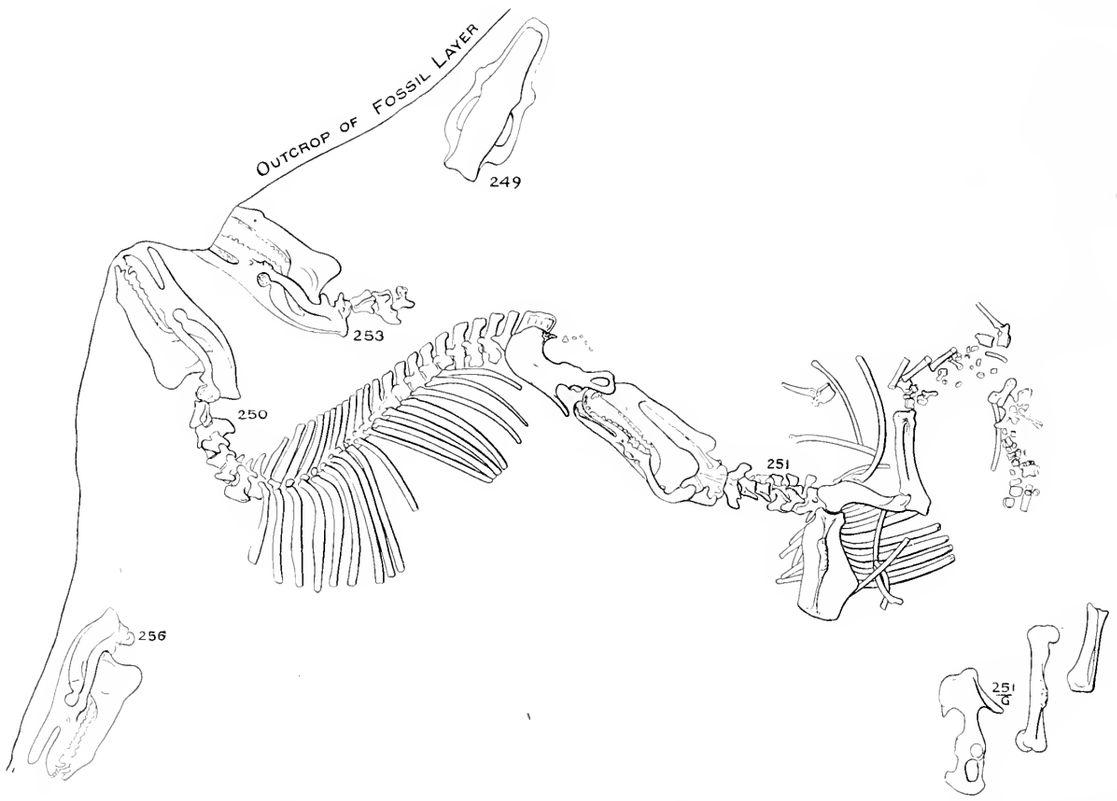


FIG. 2. Showing the position of different specimens of *Dolichorhinus* in the quarry. The numbers are those given in Mr. Douglass' field-notes. No. 250 is No. 11,072, and 251 is No. 11,071, C. M. Cat. Vert. Fossils.

their tough matrix, after they had been turned over to him in the laboratory. The restoration in the Gallery of Fossil Mammals in the Carnegie Museum (See Plate LV) was prepared by Mr. Agostini. To the Field Museum and to the American Museum of Natural History we are indebted for a number of original

illustrations, for which special acknowledgement is given in their titles. Mr. Sidney Prentice is the author of the plates given in this memoir and of most of the text-figures. Finally I wish to make special acknowledgement to Dr. W. J. Holland for his helpful suggestions and for his kind assistance in revising this paper and preparing it for the press.

The upper Eocene on the eastern borders of the Uinta Basin has yielded much material representing the titanotheres, which is now installed in various museums of this country. The recent collections made by the Carnegie Museum contain the best preserved specimens brought from this field up to the present time. The author believes that a systematic description of the osteology of *Dolichorhinus*, so far as it is decipherable from this material, will be of considerable service to students.

Seven species have up to the present time been assigned to the genus *Dolichorhinus*. When more and better material is secured the number of proposed species will very probably be reduced. At present, however, we would not gain much by attempting to reduce some of these species to the rank of synonyms, as some of them are so very imperfectly represented by the material at command; and we accordingly recognize them provisionally as they stand in the literature of the subject. This course is pursued in face of the fact that there does not appear to have been complete accord in regard to some proposed species in the genus *Dolichorhinus*. Osborn (Bull. A. M. N. H., Vol. XXIV, 1908, p. 611) regards *D. cornutus* Osborn as being identical with *D. hyognathus* Scott and Osborn, the latter having priority. On the other hand Riggs (Field Museum Nat. Hist., Geol. Ser., Vol. IV, 1912, pp. 31–32) regards it as undesirable to unite the two, being inclined to accept *D. cornutus* Osborn as a valid species, until more material representing the skulls and mandibles shall be found. Riggs discovered that there is a disparity in the length of the molar-premolar series in the types of the two species, *D. hyognathus* and *D. cornutus*, as well as other differences in proportion. Further remarks on this subject will be found on pp. 410, and 430-4.

During the study of the remains of *Dolichorhinus* in the Carnegie Museum the writer was led more and more to doubt that any species of the genus has only two incisors in the lower jaw, as stated by Professor Osborn (Bull. A. M. N. H., Vol. VII, 1895, p. 93). Finally a note was forwarded to the American Museum of Natural History, requesting a re-examination of the lower jaws of their specimen, No. 1,857, which had been studied and published upon by Dr. Osborn, as well as other individuals of *Dolichorhinus* in the collections of that institution. I am indebted to the courtesy of Dr. William K. Gregory for the following letter:

American Museum of Natural History,
77th Street & Central Park West,
New York, N. Y.
November 15, 1920.

Dear Mr. Peterson:

In answer to your inquiry regarding jaw No. 1857: I have examined the specimen and find that it is a very old animal of *Dolichorhinus cornutus* (*hyognathus*). Although there are only two incisors in place on each side there are traces of the alveoli of the third incisors, so that the statement is probably an error. I have never seen any *Dolichorhinus* jaws, or for that matter any Uinta titanotheres, with less than three incisors on each side.

Very sincerely yours,
William K. Gregory.

This note seems to dispose of the difficulty arising from the statement inadvertently made by Dr. Osborn. This fact and the unusual position of the posterior nares enable me to present a statement of the generic characters of the genus *Dolichorhinus*, based upon that already given by Riggs (Field Mus. Nat. Hist., Geol. Ser., Vol. IV, 1912, p. 31) which I adopt, enclosing my emendations in brackets.

GENERIC CHARACTERS OF DOLICHORHINUS.

"Middle Eocene titanotheres, progressively dolichocephalic, nasals elongate and laterally infolded, cranial region strongly convex, incipient horn-cores above the orbits, a shelf-like infra-orbital process, occiput broad and low, condyles broad. Dentition complete [$I.\frac{3}{3}$, $C.\frac{1}{1}$, $P\frac{4}{4}$, $M\frac{3}{3}$] premolars relatively progressive, first pair of upper incisors separated by median diastema, posterior nares [far back] of last molar."

SKULL AND LOWER JAWS. (Plates XLIV–XLVI.

In the collection of the Carnegie Museum specimens Nos. 11,071 and 11,072, which are more or less complete, have crania associated with lower jaws. These two specimens, with other material obtained from the same and other localities in the same general region, furnish the basis of the descriptions given in the following pages. The jaws articulated with the crania in these specimens definitely establish the fact that *Dolichorhinus longiceps*[1] and *D. hyognathus* are closely related.

The crania, especially those of Nos. 11,071 and 11,072, which are here provisionally referred to *D. longiceps* Douglass, have the same contour as *D. cornutus*

[1] *Dolichorhinus longiceps* Douglass may be the female of *D. cornutus* Osborn.

Osborn and in general agree with Osborn's descriptions and illustrations. The smaller horn-cores of *Dolichorhinus longiceps* as well as the earlier geological formation in which the type was found are made the subject of discussion in the general description hereafter given and in the review of the species towards the end of this paper (See pp. 437–39).

Two crania, Nos. 11,080 and 11,081, likewise provisionally referred to *Dolichorhinus longiceps*, are of especial interest, as they are well preserved in the palatine and pterygoid regions. In these skulls there are found no posterior nares in the region of the median pterygoid fossa, where these openings are usually found in most mammalia, especially in the Perissodactyla. In the posterior region of the palate there is, however, a depression, which apparently marks the original position of this orifice, and where also the postnares are located in the Oligocene titanotheres. The depression referred to is covered with a bony structure and four or five centimeters further back is a second depression. In skull No. 11,081 the anterior margin of this depression is pierced, especially on the left side, while in skull No. 11,080 this depression is not pierced. The piercing of this film of bone was undoubtedly done by some insect larva, possibly by *Dermestes*, shortly after the death of the animal, and might be mistaken for the orifices of the postnarial openings. Back of this second depression there are oblong or ovate inflated areas of this same thin kind of bone, which measure about seven or eight centimeters in length. These last mentioned inflations and depressions are separated by a thin vertical plate, the vomer. This vomerine plate extends backward to, and forms a contact with, the basisphenoid. At the point of contact the latter bone has a sudden upward turn, which imparts a curious angle to the basicranial axis. On either side of the vomer between the pterygoid processes back of the swollen area described there are again deep depressions, which I judge to be the functional posterior nares. In the region of the anterior margin of this depression the thin bony structure is partly destroyed, so that the margin of this orifice is not complete. I feel, however, quite certain that in better preserved specimens the complete anterior margins of the posterior nares will be found at this point. The nasopalatine passages of this genus are thus seen to be of great length and of a most unusual character, heretofore not clearly known[2] (See Plate XLV, fig. 3, and Plate XLVI, fig. 2).

In this connection it is of interest to turn to the genus *Sphenocœlus* from the lower portion of Horizon B of the Eocene beds of the Uinta Basin, described by

[2] From Mr. Riggs' general description of the material in the Field Museum of Natural History (Field Museum Publications, No. 159, Geol. Ser., Vol. IV, 1912, p. 33) it is clear that he found some evidence of these thin bony plates bridging over the postnares.

Osborn (Bull. A. M. N. H., Vol. VII, 1895, p. 98). On comparing Osborn's illustration (*l. c.*, p. 99, fig. 12) with the palate of *Dolichorhinus* just described (See Plate XLVI, fig. 2) there is a most remarkable similarity of characters disclosed. Not only do the foramina and the different processes, including the zygomatic process of the squamosal, agree in general, but, most interesting of all, is the pair of pits in the floor of the skull upon either side of the narrow vomerine extension of the presphenoid, described by Osborn (*l. c.*, pp. 98–99). In the light of what is revealed by the crania of *Dolichorhinus*, I now believe that these pits in *Sphenocœlus* mark the position of the postnares. We would thus have another genus possessing these long and curious infundibula of the backward extension of the narial passages. We may even be justified in provisionally including *Sphenocœlus* in the dolichorhinine series of the Uinta titanotheres under the name *Sphenocœlinæ*, distinguished by a long narrow cranium, and a short sagittal crest with diverging sagittal ridges.

A comparison of the lower jaws of our specimens, Nos. 11,071 and 11,072, with the illustrations and descriptions of *Dolichorhinus hyognathus* by Mr. Charles Earle[3] reveals differences of at least specific value. As in *D. hyognathus* from the Washakie, the jaw of *D. longiceps* is elongated and shallow, but it is noticeable that in *D. hyognathus* the jaw decreases more rapidly from the vertical ramus forward, so that the diameter at M_3 is very nearly twice that at P_2, as was observed by Earle (*l. c.*, p. 349). In the species from the Uinta, on the other hand, the ramus is more uniform in depth from M_3 forward to P_2. The extraordinary length of the symphysis is perhaps the most striking feature in *D. hyognathus*, a character well emphasized by Earle (*l. c.*) and also remarked by Scott and Osborn (See their original description, Trans. Am. Phil. Soc., Vol. XVI, p. 513) and by Osborn (Bull. A. M. N. H., Vol. VII, p. 93), who states that the symphysis of the lower jaw (Specimen No. 1,857, A. M. N. H.) which he referred to *D. cornutus*: "presents somewhat more angulation of the chin than in *T. hyognathum*." If the symphysis of the jaw in the type of *D. hyognathus* (Scott and Osborn) is in a natural condition, we shall also have to admit a proportionally longer postcanine region in its skull than we find in any of the forms of the genus known from the Uinta beds. On comparing the lower border of the ramus of *D. longiceps* with the illustration in Mr. Earle's paper (*l. c.*, Plate XI, fig. 10) it is interesting to find that in this figure there is a failure to represent the downward thrust, which is so prominent immediately anterior to the angle along the inferior border of the ramus in *D. longiceps*. From this illustration in Mr. Earle's article, it may also

[3] Journal Acad. Nat. Sci. of Philadelphia, Vol. IX, 1884–95, p. 348, Pl. XI, figs. 10 and 11.

be inferred that the vertical ramus of *D. hyognathus* has proportionally a greater antero-posterior diameter than is the case in the jaw of *D. longiceps*.

In the lower jaws of C. M. No. 11,071 the symphysis is of about the same length as in the type of *D. hyognathus*. This is, however, entirely due to pathological conditions, the animal during life having received injury in the region of the chin, which caused a backward exostosis. With this exception there is little or no noteworthy difference from the lower jaws belonging to C. M. No. 11,072 above mentioned.

HYOID ARCH.

The hyoid arch of *Dolichorhinus* is chiefly known through the studies of Mr. O. A. Peterson (Ann. Car. Mus., Vol. IV, 1914, pp. 130–131). In the skull forming a part of the skeleton of C. M. No. 11,071 the greater part of the hyoid arch was found practically in position, as shown on Plate XLIV, figs. 1 and 4. This material supplements that described by Peterson (*l. c.*) and gives us further knowledge as to this portion of the anatomy. The stylohyoid only differs from that already described by Peterson in having the proximal end less expanded vertically, and thus corresponding more nearly to the same element in the living tapir, *e. g. Tapirus terrestris*. The bone as a whole is, however, slenderer in proportion than in the tapir, as has already been pointed out by the writer. The ceratohyal in the present specimen is complete. It is rib-like, with the outer surface convex from side to side and the inner surface plane. The contact with the basihyal is expanded, especially transversely, to meet the large contact-surface on the basihyal. Immediately above this contact-surface and for two-thirds of the length of the bone the shaft is uniform in its antero-posterior diameter. It curves first upward and forward from the base, then upward and slightly backward. The upper one-third is reduced in size and the contact with the epihyal is attenuated. The latter bone is not at present known to the writer to be represented in any material of *Dolichorhinus* which has been thus far collected. The basihyal does not appear to be completely represented in the specimen under consideration, inasmuch as the anterior truncated appendix, shown in the basihyal earlier described by Peterson (*l. c.*) is not so well developed in C. M. No. 11,071. This region appears to have received some abrasion, but to what extent cannot be stated. The thyrohyal is represented by the proximal end and a portion of the shaft. This bone is a round process, largest at the contact with the basihyal, and tapered toward the free end. The bone, when found complete, will no doubt bear a close similarity to that in the horse.

VERTEBRAL COLUMN.

Specimen No. 11,072, C. M., Cat. Vert. Foss., consists of the complete skull and lower jaws, the entire vertebral column with the pelvis, the ribs, and the anterior portion of the sternum, all in position as originally found in the quarry (See Plates XLVII and LV). A portion of the scapula and the humerus were also found in front of the ribs and below the cervicals. The rest of the limb and foot-bones were dislocated, but found in close proximity to the skeleton. This individual is slightly larger than No. 11,071, in this respect more nearly agreeing with the type of *D. cornutus* (Osborn). Osborn has given fifteen dorsals in his restoration of *Dolichorhinus "hyognathus,"*[4] while Riggs states the correct number of dorsal vertebræ to be seventeen.[5] The view maintained by Riggs is confirmed by specimen No. 11,072, in which there are present and articulated in position seven cervicals, seventeen dorsals, four lumbars, and four sacrals[6]. Slightly disarticulated, but near the sacrum, were also found six of the proximal caudal vertebræ. The exact number of caudals is, therefore, not as yet exactly known.

Atlas.—The atlas is broadly expanded laterally. This is due in a great measure to the expanse of the transverse process (See Plates XLVII and LVI). The posterior face of the transverse process at the base is pierced by a well developed arterial canal. The atlantal foramen is also of normal size. The neural spine is well developed and the cotyli for the occipital condyles are deeply excavated, while ventrally the arch is well rounded from side to side with but slightly developed or no hypapophyses. The articulation for the axis is well expanded laterally, extending outwardly on the base of the transverse process.

Axis.—The axis has a very prominent and sharp ventral keel, which terminates posteriorly in a rugose tubercle, triangular in outline. The neural spine is well elevated, very heavy, and triangular in cross-section, with the apex of the triangle directed forwards. The articulation for the atlas is well expanded laterally to fit the corresponding surface on the atlas, already described. The transverse process of the axis is not very prominent.

Remaining Cervicals.—The third, fourth, and fifth cervical vertebræ are very nearly uniform in size and in structural details. The ventral keel is prominent and sharp on the third and fourth, but back of the fourth this keel becomes gradually lighter. On the fifth cervical the posterior wing of the transverse process is slightly more rugose on the external face than is the case on the transverse process of the preceding vertebræ. The neural spine is also slightly higher than

[4] Bull. A. M. N. H., Vol. XXIV, 1908, p. 612.

[5] Field Mus. N. H., Vol. IV, 1912, p. 31.

[6] The number of sacrals varies from four to five, (see later under *sacrum*).

on the third and fourth cervicals. The sixth cervical has the usual hatchet-shaped ventral portion of the transverse process, which in this individual extends well beyond the centrum both in front and back. The upper portion, or the true transverse process, is well developed, trihedral in section, and extends directly outward from the side of the vertebra. The neural spine, though thin, is normal in height. The transverse process of the seventh cervical, as is usual in the perissodactyla, lacks the inferior lamella, but the process itself is prominent and extends laterally beyond that of the first dorsal. The neural spine of this vertebra is well elevated over the arch and terminates in a sharp trihedral point.

Dorsals.—There is a sudden rise of the neural spines of the anterior dorsals which then gradually decrease in height until the twelfth is reached. At this point the neural spines gradually take on the more attenuated characters of the lumbar vertebræ. On the eleventh and twelfth dorsals the post-zygapophyses are larger and more elevated over the prezygapophyses of the succeeding vertebræ; and the interlocking condition characteristic of the lumbars does not begin to take place until the fifteenth dorsal is reached.

Lumbar vertebræ.—The transverse process of the lumbar vertebræ are moderately expanded laterally, and are quite attenuated. The anterior border has a curve from the base outwards and forwards while the posterior border is more nearly straight. The transverse process of the last lumbar has the anterior

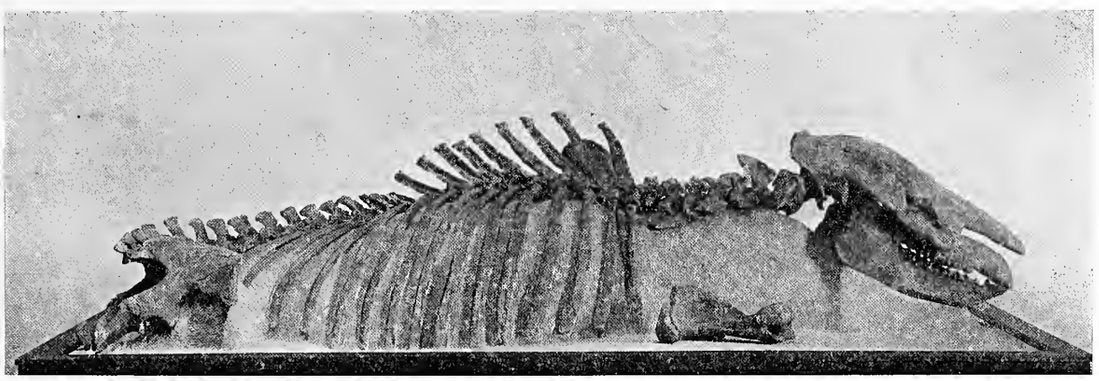


FIG. 3. *Dolichorhinus longiceps* Douglass. No. 12,200, Field Museum of Natural History. About one-sixteenth natural size. Showing the skeleton practically in the position in which it was found. (Courtesy of the Field Museum of Natural History).

and posterior borders more nearly parallel, and the process itself is also smaller than on the preceding vertebræ. The zygapophyses of the lumbars are well interlocked and present features not unlike those in the recent horse.

Sacrals.—There are in No. 11,072, as stated above, four coössified sacral vertebræ, of which the two anterior carry the heaviest neural spines. The third sacral has a slightly reduced spine, while in the fourth the reduction is more

noticeable. All of the spines are close together and show a tendency to coalesce, but are distinctly differentiated one from the other. The ilium is supported mainly by the two anterior vertebræ, though the pleurapophyses are well developed throughout the sacrum, and it is completely consolidated with the ilium. The sacrum of *Dolichorhinus* varies considerably in regard to the number of ankylosed centra, and also in the detailed structure of the neural spines. In the collection of the Carnegie Museum are two sacra (Nos. 3,840 and 11,071) which have five coössified centra. No. 11,071 also shows a wider spacing between the neural spines, and the spines themselves are more expanded fore-and-aft at their summits than those of No. 11,072. Mr. E. S. Riggs of the Field Museum of Natural History has made a positive statement (Field Museum Publications, No. 159, Geol. Ser., Vol. IV, p. 31), that the specimen in Chicago has four sacrals. A recent communication from Riggs confirms his published statement and he adds that the neural spines are close together but distinct from one another. This description appears to agree with the conditions found in our No. 11,072. (See Plate XLVII, fig. 2.) Professor Osborn has apparently given four centra to the sacrum in his restoration of *Dolichorhinus* (Bull. A. M. N. H., Vol. XXIV, p. 612).

Caudals.—The caudal region is, as stated above, p. 412, represented by six vertebræ, which pertain to the proximal portion of the tail. The exact number of caudals is not known, but it does not appear unlikely that Professor Osborn, who has given approximately twenty as the correct number, is right, especially since he appears to have some vertebræ, which are represented in the distal portion of the tail in his restoration (*l. c.*, p. 612). The caudal vertebræ which belong to our No. 11,071 display the characteristic titanotheroid features in having with the exception of the first, well developed and forwardly directed chevrons, which are solidly coössified with the centra. The neural spines of the first three caudals have their summits expanded fore-and-aft like those of *Brontops dispar;* the transverse processes are heavy; and the prezygapophyses are located high on the pedicle as in the Oligocene genus. The vertebra, which is designated as the first caudal, has no chevron, while on the second the processes are broken, but indicate that there was originally a chevron of considerable size. On the third of the series the chevron is preserved and has a length of about 24 mm., while that of the fourth is about 35 mm. long. Back of the fourth caudal the chevrons appear to be wanting and the neural spine is also reduced.

RIBS.

The ribs are heavy, flat, broad, but not especially long. They are not unlike those of the Oligocene titanotheres, and thus indicate a large thorax, with but a

short space between the last rib and the antero-superior border of the ilium, as is the case in most Perissodactyla. The last rib is suddenly reduced both in length and thickness, but retains a perfect and enlarged ventral end for cartilaginous attachments. The first and second sternebræ are in position. The manubrium is quite long, expanded and truncated immediately in front of, and constricted back of, the attachments for the first pair of ribs. Back of this constriction, the bone is sub-triangular in cross-section and gradually expands posteriorly, terminating in a truncated and rugose end. The succeeding segment is less than one-half the length of the presternum and is quadrate in outline.

Measurements.	No. 11,072	No. 11,071
Greatest length of skull	620 mm.	600 mm.
Length of superior dentition, I^1 to and including M^3	293[7]	298
Length of premolar series, including diastema back of P^1	84	84
Length of molar series	120	120
Greatest length of mandible	465	480
Length of inferior dentition I_1 to and including M_3	290	304
Length of premolar series, including diastema back of P_1	93	92
Length of molar series	125	120
Total length of vertebral column measured along the curves of the back bone	1650 mm.	
Length of cervical region	400 mm.	
Length of dorsal region	750 mm.	
Length of lumbar region	250 mm.	
Length of sacral region	145 mm.	
Length of tail as represented by vertebræ present	54 mm.	
Length of first rib	245 mm.	
Length of seventh rib	510 mm.	
Length of last rib	310 mm.	
Length of manubrium	123 mm.	
Length of sternebra	58 mm.	

FORE LIMB

The fore limb of No. 11,071 was found in position.

Scapula.—With the exception of slight crushing of the spine, the scapula is perfectly preserved, and thus for the first time we are able to ascertain its complete and correct outline. From the incomplete scapula described and figured in an earlier publication[8] Peterson was led to believe that "the general outlines of the scapula are on the whole more suggestive of the Rhinocerotidæ than the titanotheres." This is now seen to be erroneous, since the complete scapula before us, shows that it is conformed to that of the titanotheres. The bone, however, is proportionally longer and slenderer than in *Brontops dispar*, and the

[7] The incisors of the upper and lower jaws, as well as the canines, are restored, and the measurements are only approximate.

[8] Peterson, Annals Car. Mus., Vol. IX, 1914, p. 134.

lower portion of the blade has the appearance of being thrust forward as in *Diceratherium*, while the upper part differs from the latter by extending forward instead of backward, thus giving the coracoid border a sinuous curve above the supra-scapular notch, which is well illustrated on Plate XLVIII, fig. 2. The spine is quite prominent, as in the Oligocene titanotheres, but the supra-spinous fossa is of relatively greater antero-posterior diameter than in the latter. The infra-spinous fossa is subtriangular in outline, chiefly due to the prominent and angular process for ligamentary attachments. There is relatively a greater distance from this process to the extreme superior border of the scapula than in *Brontops dispar*, which gives the bone the proportionally greater length and slenderness referred to above. The glenoid cavity is ovate in outline with a beak-like process of considerable size directly in front. The coracoid process is rather small and more distinctly separated from the border of the glenoid cavity than in *Brontops dispar*. The latter has a heavy rugose ridge extending from the antero-external angle of the glenoid cavity to and across the coracoid process, which does not occur in *Dolichorhinus*. The inner face of the blade of the scapula is quite smooth, concave from above downward, and convex antero-posteriorly. The subscapular fossa is not deep or large.

Humerus.—The humerus of No. 11,071 has been laterally crushed. The distal end is especially affected by this crushing, so that the trochlea and anconeal fossa appear too narrow, and the shaft too long, when compared with the uncrushed humeri of other individuals. In No. 11,072, on the other hand, the bone has received vertical crushing, so that the humerus appears too short. The humerus of No. 2,865 described as *Dolichorhinus longiceps* by Peterson[9] retains the original shape and serves well as a guide. The articular surface of the head extends downwards on the posterior face to a rather unusual extent, and in this respect is unlike that in the Oligocene genus *Brontops* and more nearly suggests some rhinoceroses of the Oligocene (*Trigonias* and *Hyracodon*). The greater tuberosity has the same relative height and antero-posterior extent upon the head as in *Brontops dispar*, but transversely it has proportionally a smaller diameter. The deltoid groove is deep as in *Brontops*, due to the development of the lesser tuberosity and the hook-like process bordering the groove on the ulnar side. The development of the external tubercle on the deltoid ridge is very much less than in *Brontops dispar*. This together with the great development in the region of the ectepicondyle, or the supinator ridge in the latter genus, is not developed nearly as greatly as in *Dolichorhinus*. The distal trochlea is oblique as in *Brontops dispar*, though deeper. The internal condyle takes up the greater portion of the

[9] Peterson, Annals Car. Mus., Vol. IX, 1914, p. 134.

articulation, the external condyle chiefly consisting of a small facet on the anterior face of the trochlea external to the heavy intercondylar ridge. In fact the general proportions of the humerus as a whole recall the Oligocene rhinoceroses.

Radius and Ulna.—The radius and ulna are crushed laterally in the same way as the humerus described above. This crushing has, no doubt, increased the length, so that both the humerus and the lower part of the limb appear relatively longer, when compared with the more perfectly preserved limb of *Dolichorhinus longiceps* described by Peterson, (*l. c.*, p. 134.) As in that specimen, the radius and ulna of No. 11,071 are coössified at the upper and lower ends, a condition unlike that found in these bones in *Brontops dispar*, where they are separated throughout. The head and distal end of the radius in *Brontops* are also seen to be more enlarged than in the present genus. The bones are on the whole relatively longer in *Dolichorhinus* than in *Brontops*, even when proper allowance is made for the crushing referred to above. Besides the greater slenderness of the ulna, the region of the olecranon is less developed in the form from the Uinta; consequently there is not that great backward projection of the olecranon process seen in *Brontops dispar*. The bones are therefore more nearly like those of the Oligocene rhinoceroses than of the true titanotheres.

Although the humerus of the genus *Eotitanotherium*[10] from the Uinta is in general construction typical of the titanotheres of the Oligocene, the radius and ulna (*l. c.*, p. 44) are slender and more nearly like those of *Dolichorhinus*.

The manus of *Dolichorhinus* was described by O. A. Peterson (*l. c.*, pp. 135–137), but a closer comparison of the elements of the manus in the three genera *Eotitanotherium*, *Dolichorhinus*, and *Brontops* is here given to aid the student.

Scaphoid.—The scaphoid of *Dolichorhinus* is actually higher than in *Eotitanotherium osborni* (C. M., No. 2,860). The scaphoid of the latter is a larger bone, especially in the fore-and-aft dimensions, and, as Peterson has already stated, (*l. c.*, p. 135), the anterior articulation for the magnum is of much larger size, due to the larger descending and truncated mass of the bone in *Eotitanotherium*, a distinct feature of the Oligocene forms (Compare *Brontops*). A second feature very noticeable is the facet for the lunar along the ulnar face. In *Dolichorhinus* this facet is located on an overhanging lip near the dorsal face, and forms nearly one-half of a circle; while in *Eotitanotherium* it runs in an almost straight direction fore-and-aft as in *Brontops dispar*. The radial surface of the scaphoid in *Dolichorhinus* is more convex than it is in *Eotitanotherium*, and in this respect *Dolichorhinus* from the Uinta and *Brontops* from the Oligocene are more nearly alike. There is no noteworthy difference between the scaphoid of No. 11,071, and

[10] Peterson, Annals Car. Mus., Vol. IX, 1914, p. 43.

of No. 2,865, which Mr. Peterson described as belonging to *Dolichorhinus longiceps* (*l. c.*, p. 135).

Lunar.—The lunar has a greater constriction of the articulation for the radius; and the palmar portion of this articulation is more oblique downward and outward than in *Brontops*. The greater degree of this constriction in *Dolichorhinus* is chiefly in order to accommodate the greater convexity of the articulation of the scaphoid described above. The broad facet for the unciform is seen to be equally broad in *Brontops dispar*, but, as Peterson has already observed (*l. c.*, pp. 135–136), the latter has the posterior portion of this facet suddenly concave nearly to the same degree as the facet for the magnum. In *Dolichorhinus*, on the other hand, the facet for the unciform does not extend so far back, and has a more evenly convex surface from the front backward, and the posterior portion of the two facets, that for the unciform and that for the magnum, besides being dissimilar, are more distinctly separated by a ridge, which extends lower down than is the case in *Brontops dispar*. The lunar of No. 11,071 appears to have the anterior portion of the facet for the radius narrower than is the case in No. 2,865, described in 1914. Otherwise there is little or no difference in this bone in the two animals.

Cuneiform.—The cuneiform of *Dolichorhinus* is relatively high, when compared with *Brontops dispar*, and is, no doubt, also higher than in *Eotitanotherium*. As Peterson has already stated (*l. c.*, p. 136) the facet for the pisiform occupies a relatively greater transverse area than in *Brontops*, but the ulnar portion of the cuneiform has relatively a smaller antero-posterior diameter, so that the facet for the radius has a triangular outline with the apex directed towards the ulnar face, while in *Brontops dispar* the facet is subovate, the external and internal portions of the facet having equal dimensions. The radial face carries the two facets for the lunar usually found in the Perissodactyla, the superior being somewhat less overhanging than in *Brontops*, due to the smaller development of the dorsal radial angle of the cuneiform. The distal face is entirely taken up by the facet for the unciform. The latter facet is more evenly concave from side to side than in *Brontops*, and is really more analogous to that in Miocene rhinoceroses (Compare *Diceratherium*). The differences in the cuneiform of No. 11,071 and No. 2,865 are slight.

Pisiform.—Peterson has observed that the pisiform of *Dolichorhinus* differs from that of *Eotitanotherium* and the Oligocene titanotheres generally by being proportionally heavier and shorter. The transverse diameter of the facet for the ulna is relatively smaller, while that for the cuneiform is greater than in *Brontops dispar*. The pisiform of *Eotitanotherium* (C. M., No. 2,860) is too much crushed at the proximal end to admit of an accurate comparison. This bone of the two

latter genera is, however, remarkably similar in having attenuated shafts and deep terminal tuberosities, which have already been pointed out by Peterson (*l. c.*, p. 45). There is no noteworthy difference in the pisiform of the present specimen and that described earlier (*l. c.*, p. 136).

Trapezium.—The trapezium is relatively large when compared with *Brontops dispar*. In an earlier publication it was observed that there are "three articulating facets on the ulnar angle; a large median surface for the trapezoid and two smaller facets separated from the larger by well defined ridges, and articulating, one with the scaphoid, and the other with Mc. II," (Peterson, *l. c.*, p. 136). The trapezium as a whole has actually a greater vertical diameter than in *Brontops*. This is chiefly due to the downward projecting process which is apparently absent in the Oligocene genus. The differences in the trapezium of the present specimen and the one described earlier are only of very minor importance.

Trapezoid.—The trapezoid of No. 11,071 is narrow, but has a proportionally greater antero-posterior diameter than in either *Eotitanotherium* or *Brontops*. The surface for the scaphoid is saddle-shaped, as in the titanotheres generally, but the palmar-radial portion of the facet extends further back, due to an extended tubercle which is not, however, nearly so well developed in *Eotitanotherium* or *Brontops*. Radially the bone bears a large flat facet for the trapezium, while on the ulnar side there is, besides the large facet for the magnum, a second very small facet on the palmar-superior angle, which comes in contact with the posterior elevated portion of the magnum upon flexion of the carpals. This second facet on the ulnar face of the trapezoid is very much better developed in both *Eotitanotherium* and *Brontops*. (*Cf.* Peterson, *l. c.*, p. 136). Distally the entire bone is taken up by the saddle-shaped facet for Mc. II, which is slightly less convex fore-and-aft than the proximal face. The transverse diameter of the trapezoid in No. 11,071 is less, and the antero-posterior diameter greater, than in No. 2,865. This is mainly due to the greater development of the palmar tubercle in No. 11,071 referred to above, and the smaller development of the radial angle. These characters may be of specific value, but most probably are only individual differences.

Magnum.—The magnum differs from that bone in *Brontops dispar* in one or two important characters. The head of Mc.IV does not touch the palmar ulnar angle of the magnum so as to form a facet, as in *Brontops*, and the palmar tuberosity has a relatively greater transverse and a smaller vertical diameter. The latter character, together with the steep slope of the articular facet for the unciform and the relatively greater height of the magnum when compared with that in *Brontops*, was noted in a former paper (Peterson, *l. c.*, p. 136). Unfortunately the magnum of *Eotitanotherium* is not known, and Mc.IV of the same genus is also injured

along the radial border of the head. There are no differences worthy of mention between the magnum in Nos. 11,071 and 2,865.

Unciform.—The unciform is relatively higher than in *Brontops*. The region of the proximal facets (those for the lunar and cuneiform) are notably elevated above the palmar tuberosity, when compared with *Brontops*. In the latter there is, however, an elevated and hemispherical posterior portion of the facet for the lunar, which also articulates with the plantar-radial part of the facet for the cuneiform, not found in *Dolichorhinus*. These characters, together with the steeper slope of the articulation for the magnum of this bone in the two genera has already been observed. (*Cf.* Peterson, *l. c.*, p. 136). The articulations for the lunar and cuneiform in the unciform of No. 11,071 are greater in their antero-posterior diameters than in No. 2,865, while the palmar tuberosity is less developed. These are, no doubt, individual differences, which should be regarded as of minor importance.

Peterson (*l. c.*, p. 137) states that the metacarpals of *Dolichorhinus* are relatively short, when compared with those in *Eotitanotherium*. On making a comparison with the metacarpals in *Brontops dispar*, on the other hand, it is plain that those in *Dolichorhinus* are longer and slenderer in proportion. The head of Mc.III rises higher, giving a greater elevation to the magnum than in *Brontops*. This feature in *Dolichorhinus* is more nearly the condition found in the rhinoceroses. In *Dolichorhinus* the radial face of the head of Mc.IV only articulates with Mc.III, while in *Brontops* there is a small facet back of that for Mc.III, which touches the posterior ulnar angle of the distal articulation of the magnum. This facet furnishes additional support for the fourth digit in the Oligocene titanotheres and has already been described above. The shafts of the metacarpals are rather flat and straight, which is characteristic of the titanotheres. In *Dolichorhinus* the distal ends of the metacarpals are not enlarged laterally as much as in *Brontops*, while in the fore-and-aft direction they are equally developed in the two genera. The carina of the distal trochlea, in the two forms is also equally developed. There is little or no difference in the metacarpals of No. 11,071 and those of No. 2,865.

The sesamoids are well developed, especially in their plantar-dorsal direction. They are sometimes found to be coössified and have between them a tendinal groove on the plantar face of the coössified bones.

The phalanges are characteristically titanotheroid in all their main features, that is to say, they are broad, flat, and rather short. Those of the proximal row are about twice the length of those in the median row. The terminal phalanges are very short, quite rugose, and truncated anteriorly, indicating a blunt horny covering.

Measurements.	No. 11,071	No. 11,072
Scapula, greatest length	395 mm.	
Scapula, greatest diameter across the blade	205 mm.	
Scapula, antero-posterior diameter just above articular surface for humerus	92 mm.	
Scapula, greatest antero-posterior diameter of head of scapula	100 mm.	103 mm.
Scapula, antero-posterior diameter of glenoid articulation	73 mm.	78 mm.
Scapula, transverse diameter of glenoid articulation	57 mm.	57 mm.
Humerus, greatest length	340 mm.	285*mm.
Humerus, length from articulating head to distal end	302 mm.	260*mm.
Humerus, greatest transverse diameter of distal end	77*mm.	100 mm.
Humerus, greatest transverse diameter of trochlea	62*mm.	77 mm.
Ulna, greatest length	315 mm.	
Radius, greatest length	328 mm.	
Radius, transverse diameter of head	65*mm.	
Radius, transverse diameter of distal end (distal end of ulna included)	83*mm.	
Manus, greatest length	225 mm.	
Carpus, greatest vertical diameter	58 mm.	
Carpus, greatest breadth, measured across the top row of carpals	87 mm.	
Scaphoid, greatest transverse diameter	43 mm.	
Scaphoid, greatest antero-posterior diameter	33 mm.	
Scaphoid, greatest vertical diameter	31 mm.	
Lunar, greatest vertical diameter	34 mm.	
Lunar, greatest transverse diameter	30 mm.	
Lunar, greatest antero-posterior diameter	41 mm.	
Cuneiform, greatest antero-posterior diameter	25 mm.	
Cuneiform, greatest transverse diameter	41 mm.	
Cuneiform, greatest vertical diameter	26 mm.	
Pisiform, greatest length	52 mm.	
Pisiform, vertical diameter of free end	27 mm.	
Pisiform, greatest vertical diameter of proximal end	20 mm.	
Pisiform, greatest antero-posterior diameter of proximal end	25 mm.	
Trapezium, greatest antero-posterior diameter	13 mm.	
Trapezium, greatest vertical diameter	27 mm.	
Trapezoid, greatest vertical diameter	18 mm.	
Trapezoid, greatest transverse diameter	20 mm.	
Trapezoid, greatest antero-posterior diameter	31 mm.	
Magnum, greatest antero-posterior diameter	48 mm.	
Magnum, greatest transverse diameter	18 mm.	
Magnum, greatest vertical diameter	38 mm.	
Unciform, greatest vertical diameter	40 mm.	
Unciform, greatest transverse diameter	41 mm.	
Unciform, greatest antero-posterior diameter	42 mm.	
Metacarpal II, greatest length	122 mm.	
Metacarpal III, greatest length	128 mm.	
Metacarpal IV, greatest length	115 mm.	
Metacarpal V, greatest length	103 mm.	
Phalanges, length of the total series, digit II	53 mm.	
Phalanges, length of the total series, digit III, approximately	55 mm.	
Phalanges, length of the total series, digit IV	62 mm.	
Phalanges, length of the total series, digit V	55 mm.	

* Indicates distortion and unreliable measurements.

HIND LIMB.

Pelvis.—The pelvis of *Dolichorhinus* may be said to combine the characters of the Oligocene rhinoceroses and the titanotheres. The ilium is evenly rounded above and the pubic symphysis is heavy and well coössified, with a tendency to the heavy downward projecting hook at the posterior inferior extremity of the pubis, as in the titanotheres; while the gluteal surface of the ilium is more concave, the shaft longer, the sacro-sciatic notch deeper, and the ischium and pubis longer, as in the rhinoceroses. The author has previously observed (*l. c.*, p. 47) that the ilium of *Eotitanotherium osborni* has a relatively longer shaft than is the case in *Brontops*. In *Dolichorhinus* the ilium is broadly expanded across the region of the gluteal muscles terminating above in a recurved process with its summit evenly rounded fore-and-aft, enlarged and rugose transversely, and with a liberal antero-posterior dimension. The point of the ilium consists of an evenly rounded process. The crest of the ilium is, as stated above, well rounded, while behind the flare is suddenly contracted into the rather long shaft, producing deep notches above and below, of which the sacro-sciatic is the deeper partly because of the backward prolongation of the sacrum and the prominent ischial spine. The acetabulum is evenly rounded, deep, its upper border heavier than the lower; the cotyloid notch wide; and the pit for the round ligament rather large. The ischium, though short, is relatively longer than in *Brontops*. Its shaft is trihedral in cross-section and expands suddenly behind, terminating in a truncated end, which is vertically deep. This vertical depth is due in part to the prominent ischial tuberosity, but more especially to the ramus, which extends downwards to meet the pubis. The obturator foramen is large and ovate in outline. The shaft of the pubis below the acetabulum is well proportioned and the symphysis is solidly coössified. The ramus on the border of the obturator foramen is rather slender and trihedral in cross-section.

The pelvis of No. 11,072 is crushed fore-and-aft, especially on the right side, so that the shaft of the ilium appears short. The ischium is also more or less affected by this crushing. In No. 3,840 the pelvis is more perfectly preserved and has been partly used in preparing the above description. (See Plate L.)

Femur.—Four femora were found by Mr. Douglass in the quarry near the Wagonhound Canyon. These bones vary in shape, but more especially in size, no doubt due to sex, individual differences, and to crushing in one way or another. The largest of these four femora is provisionally referred to No. 11,072, described above. The head is rounded and the pit for the ligamentum teres is well developed, but the neck is short and affords comparatively limited surface for the insertion of

the capsular ligament of the hip-joint. The greater trochanter is slightly higher than the head and at its top somewhat laterally expanded, a typical titanotheroid feature. The digital fossa is small, which is also characteristic of *Brontops*. The upper anterior face of the shaft has a broad surface indented by a rather shallow fossa, which extends well downwards. Behind there is a deeper fossa, which is bordered on the fibular side by a heavy ridge descending from the trochanteric mass, and on the tibial side by a rather sharp ridge, which begins immediately below the rim of the articulation and continues downwards to the apex of the lesser trochanter. The third trochanter is of moderate size in the femur provisionally referred to No. 11,072, while on the bone referred to No. 11,071 it is larger and gives a twisted appearance to this region of the shaft, viewed from behind. (See Plate LII, fig. 2.) Below the third trochanter the shaft is D-shaped in No. 11,072, while in some of the other specimens this region is more or less trihedral in cross-section. These differences are to some extent due to crushing. The lower extremity is not greatly expanded, the inter-condylar notch and the articulating surfaces of the condyles being rather narrow. The rotular trochlea is rather evenly convex from side to side and the lateral borders are thin and sharp.

There is not much difference in size or in the general details of structure in the femur of *Dolichorhinus* and *Eotitanotherium*. In the latter the supracondylar fossa is, however, shallower, and the fossa above the rotular trochlea deeper and larger than in *Dolichorhinus* and in *Brontops dispar*, as already noted by Peterson, (*l. c.*, p. 47).

Patella.—The patella is higher than broad as is usual in the titanotheres. The anterior face of the bone is unevenly convex, the tibial border being heavier than the fibular. Near the top along the inside border is a large truncated tubercle for muscular attachments. The articulating surfaces for the rotular trochlea of the femur are divided by a heavy and vertical ridge. The articulation on the tibial side of this ridge is slightly larger than that on the fibular side. The patella is titanotheroid in every respect.

The tibia, fibula, and hind foot were found in close proximity to the smaller skeleton, No. 11,071 and are provisionally assigned to it.

Tibia.—The tibia is approximately three-fourths the length of the four femora mentioned in the foregoing description. The spine, which separates the articulating surfaces of the head, is prominent, especially on the fibular side and the articulating surfaces themselves are well expanded, furnishing a liberal support for the condyles of the femur. The cnemial crest is not large and slopes rather rapidly in its downward course, the upper part of the shaft being distinctly tri-

angular in cross-section. The middle region of the shaft may be said to have four faces, the tibial and fibular being flat, while the posterior and postero-tibial are more rounded. The lower portion of the shaft is well demarcated, especially by the prominent ridges in front and on the fibular angle. The distal trochlea is divided by a heavy rounded ridge. The tibial portion of the trochlea is narrow and evenly convex fore-and-aft, as well as from side to side, while the fibular portion slants upward at an angle of 60° or more, so that when the tibia is placed on the astragalus there is a quite noteworthy outward turn at the ankle-joint. The distal end of the tibia does not come in contact with the calcaneum.

The tibia in *Eotitanotherium osborni* described by Peterson (*l. c.*, p. 48) is no heavier than that bone in *Dolichorhinus*, but is nearly one-fourth longer. Even when the crushing of the tibia in *Eotitanotherium* is taken into proper consideration it is quite plain that this bone in that genus is not as distinctly marked by ridges extending up and down on the shaft as in *Dolichorhinus*.

Fibula.—The upper end of the fibula is solidly coössified with the tibia. The reduction of the shaft is in about the same ratio as in *Brontops dispar*. The antero-posterior diameter of the distal end is twice the transverse diameter. The contact with the tibia is quite rugose, but coössification does not take place. The articulation for the astragalus is liberal in dimension, and on the posterior distal angle there is located a small facet, which comes in contact with the calcaneum on flexion of the ankle-joint.

In *Eotitanotherium* the ankle-joint does not appear to be so much thrown outward as in *Dolichorhinus* and the whole aspect of the hind limb appears lighter. In *Brontops dispar*, on the other hand, the hind limb has more nearly the proprotions of *Dolichorhinus*, while the ankle-joint is more in line with the shaft of the tibia and recalls that of *Eotitanotherium*.

The hind foot of *Dolichorhinus* is very nearly complete in No. 11,071, the sesamoids and phalanges being the only parts not recovered. The relative height of the fore and hind feet is approximately the same as in *Brontops dispar*. In *Eotitanotherium* the feet, as well as the limbs, are longer and slenderer, as has already been pointed out by Peterson (*l. c.*, pp. 46–50).

Astragalus.—The astragalus in detail is much like that of *Eotitanotherium*. In the latter genus the part below the trochlear groove is, however, longer; the ectal and cuboidal facets are united on the plantar face; the vertical ridge on the tibial face is less developed below and the facet for the cuboid has a more direct distal location. The two last mentioned characters in *Dolichorhinus* are obviously more like what is seen in *Brontops*, where the comparatively large facet for the

cuboid is directly distal and the whole inside face of the bone near the articular facet for the navicular has developed into a heavy, rounded, and rugose ridge. In *Dolichorhinus* the ectal and cuboidal facets on the plantar face are distinctly separated by an excavation as in *Brontops*, and unlike *Eotitanotherium* where these two facets are united, as shown by Peterson. The external or fibular ridge of the astragalar trochlea is extended further back against the tuber of the calcaneum than in *Brontops*, so that the tibia does not come in contact with the calcaneum on flexion as in *Brontops*. On the whole the width of the astragalus in *Dolichorhinus* is slightly greater than the length. In *Brontops* the width is very considerably greater than the length, while in *Eotitanotherium* the length of the bone is greater than the width.

Calcaneum.—The most noticeable and distinctive feature of the calcaneum in *Dolichorhinus* is the broad plantar face of the tuber calcis, which is different from both *Brontops* and *Eotitanotherium*. In the two latter the tuber of the calcaneum is similar in its general details of structure, as well as in its position in the articulated foot. In *Eotitanotherium* and in *Brontops* the fibular face of the tuber calcis, when in the articulated foot, has a decided inward dip, while in *Dolichorhinus* the external or fibular face is more nearly vertical. The extremity of the tuber in *Dolichorhinus* is also more enlarged than in the other two genera. In *Dolichorhinus* the proximal astragalar facet is raised above the upper margin of the tuber calcis as in *Brontops*, but there is no directly posterior facet for the lower end of the tibia, as in the latter. On the fibular angle there is, however, a small facet, which meets a corresponding facet on the fibula. The greater process of the lower end is shorter, and the lesser process is longer than in *Eotitanotherium*. In this respect it thus appears that the lower end of the calcaneum in *Brontops* and *Dolichorhinus* are more alike, they having their distal processes more nearly on a line at right angle with the axis of the bone than in *Eotitanotherium*, in which the facet for the cuboid is more slanted inwardly and upwardly and the lesser process not descending so low.

Cuboid.—The cuboid in general appearance is more rhinoceroid than titanotheroid. It is high, rather narrow, with the plantar tuberosity large, hook-like, and extending well below the articulating surface for the fourth metatarsal. The facet for the fourth metatarsal occupies the entire distal face as in *Diceratherium*, while in the Oligocene titanotheres there is in addition a facet for Mt. III on the tibial angle of the cuboid. On the tibial face there are four facets. Two of these articulate with the navicular and are located, one on the angle of the articulation for the astragalus, and the other on the upper portion of a lip-like projection

on the tibial face of the bone. The other two facets articulate with the ectocuneiform. One of these takes up the inferior portion of the lip-like projection referred to above and the other is located on the tibial angle of the facet for Mt. IV. The proximal face is taken up by the articular facets for the calcaneum and astragalus. These two facets are separated by a rounded ridge, almost directly fore-and-aft in position. The facet for the calcaneum takes up two-thirds of the area, while that for the astragalus covers one-third of the proximal face along the tibial side of the bone. The dorsal, plantar, and fibular faces are rugose, but quite distinct from one another, due to the rather prominent vertical ridges on the antero- and postero-fibular angles.

In the Oligocene titanotheres the cuboid is more depressed, the proximal facets placed at greater angles from one another, the distal face with two facets instead of one, and the tibial face has a long contact with the ectocuneiform. In *Eotitanotherium* the cuboid is not known.

Navicular.—The navicular, though relatively somewhat higher, has the breadth characteristic of the titanotheres in general. The articulation for the astragalus is evenly concave from before backward, and not basin-shaped, as in some of the titanotheres. The fibular portion of the facet is also more gently rounded in a downward direction, while in *Brontops* there is a more decided ridge separating the two portions of the facet, and the fibular portion is directed downward at a greater angle. Distally the bone is convex in all directions, not unlike what is seen in the true titanotheres, and the facets for the cuneiforms are slightly separated by an almost imperceptible ridge. The fibular face is broadly excavated in the middle; in front and back of this excavation are facets articulating with the cuboid. This excavation is, however, not as deep as in the rhinoceroses, for example *Diceratherium*. The dorsal face is gently and evenly rounded, with a shallow and rugose groove extending nearly across the entire front of the bone. The tibial and plantar faces are broken in our specimens.

Ectocuneiform.—The ectocuneiform has a greater vertical diameter than the navicular. The bone is titanotheroid in its general outlines. In detail it differs slightly from the titanotheres, the most noticeable difference being the presence of two facets for the cuboid separated by a shallow excavation, whereas in *Brontops* the articulating surface is continuous. On the tibial face the bone articulates with Mt. II and with the mesocuneiform. Distally the articulation for Mt. III, as usual, occupies the entire surface. This facet is evenly concave fore-and-aft, nearly flat transversely, while in *Brontops* the surface is gently convex from side to side. The proximal face has two articulations: the larger, which is gently

antero-posteriorly concave, articulating with the navicular; the smaller, located on the postero-fibular angle and articulating with the corresponding facet on the lower face of the projecting tubercle on the tibial face of the cuboid. The lower anterior portion of the fibular face is developed into a truncated process. This process touches the cuboid by an articular facet, which does not extend backwards, as generally is the case in the titanotheres. The dorsal face is gently rounded and rugose, while there is no tuberosity on the plantar surface.

Mesocuneiform.—The mesocuneiform is considerably reduced in size. Its proximal face is concave from side to side, and very gently concave from front to back. The articulation for the second metatarsal is nearly straight in the antero-posterior direction, while laterally it is convex. The antero-fibular angle is developed into a rounded and blunt process, while the dorso-tibial portion is nearly a plane surface, due to a vertical ridge, which separates the dorsal and tibial faces of the bone. The tibial face is much injured in the specimen I am describing. The fibular face is almost vertical and presents nearly a straight contour fore-and-aft. There are apparently three facets for the ectocuneiform, one above and two below. The posterior face is also injured. Whether or not there was an entocuneiform present, as in *Brontops*, cannot be determined from this specimen, due to the injury which the mesocuneiform has received.

Metatarsals.—The metatarsals are shorter and heavier than in *Eotitanotherium*. They are also different in general shape, those in the latter genus having the shafts more rounded or cylindroid, especially the second metatarsals. The shaft of this bone in *Dolichorhinus* is throughout more trihedral; the dorso-proximal portion being especially developed in the fibular direction. The articulation on the proximal end is evenly concave from side to side to correspond with the cuneiform, and there is an articulation on the plantar tibial face of the head, possibly for a rudimentary first metatarsal. If the latter metatarsal was represented, there was also undoubtedly an entocuneiform. The distal end is very little wider than the shaft and the articular surface for the phalanx differs in no noteworthy respect from that in the titanotheres generally.

The chief distinguishing feature of the third metatarsal is its single articulating surface for the ectocuneiform, while that in *Brontops* and the titanotheres generally shares the articulating surface with the cuboid, as stated above. Furthermore the articulations for Mt.IV in *Brontops* is connected by a prominent ridge along the upper edge of the head, while in *Dolichorhinus* this area is deeply excavated clear through to the proximal articulation, leaving these two facets widely separated on a lip-like projection on the dorsal and plantar angles of the

head. The shaft is flat as in the titanotheres, and, as in Mt.II, the distal end is slightly wider than the shaft. The metapodial keel is confined to the posterior portion of the articulation.

The fourth metatarsal is slightly arched forward, but not to the extent seen in *Eotitanotherium*. The articulation for the cuboid is also less convex fore-and-aft, the surface being flat, more nearly as in *Brontops*. From the latter genus it differs, however, by having the anterior articulation for Mt.III the larger; whereas in *Brontops* the posterior articulation is the larger. This may be only an individual character. The shaft is heavy and trihedral in section. The distal end is no wider than the lower portion of the shaft and the trochlea is rather narrow, quite convex antero-posteriorly, and very gently convex transversely. The carina is of medium size.

MEASUREMENTS.

	No. 11,071	No. 11,072
Pelvis, greatest length	485 mm.	419*mm.
Femur, greatest length	457*mm.	444 mm.
Tibia, greatest length	335 mm.	
Tibia, antero-posterior diameter of head	104 mm.	
Tibia, transverse diameter of head	100 mm.	
Tibia, transverse diameter distal end, fibula included	83 mm.	
Tibia, antero-posterior diameter distal end	61 mm.	
Pes, greatest length, phalanges not included	280 mm.	
Tarsus, greatest length, tuber of calcaneum included	145 mm.	
Calcaneum, greatest length	112 mm.	
Calcaneum, vertical diameter of free end of tuber calcis	41 mm.	
Calcaneum, transverse diameter of free end of tuber	38 mm.	
Calcaneum, transverse diameter of distal end	58 mm.	
Astragalus, transverse diameter	73 mm.	
Astragalus, vertical diameter	65 mm.	
Cuboid, vertical diameter dorsal face	34 mm.	
Cuboid, greatest transverse diameter	37 mm.	
Navicular, greatest vertical diameter	19 mm.	
Ectocuneiform, greatest vertical diameter	22 mm.	
Ectocuneiform, transverse diameter	29 mm.	
Ectocuneiform, antero-posterior diameter	36 mm.	
Mesocuneiform, vertical diameter	13 mm.	
Mesocuneiform, transverse diameter	19 mm.	
Mesocuneiform, antero-posterior diameter	30 mm.	
Metatarsal II, greatest length	128 mm.	
Metatarsal III, greatest length	132 mm.	
Metatarsal IV, greatest length	120 mm.	

* Indicates distortion and unreliable measurement.

RESTORATION OF THE SKELETON OF DOLICHORHINUS

(Plates LV and LVI).

The restoration of the skeleton of *Dolichorhinus* represented on Plate LVI is based upon the two skeletons Nos. 11,071 and 11,072, described in detail in the foregoing pages. The two skeletons are imbedded in half relief on a hard, brown, sandstone of fine texture (Plate LV). As already stated in the early part of this paper, the skeleton No. 11,072 consists of the nearly complete skull with lower jaws articulated and entire trunk. Parts of the fore limbs were found imbedded nearly in their proper position. No. 11,071 was found somewhat more disarticulated, but the association of the different parts is comparatively easy, since this specimen is a smaller and younger individual than No. 11,072. This second specimen also has the skull and lower jaws attached to the neck, the anterior portion of the trunk in position, but the posterior portion was disturbed, and the limbs, though found in close proximity, were disarticulated before final interment. These two specimens supplement one another most admirably and from them it has been possible to effect a restoration which is thought to be very nearly correct in all its main proportions.

The most characteristic feature of the animal is its long and narrow head. Among the titanotheres, the head of *Dolichorhinus* is rather unusual in having a decided convexity fore-and-aft as well as laterally in the region of the posterior portion of the frontals and the parietals. The maxillaries are long and slender and the nasals are long and deeply excavated laterally as is usual in the long-nosed titanotheres. To compensate for the elongated head, the neck is proportionally short. The trunk is typically titanotheroid, the thorax being long and the lumbar region short. The depth of the thoracic cavity is not excessive, as indicated by the ribs. The sacrum has usually four coössified vertebræ; this varies, however, as five centra are sometimes found. The proximal portion of the tail has chevrons characteristic of the Oligocene titanotheres (Compare *Brontops dispar*) and the length of the caudal appendage is approximately that of the latter genus.

As has been stated, the limbs are in part those of No. 11,071 and, as that individual is slightly smaller, the appendicular portion of the restoration, as represented on Plate LVI, may be a few centimeters shorter than would possibly be the case, were all the limb bones preserved in No. 11,072.

Plate LVII represents *Dolichorhinus* in the flesh to guide the eye, as to the probable appearance of this curious titanothere. This illustration brings out the elongated head and the slenderness of the anterior region of the neck in comparison with the true rhinoceros-like appearance of the trunk.

MEASUREMENTS.

Height of skeleton at fore limbs	123 cm.
Height of skeleton at hind limbs	114 cm.
Greatest length of skeleton	234 cm.
Length of skeleton from end of pubis to posterior face of seventh cervical	135 cm.
Length of neck	40 cm.

Plate LV represents *Dolichorhinus longiceps* as finally prepared for exhibition in the Gallery of Fossil Mammals in the Carnegie Museum. The head, neck, and trunk remain in the original position in which they were found in the field. A portion of the left scapula and the humerus belonging to the trunk were found very nearly in the position in which they are placed in the exhibit, while the lower part of the fore limb and foot is partly or wholly restored from the opposite member. The right fore limb, as stated before, is complete and belongs to No. 11,071. The left femur is inserted, as probably belonging to specimen No. 11,072. As in the fore limb, the lower portion of the left hind limb and pes are restored from the opposite side. The caudals present with No. 11,072 have been worked out in half relief, in the same manner as the trunk and neck, and are mounted very nearly in the position in which they were originally found.

REVIEW OF THE SPECIES OF DOLICHORHINUS HATCHER[11] IN THEIR ORDER OF PUBLICATION.

1. **Dolichorhinus hyognathus** (Scott and Osborn).

Palæosyops hyognathus Scott and Osborn, Trans. Amer. Philos. Soc. N. S., Vol. XVI, Part III, Aug. 20, 1889, p. 513.

Type: Lower jaw, No. 10,273, Princeton Museum.

Locality: Washakie Basin, Wyoming.

Horizon: Upper Eocene, Horizon B of the Washakie Beds.

Original Description: "In the Washakie beds is found a large species, about the same size as *P. vallidens* Cope, which is provisionally referred to *Palæosyops* (*P. hyognathus*, spec. nov., Princeton collection No. 10,273). This is represented by a lower jaw seven-eighths as large as the type mandible of *Diplacodon*. As in the latter, the incisors form a close procumbent series; the tips forming a gently arched line when seen from above. The symphysis is extremely long (11 cm.) and shallow; the canines are rather small and semi-procumbent. The molar-premolar series measures 24.5 cm., the last molar measures 6.5 cm.; in *Diplacodon elatus* the same measurement is 10 cm. Unfortunately the premolar crowns are

[11] Hatcher separated *Dolichorhinus* from other Eocene titanotheres in 1895. Amer. Nat. Vol. XXIX, p. 1090.

broken; it is probable that one or two of the premolars will be found to be like the molars. The characters of the chin and symphysis are significant of close relationship to *Diplacodon elatus.*"

Mr. Charles Earle in his important "*Memoir Upon The Genus Palæosyops Leidy, And Its Allies*" (Jour. Acad. Nat. Sci., Phila., Vol. IX, 1884, pp. 348–350, Plate XI, figs. 10, 11), has furnished us with a description and excellent illustrations of the fragmentary type of *Dolichorhinus hyognathus.*

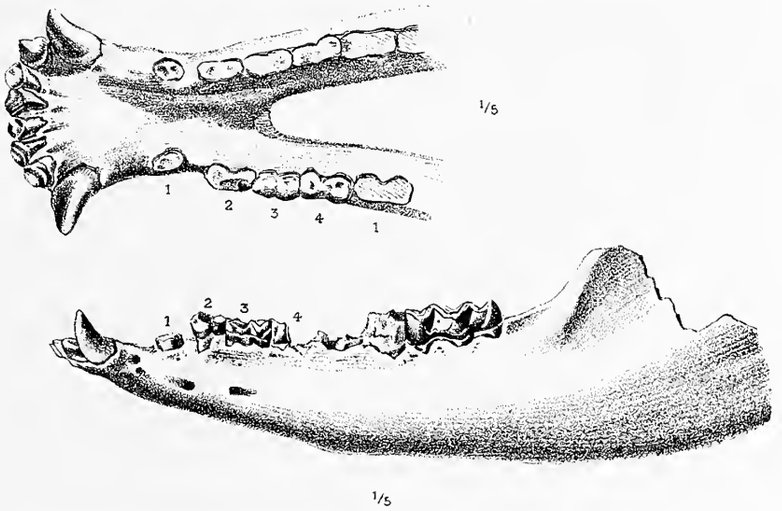


FIG. 4. *Dolichorhinus hyognathus* (Osborn) *Type.* No. 10,273, Princeton University Museum. (After Charles Earle.)

From Earle's description and illustrations together with the description of Scott and Osborn *Dolichorhinus hyognathus* is clearly seen to be a distinct species. The long symphysis and vertical ramus, the rapidly tapering horizontal ramus, and the apparent lack of the long and descending lobe of the inferior border of the ramus near the posterior end of the angle are characters which cannot be dismissed as merely individual. These facts taken together with the opinion already expressed by Mr. Riggs[12] constrain me to regard *D. hyognathus* as at least specifically distinct from any of the species of the Uinta deposits.

2. **Dolichorhinus cornutus** (Osborn).

Telmatotherium cornutum Osborn, Bull. A. M. N. H., Vol. VII, 1895, pp. 90–94.

Type: Skull No. 1,851, Collection American Museum of Natural History.

Paratypes: Skulls Nos. 1,850, 1,847, 1,848, 1,852, and 1,837[13]. Lower jaws No. 1,857, 1,858, 1854 and 1,855. Collection A. M. N. H.

[12] Field Museum of Natural History, Geol. Ser., Vol. IV, 1912, p. 32.

[13] In a later publication Professor Osborn used the skull bearing No. 1,837 as the type of his species *D. intermedius.* (Bull. Amer. Mus. Nat. Hist., Vol. XXIV, 1908, p. 611.

Locality: Uinta Basin, eastern part.

Horizon: Uinta Eocene, upper part of Horizon B.

Original Description: "Incisors $\frac{3}{2}$. $[\frac{3}{3}]$* Premolar-molar series, 208 mm. A narrow diastema. Upper canines lanceolate. Long premaxillary symphysis. A well-developed nasofrontal protuberance. Top of cranium completely flattened. No sagittal crest. An infraorbital process upon malar.

"The type of this species is a fine skull (No. 1,851), while several other well-preserved skulls from the same levels give us all the cranial characters and the superior dentition (Nos. 1,850, 1,847, 1,848, 1,852, 1,837). Unfortunately none of these skulls have the jaws associated with them, but several more or less perfect jaws, although found apart, agree perfectly in size (Nos. 1,857, 1,858, 1,854, 1,855); they are all readily distinguished from the jaw of *T. hyognathum* by the presence of *only two incisors*.

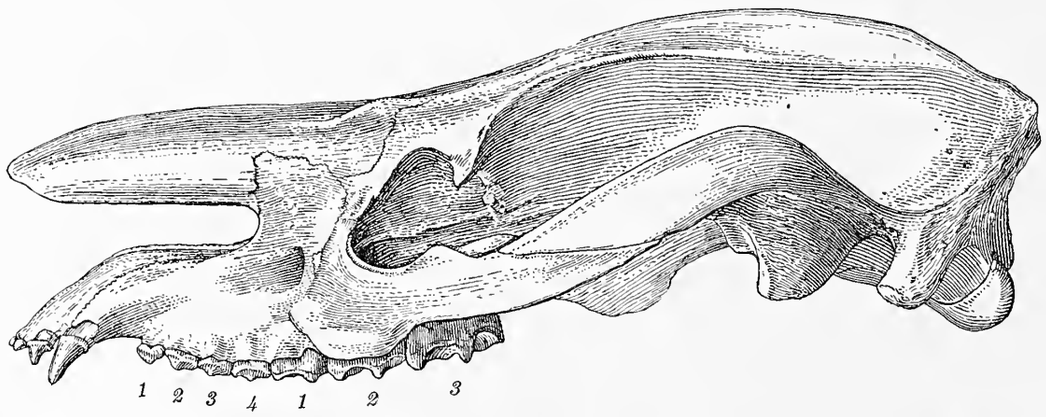


FIG. 5. *Dolichorhinus cornutus* (Osborn). *Type*. No. 1,851, Amer Mus. Nat. Hist. Side view, one-fourth natural size. (After Osborn.)

"This species is remarkable for its very long flat-topped cranium and its incipient knob-like osseous horns borne chiefly upon the nasals but partly upon the frontals. These horns project laterally and rise slightly above the general surface, and are best seen in the anterior view, Fig. 10. These characters and the absence of the fronto-parietal and inter-parietal sutures all point well towards *Titanotherium*, but the premolars are still absolutely simple, showing no trace of the postero-internal cusps which characterize *Diplacodon elatus*.

"Other striking peculiarities are the upward arching midcranial region, the extremely long, narrow, and laterally decurved nasals; the strong infraorbital shelf upon the malars (seen also in *T. megarhinum*), the slender zygomatic arch, the low occiput, the backward extension of the posterior nares by the palatines, and the partial inclosing of the roof of the pharynx by the pterygoids.

"More in detail (No. 1,851) the *nasals* almost overhang the premaxillaries, they are laterally compressed above the infraorbital foramina so as to give the impression of distal expansion; the median fronto-nasal suture extends back beyond the mid-orbital line, but laterally the nasals terminate just above the orbits so as to include most of the incipient horn. The *premaxillary* symphysis

* Inserted by O. A. Peterson.

is elongate as in *T. validum.* The *maxillaries* are shut off by the very narrow lachrymals from the anterior border of the orbits. The infraorbital foramen is placed above M^1 in front of the malar suture. The *malars* extend sharply upon the side of the face and then dip into the outwardly projecting shelf; with an obtuse postorbital knob. The *frontals* exhibit a prominent postorbital hook; there is a delicate lateral ridge marking the limits of the temporal fossa; between these ridges the cranium is arched both from side to side and antero-posteriorly, presenting a very different form from the concave profile of even the oldest known Titanothere; there is a slight constriction in the posterior third, but the cranium is even here two inches wide, and there is not the semblance of the crest seen in *T. vallidens;* the entire absence of the upper cranial sutures even in the young individuals (No. 1,847) is a noteworthy Titanothere character. Owing to the sudden dipping of the superior contour the occiput is rather low and subquadrate in outline.

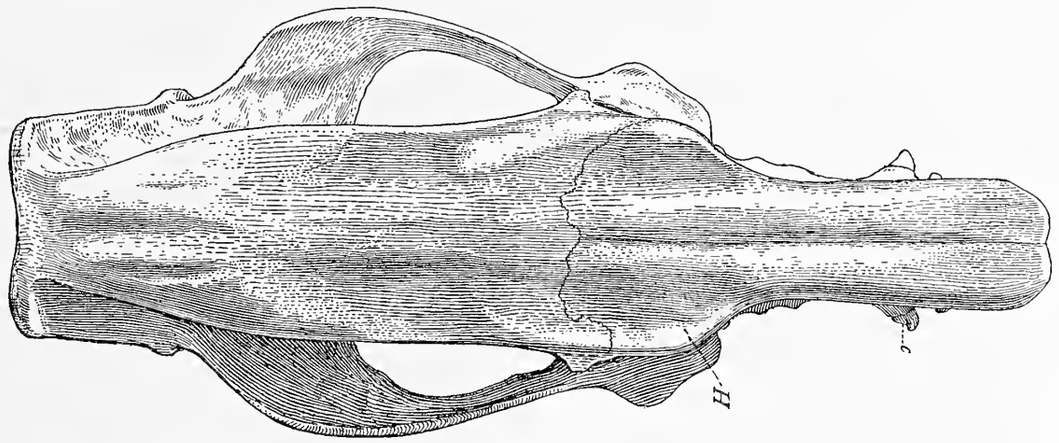


FIG. 6. *Dolichorhinus cornutus* (Osborn). *Type.* No. 1,851, Amer. Mus. Nat. Hist. Superior view, one-fourth natural size. (After Osborn.)

"In side view the faint temporal ridges can be traced to the superior angle of the occiput. The zygomatic arch is very slender; it arches slightly upwards and very much less strongly outwards than in *T. vallidens.* The postglenoid process is very thick in antero-posterior section.

"In palatal view we observe a diastema between the median incisors and a post-canine diastema of 28 mm. The molar series are placed closely parallel so that the palate is long, narrow and deeply arched, and the posterior nares opens far back behind the last molar. The deep and long pterygoids arch towards each other in the median line, forming a deep fossa.

"*Foramina.*—The alisphenoid canal is very long; the for. ovale is widely separated from the for. lac. medium; the for. lac. medium and the for. lac. posterius are very small and partly confluent; the condylar foramen is midway between the condyles and the for. lac. medium.

"*Lower Jaw.*—The most perfect of the lower jaws is No. 1,857; it ragees in size exactly with the type skull No. 1,851. In proportion it is rather shallow and

slender, but presents somewhat more angulation of the chin than in *T. hyognathus*. The most distinctive character is the extremely long hook-shaped coronoid process which extends back over the condyle. The symphysis is long and rather shallow.

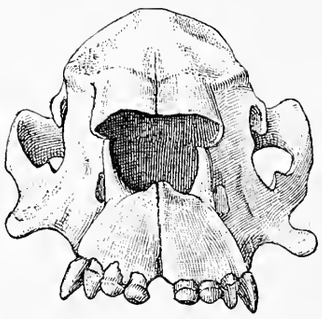


FIG. 7. *Dolichorhinus cornutus* (Osborn). *Type*. No. 1,851, Amer. Mus. Nat. Hist. Anterior view, one-fourth natural size. (After Osborn.)

"*Dentition.*—Inferior: A very distinctive and progressive feature is the presence of but two incisors in the lower jaw. The formula is thus $I\frac{3}{2}$, $C\frac{1}{1}$, $P\frac{4}{4}$, $M\frac{3}{3}$. A second Titanothere feature is seen in the relatively short, rounded canines of the lower jaw, which present a wide contrast with the compressed lance-shaped tusks of *T. validum* and *T. cultridens*; an especial feature is the absence of enamel upon the fang. It is to be noted, however, that the specific reference of these jaws is not certain.

"Superior: The incisor series of the type (No. 1,851) present a third circle, but the median incisors are separated by a slight space; they all exhibit prominent posterior basal cingula; the lateral incisor is considerably enlarged. The *canines* have short, outwardly and forwardly directed but slightly incurved crowns, with rather sharp borders, a suboval section and posterior basal cingula. Behind a short diastema is the first *premolar*, a simple, conical crown with an internal basal ridge; the second, third and fourth premolars exhibit *single* blunt or rounded internal cones, incomplete cingula, a strong antero-external (parastyle) and a feebler postero-internal (metastyle) ridge. The *molars* have the generic conformation; the third molar is the largest of the series, and exhibits a strong parastyle and mesostyle and a feebler metastyle; there is a strong cingulum at the outer base of the paracone, and a feebler one at the outer base of the metacone; the hypocone is feebly developed upon M^3. All these teeth are well worn, and the animal was fully adult.

"The superior dentition of No. 1,850 belongs to a younger animal with sharply defined characters. Here we see more plainly the resemblances to the type of *T. cultridens*. The canines are laniariform, with sharp lateral edges, basal cingula less marked and enamel continued far down. The outer faces of the premolars and molars are prominent and closely approximated to the internal cusps. We observe also a trace of the paraconule upon M^2, and a distinct paraconule upon M^3. In this specimen the pterygoids are long and not so deep."

3. **Dolichorhinus heterodon** Douglass.

Dolichorhinus heterodon Douglass, Annals Carnegie Museum, Vol. VI, 1909, p. 310.

Type: Skull. No. 2,340, Collection Carnegie Museum.

Locality: Uinta Basin, Utah. (Six or seven miles northeast of Well No. 2)[14].

Horizon: Uinta Eocene. Upper part of horizon "B" or lower part of horizon "C".

Original Description: "The skull is long, narrow, and moderately high. The face is short and the brain-case long. The free nasals are long, the posterior opening of the anterior nares extending well backward toward the orbit. The lower border of the nasals approach each other, but this is probably in part due to lateral crushing. The infraorbital foramen is large. The infraorbital shelf is represented by a protuberance, which is thickened on the free outer surface. If there were horn-cores above the orbit they were very small. The long brain-case

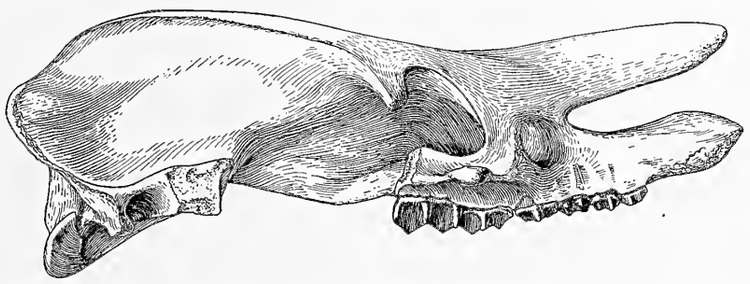


Fig. 8. *Dolichorhinus heterodon* Douglass. *Type.* No. 2,340, Car. Mus. Cat. Vert. Fossils. Side view, one-fifth natural size. (After Douglass.)

was apparently arched from before backward, the posterior descent to the crest of the occiput being very steep, though this may be somewhat exaggerated by crushing. The occipital condyles are very large. The median portion of the occiput above them is convex while above this there is a large concavity. The postglenoid processes are not excessively large.

"The premolars are small, the last being very decidedly smaller than the first molar. The first premolar is not preserved, but it was evidently a simple

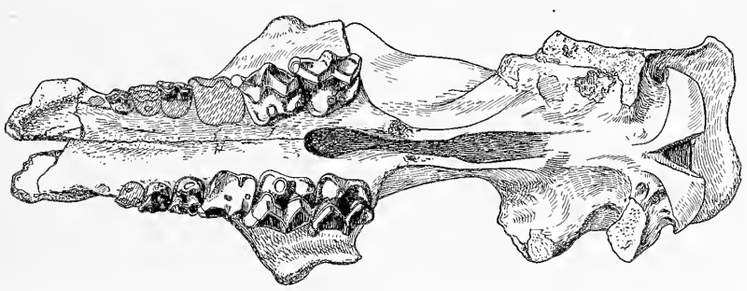


Fig. 9. *Dolichorhinus heterodon* Douglass. *Type.* No. 2,340, Car. Mus. Cat. Vert. Fossils. Palatal view, one-fifth natural size. (After Douglass.)

[14] Reference to local stations established by the Barber Asphaltum Company which operated in that country during the time in which the collection was made upon which Mr. Douglass based his work.

tooth. In the last three premolars there is a lobe or buttress on the antero-external portion of the tooth, which makes the anterior margin oblique. The inner cusps (deuterocones) are low with rounded summits. They are more nearly opposite the postero-external than the antero-external cusps. There are inner cingula on P^3 and P^4. The antero-internal cusp in M^2 is quite high and M^1 conical. The postero-internal cusp is due simply to an increase in height of the cingulum."

Measurements.

Total length of top of skull from end of nasals to crest of occiput	500 mm.
From anterior of orbit to front of nasals	160 mm.
From anterior of orbit to posterior part of narial opening of front of nasals	55 mm.
Width of occiput	128 mm.
Height of occiput	140 mm.
Length of molar premolar series	190 mm.
Length of premolar series	75 mm.
Length of molar series	115 mm.
Length of P^2	20 mm.
Width of P^2	16 mm.
Length of P^3	21 mm.
Width of P^3	20 mm.
Length of P^4	24 mm.
Width of P^4	27 mm.
Length of M^1	34 mm.
Width of M^1	35 mm.
Length of M^2	46 mm.
Width of M^2	42 mm.
Length of M^3	48 mm.
Width of M^3	42 mm.

Mr. E. S. Riggs of the Field Museum has found that *D. heterodon* compares in many respects quite closely with his proposed species, *Mesatirhinus superior* (Field Mus. Publ. Geol. Ser., IV, 1912, p. 26). Further on in the same publication, p. 35, Riggs states: "If this figure (given in Douglass' original paper) of the nares is correct, the great convexity in the supracranial region is the chief distinction between this form and *Mesatirhinus superior*."

On again consulting the original description and the type of *D. heterodon* it appears that Mr. Douglass made no mention of the posterior nares, perhaps because the specimen is much crushed in that region and no entirely satisfactory statement can be made in regard to its true condition. However, the post-narial opening in the palatine region appears shallow and did not function as the post-narial opening. In other words, it appears that an opening is indicated in the illustration, where in reality a shallow depression should have been represented, such as is usually found in more perfectly preserved crania of *Dolichorhinus* (See pl. XLVI). The anterior portion of this depression in the type of *D. heterodon*

has been much distorted by crushing. By very careful study it is possible to partly make out the original condition, and it is shown that a thin bony septum divided the narial from the main oral cavity. This thin bony structure in most skulls of *Dolichorhinus* is usually broken and does not, therefore, allow accurate study. Furthermore, there is between the hamular processes just such a recession as Riggs speaks of in his description of *D. fluminalis*. This cavity is partly indicated in Douglass' figure, which is reproduced in fig. 9. It also may here be stated that Mr. Douglass with his customary caution explicitly stated that the steepness of the posterior descent to the crest of the occiput may be exaggerated by crushing. There can be no question that *D. heterodon* is correctly referred to the genus *Dolichorhinus*.

4. **Dolichorhinus longiceps** Douglass.

Dolichorhinus longiceps Douglass, Annals Carnegie Museum, Vol. VI, 1909, p. 312.

Type: Skull No. 2,347. Car. Mus. Cat. Vert. Fossils.

Locality: Uinta Basin, Utah. One-half mile east of Well No. 2, near Bonanza.

Horizon: Uinta Eocene, Lower part of Horizon B.

Original Description: "This skull in general outline is very much like that of *Dolichorhinus hyognathus*, though broader. In describing it I prefer to point out the characters which distinguish it from that species. Apparently it is somewhat broader proportionally than that of *D. hyognathus*. The skull is somewhat crushed, but it evidently was not flattened on top. The present specimen had no heavy protuberances or horn-cores, though there may have been the slightest beginning of such. There is a rather narrow shelf, or lateral expansion of the malars, with rounded outer borders, beneath the anterior portion of the orbit, but it is not like the infraorbital process of *D. hyognathus*. The postorbital hook does not appear to have been long or prominent. Evidently the zygomatic arches extended laterally outward more than in the last-named species; the postglenoid processes are not nearly so heavy; the palate is broader; the top of the cranium, though there is no zygomatic arch (sagittal crest)* becomes narrower anterior to the crest of the occiput.

"The teeth are very similar to those of *Dolichorhinus heterodon*, so much so, that, if only the teeth were known, they might be referred to that species. They, as well as the skull, are larger."

As Mr. Douglass states, the skull is somewhat depressed by crushing and there are numerous fractures in the region of the frontals and parietals, which are filled with sediment. These fractures most likely account to a considerable measure for the breadth which Douglass mentions. The breadth of the palate is no doubt brought about by the same cause. The postorbital hook-like process is not completely preserved on either side, so that its size or general detailed

* Supplied by O. A. Peterson.

structure cannot be fully ascertained. In the region of the postglenoid process the type is also imperfectly preserved. One cannot rely too much on the size or shape of this process in the type.

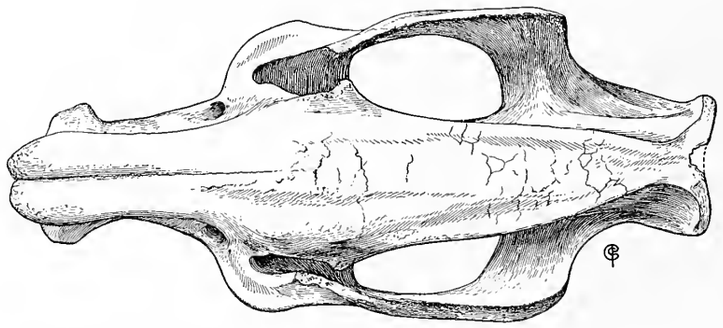


FIG. 10. *Dolichorhinus longiceps* Douglass. *Type.* No. 2,347, Car. Mus. Cat. Vert. Fossils. Superior view, one-sixth natural size. (After Douglass.)

The rest of the characters given in the original description may, or may not, be individual or sexual differences of *Dolichorhinus cornutus*. The difference in the geological horizon and the fact that no skull with large osseous knobs on the nasal have as yet been found in lower horizons are, however, of considerable interest, and may provisionally be accepted as indicating specific differences.

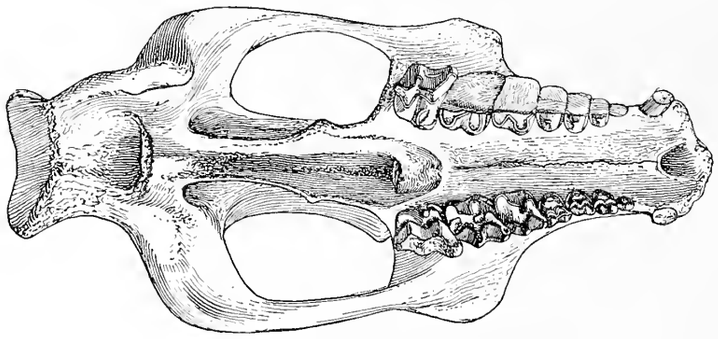


FIG. 11. *Dolichorinus longiceps* Douglass. *Type.* No. 2,347. Car. Mus. Cat. Vert. Fossils. Palatal view of cranium. One-sixth natural size. (Redrawn after Douglass.)

MEASUREMENTS.

Length of top of skull	590 mm.
Length of free nasals	150 mm.
Length of skull posterior to anterior portion of orbit	393 mm.
Length of skull at glenoid articular surface	267 mm.
Width at infraorbital shelves	247 mm.
Length of molar-premolar series	192 mm.
Length of premolar series	88 mm.
Length of molar series	112 mm.
Length of P^1	15 mm.

Width of P^1	11 mm.
Length of P^2	20 mm.
Width of P^2	20 mm.
Length of P^3	24 mm.
Width of P^3	25 mm.
Length of P^4	27 mm.
Width of P^4	31 mm.
Length of M^1	30 mm.
Width of M^1 about	37 mm.
Length of M^2	37 mm.
Width of M^2	44 mm.
Length of M^3	41 mm.
Width of M^3	43 mm.

5. **Dolichorhinus intermedius** Osborn.

Dolichorhinus intermedius Osborn, Bull. A. M. N. H., Vol. XXIV, 1908, p. 611.

Type: Skull No. 1,837, Coll. American Museum of Natural History.

Locality: Uinta Basin, northeastern Utah.

Horizon: Uinta Eocene, Horizon B.

Original Description. "Specific Characters,.—Level Uinta B. Distinguished from *D. hyognathus* (Scott and Osborn) by (1) its inferior size pm^1, m^3, = 179), M^1 m^3, = 109 mm.; (2) premolars less progressive, with subconic deuterocones; (3) all cingula less robust; (4) nasals more pointed and less expanded distally; (5) infraorbital shelf of malar relatively narrow."

FIG. 12. *Dolichorhinus intermedius* Osborn. *Type.* No. 1,837, Amer. Mus. of Nat. Hist. Superior view, one-fourth natural size. (After Osborn.)

In the foregoing brief description of this species all of the characters except those mentioned under "(2)" might well represent the individual or sexual differences existing in *D. cornutus*. Nevertheless, the species is here accepted, as proposed by Osborn.

A number of skulls from the Uinta beds in the collection of the Carnegie Museum are provisionally referred to *Dolichorhinus intermedius* Osborn. Of these Nos. 3,094, 3,095, and 3,096 are the best preserved specimens. So far as comparison based upon Osborn's description and illustration can be used this material agrees fairly well with the type in the American Museum.

6. **Dolichorhinus superior** (Riggs).

Mesatirhinus superior Riggs, Field Museum of Natural History. Geological Series, Vol. IV, No. 2, p. 26, Plate VI.

Type: Skull No. 12,188, Field Museum of Natural History.

Locality: "Upper Metarhinus Sandstones, White River divide." Northeastern Utah.

Original Description: "Specific Characters: Skull 485 x 255 mm., molar series 182 mm., nasals free to a point over last premolar, infraorbital process present, arches slender anteriorly, nasals infolded at margins, sagittal area expanded, canines small, P^2 and P^3 oblique to axis of series. Molars relatively small, strong hypocone on M^3, posterior nares opening opposite the anterior margin of last molar."

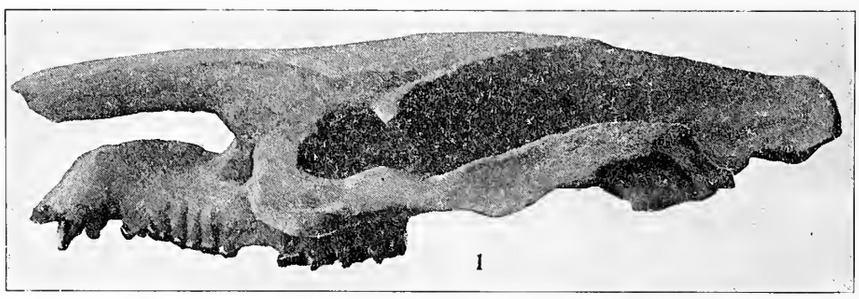


Fig. 13. *Dolichorhinus superior* (Riggs). *Type*. No. 12,188, Field Mus. Nat. Hist. Side view, about one-fifth natural size. (After Riggs.) (Courtesy Field Museum of Natural History.)

From Riggs' illustrations of *Mesatirhinus superior* I am impelled to refer the specimen to the genus *Dolichorhinus*. The only character, which would cause hesitancy in placing the type in the genus *Dolichorhinus* is the position of the posterior nares. The writer has recently re-examined the type, and finds, as Mr. Riggs states, that the opening of the postnares is shown as being well forward. This region in the type is, however, not satisfactorily preserved, and the lower wall of the narial passage may well have existed as in other specimens. Back of the anterior margin of the median pterygoid fossa the pterygoids, and the base of the skull, as Riggs states, are wanting. The facial profile is clearly like that of the genus *Dolichorhinus*. The breadth or narrowness of the cranium along the

sagittal suture in *Dolichorhinus* are in my opinion purely individual and sexual characteristics; and the strong hypocone on M^3 might well be an individual feature

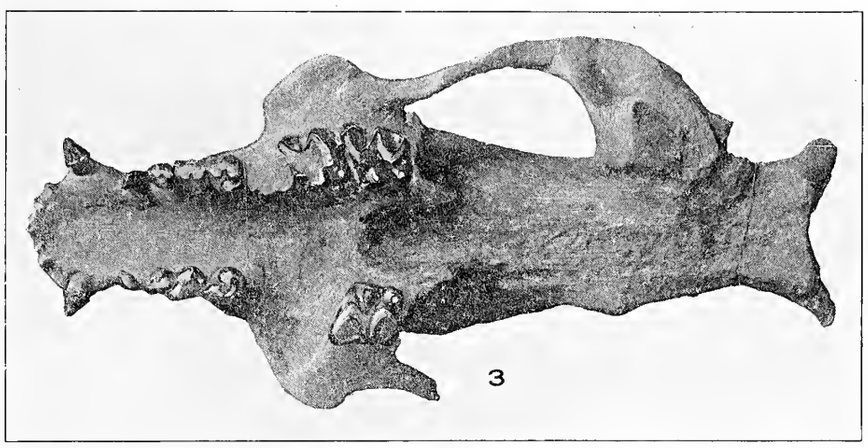


FIG. 14. *Dolichorhinus superior* (Riggs). *Type.* No. 12,188, Field Museum Nat. History. Palatal view, about one-fifth natural size. (After Riggs.) (Courtesy Field Museum of Nat. History.)

not especially characteristic of early types of the titanotheres. Finally in comparing Mr. Riggs' illustration of *Mesatirhinus superior* with his figures of *Dolichorhinus fluminalis* and other species of *Dolichorhinus*, one observes striking similarities, which Riggs himself observed (*l. c.*, p. 26).

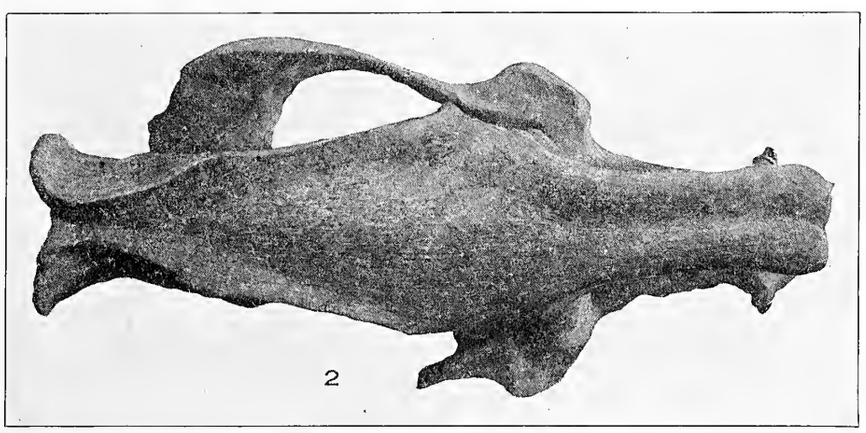


FIG. 15. *Dolichorhinus superior* (Riggs). *Type.* No. 12,188, Field Mus. Nat. Hist. Superior view, about one-fifth natural size. (After Riggs.) (Courtesy Field Museum Natural History.)

It may be stated here that a comparison of *Mesatirhinus superior* Riggs does not show close agreement either with *Mesatirhinus megarhinus* Earle (Jour. Acad. Sci. Philad., (2), Vol. IX, 1884–1895, pp. 320 *et seq.*, Plate XII, fig. 5) or with *Mesatirhinus petersoni* Osborn, Bull. A. M. N. H., Vol. XXIV, p. 608, fig. 12.

7. **Dolichorhinus fluminalis** Riggs.

Dolichorhinus fluminalis Riggs, Field Museum of Natural History, Publication No. 159, Geol. Series, Vol. IV, 1912, p. 33, Plate X.

Type: Skull No. 12,205, Coll. Field Museum of Natural History.

Locality: Uinta Basin, Utah.

Horizon: Uinta Eocene, "Amynodon Sandstone" Horizon B.

Original Description: "Specific characters: Skull, small and narrow (520 x 230 mm.), facial region much shorter than cranial, nasals narrow and slightly tapering, posterior nares opening between hamular processes, post-orbital process of jugal back of the last molar, molar-premolar series 171 mm.; canines short and recurved, incipient horn-cores in the form of high narrow ridges."

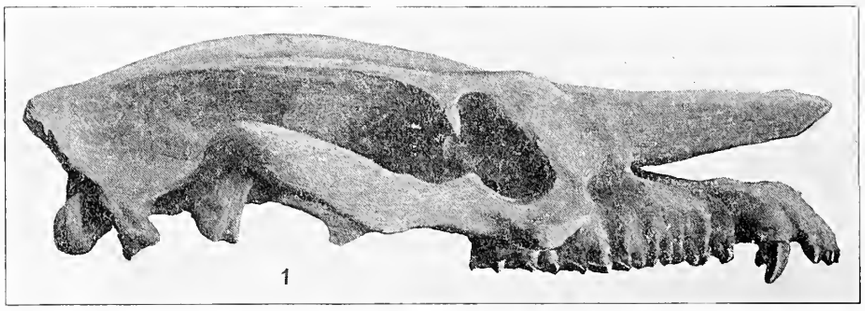


FIG. 16. *Dolichorhinus fluminalis* Riggs. *Type*. No. 12,205, Field Mus. Nat. Hist. Side view, about one-fifth natural size. (After Riggs.) (Courtesy Field Museum Natural History.)

The chief character of this species according to Riggs is the position of the postnares. He states that these openings are placed "much further back in *D. fluminalis* than in any other described species."

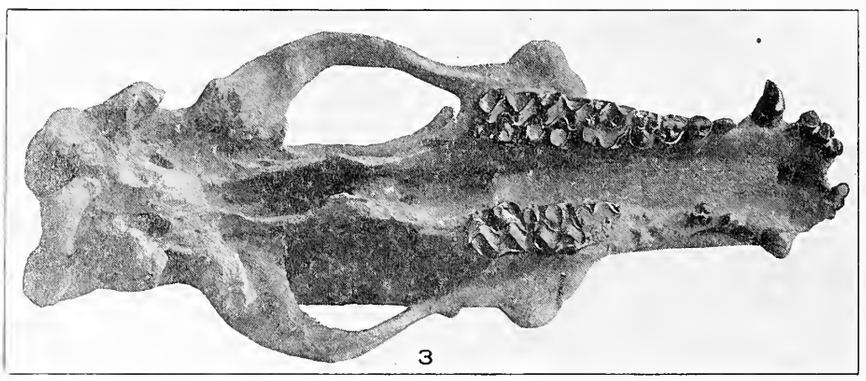


FIG. 17. *Dolichorhinus fluminalis* Riggs. *Type*. No. 12,205, Field Mus. Nat. Hist. Palatal view, slightly more than one-fifth natural size. (After Riggs.) (Courtesy Field Museum Natural History.)

As the result of his studies the writer is of the opinion that the position of the posterior nares in *Dolichorhinus* is a character of generic rank. It has been

seldom observed by students, because of the frailty of this region of the skull. As in the case of the foregoing species the writer provisionally accepts Mr. Riggs' *D. fluminalis*, the original description of which continues as follows: "The skull is slender, light, and complex in structure as compared with the massive and rounded *D. cornutus*. The molar teeth are no longer in the crown than those of *Metarhinus earli*. The jugal process of the maxillaries arises at a point back of the last molar rather than beside it as in *D. longiceps*. There is no offset in the palate between the last molars, though the primary position of the posterior narial opening is marked by a slight rugosity.

"*D. fluminalis* is most nearly related to *D. intermedius*. The skull exceeds in length the type of that species in the ratio of 520:465 mm. The molar teeth are proportionately much smaller; the series measures relatively 99:109 mm. The position of the posterior narial opening is the most distinctive character, appearing much farther back in *D. fluminalis* than in any other described species. The two forms agree more closely in the tapering form of the nasals and in the narrow recess separating them from the maxillaries."

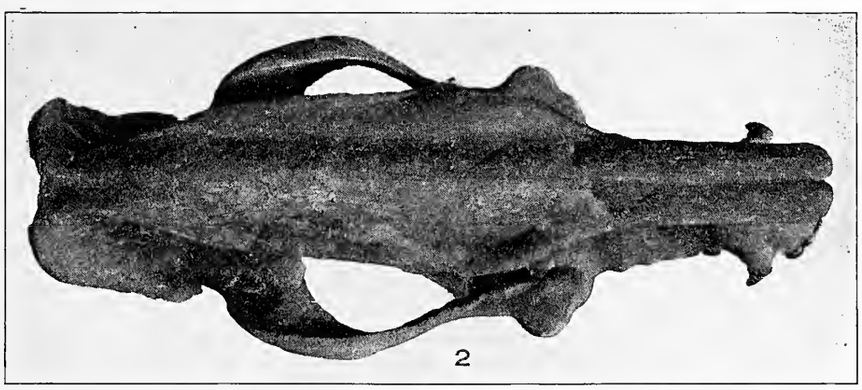


FIG. 18. *Dolichorhinus fluminalis* Riggs. *Type*. No. 12,205, Field Mus. Nat. Hist. Superior view, slightly more than one-fifth natural size. (After Riggs.) (Courtesy Field Museum of Natural History.)

Measurements of *D. fluminalis* taken from Mr. Riggs' Paper.

Skull, length incisors to condyles	520 mm.
Skull, breadth across arches	233 mm.
Skull, breadth above orbits	116 mm.
Skull, length of free nasals	137 mm.
Skull, greatest breadth of nasals	57 mm.
Skull, length of molar-premolar series	171 mm.
Skull, length of molar series	105 mm.
Skull, length of crown of canine	32 mm.
Skull, diameter, crown of canine	18 mm.
Skull, narrowest point in sagittal area	44 mm.

A description of the posterior nares in one or two skulls of *Dolichorhinus* in the collection of the Carnegie Museum has already been given on page 409. Whatever was the cause for the backward shifting of the postnares, it seems probable that this specialization was brought about in a comparatively short time; perhaps beginning with the ancestral forms in the Middle Eocene. In *Dolichorhinus,* and probably also in *Sphenocœlus,* the naso-palatine passage back of the palatine plate has an exceedingly fragile floor and its backward extension is a condition entirely unusual in the mammalia.

The dentition of these long-nosed titanotheres is complete, functioning freely. The incisors and canine are not materially changed from those of earlier types (Compare *Palœosyops*), even if they had aquatic habits, as suggested by Mr. Riggs[15]. There is nothing in the dentition to suggest this. Together with the recession of the posterior nares we have as outstanding features the long nasals, the convexity of the parietal region, the long and slender upper and lower jaws in contrast with other titanotheres from the upper Uinta and especially those of the Oligocene, which are all short-faced with saddle-shaped skulls and crowded premolars. The limbs of *Dolichorhinus* are in every way adapted in their general proportions to terrestrial movement. However, it is entirely possible, as Mr. Riggs suggests, that these animals at times fed upon aquatic vegetation.

BIBLIOGRAPHY.

Earle, Charles.

1884–1885. *A Memoir upon the Genus Palœosyops Leidy and its Allies.* Jour. Acad. Nat. Sci. Philad., Vol. IX, (2) 1884–1895; pp. 348–350, Pl. XI, Figs. 10, 11. Type of *Palœosyops hyognathus* referred to *Telmatherium* Marsh, on pp. 320–329 and Pl. XI, Figs. 4–7. Description and figures of *Palœosyops megarhinus* Earle.

Osborn, Henry Fairfield.

1889. In Scott and Osborn, *The Mammalia of the Uinta Formation.* Trans. Amer. Philos. Soc., N. S., Vol. XVI, August 20, 1889; p. 513. Describes *Palœosyops hyognathus.*

Osborn, Henry Fairfield.

1895. *Fossil Mammals of the Uinta Basin. Expedition of 1894.* Bull. A. M. N. H., Vol. VII, 1895. Describes *Telmatotherium cornutum* pp. 90–94, and *Sphenocœlus uintensis,* pp. 98–102.

[15] Field Mus. Nat. Hist., Geo. Ser., Vol. IV, 1912, p. 41.

EARLE, CHARLES.

On a Supposed Case of Parallelism in the Genus Palæosyops. Amer. Naturalist, Vol. XXIX, 1895, pp. 622–626. Refers to *Palæosyops megarhinus, Telmatotherium hyognathum,* and *Telmatotherium cornutum.*

HATCHER, J. B.

On a New Species of Diplacodon with a Discussion of the Relations of that Genus to Telmatotherium. Amer. Naturalist, Vol. XXIX, 1895, pp. 1084–1090. Describes *Diplacodon emarginatus* and discusses relationship of the titanotheres. Postscript, p. 1090, divides the genus *Telmatotherium,* and establishes two additional genera, *Manteoceras* and *Dolichorhinus.*

MERRIAM, C. HART AND PALMER, T. S.

1904. *North American Fauna.* U. S. Dept. Agri., Bull. No. 23, 1904. *Dolichorhinus* Hatcher accepted as valid genus.

OSBORN, HENRY FAIRFIELD.

1908. *New or Little Known Titanotheres from the Eocene and Oligocene.* Bull. A. M. N. H., Vol. XXIV, 1908; pp. 608, *et seq.* Establishes a new genus *Mesatirhinus,* using *Palæosyops megarhinus* Earle as the type; describes *Mesatirhinus petersoni;* describes *Dolichorhinus intermedius;* regards *Dolichorhinus cornutus* as synonymous with *Dolichorhinus hyognathus.*

DOUGLASS, EARL.

1909. *Preliminary Description of Some New Titanotheres from the Uinta Deposits.* Ann. Car. Mus., Vol. VI, 1909; pp. 310 *et seq.* Describes *Dolichorhinus heterodon;* and *Dolichorhinus longiceps.*

RIGGS, ELMER S.

1912. *New or Little Known Titanotheres from the Lower Uinta Formation.* Field Mus. Nat. Hist., Geolog. Series, Vol. IV, No. 2, 1912; pp. 25 *et seq.* Characterizes *Dolichorhinæ,* describes *Mesatirhinus superior;* reviews the genus *Dolichorhinus,* and describes *Dolichorhinus fluminalis.*

PETERSON, O. A.

1914. *Some Undescribed Remains of the Uinta Titanothere Dolichorhinus.* Ann. Car. Mus., Vol. IX, 1914, pp. 129–138. Describes material representing *Dolichorhinus longiceps.*

EXPLANATION OF PLATE XLIV.

Dolichorhinus longiceps Douglass, C. M. Cat. Vert. Foss., No. 11, 071.

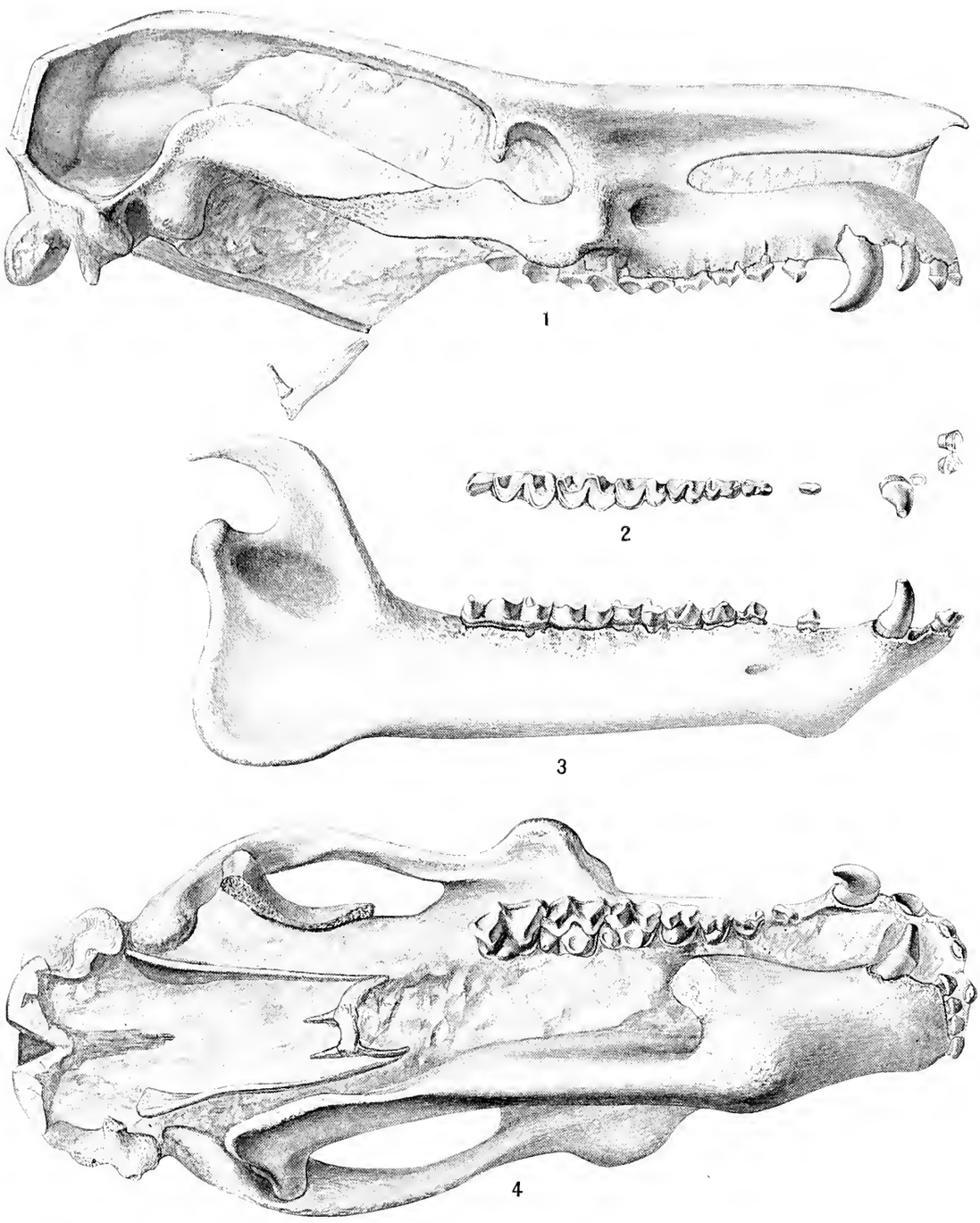
FIG. 1. Side view of skull and hyoid apparatus.

FIG. 2. Crown view of lower dentition.

FIG. 3. Side view of lower jaw.

FIG. 4. Crown view of upper dentition, inferior view of hyoid arch and mandible.

(All figures one-fourth natural size)



Dolichorhinus longiceps Douglass.

EXPLANATION OF PLATE XLV.

Dolichorhinus longiceps, C. M. Cat. Vert. Foss., No. 11,072.

FIG. 1. Side view of skull and lower jaws.

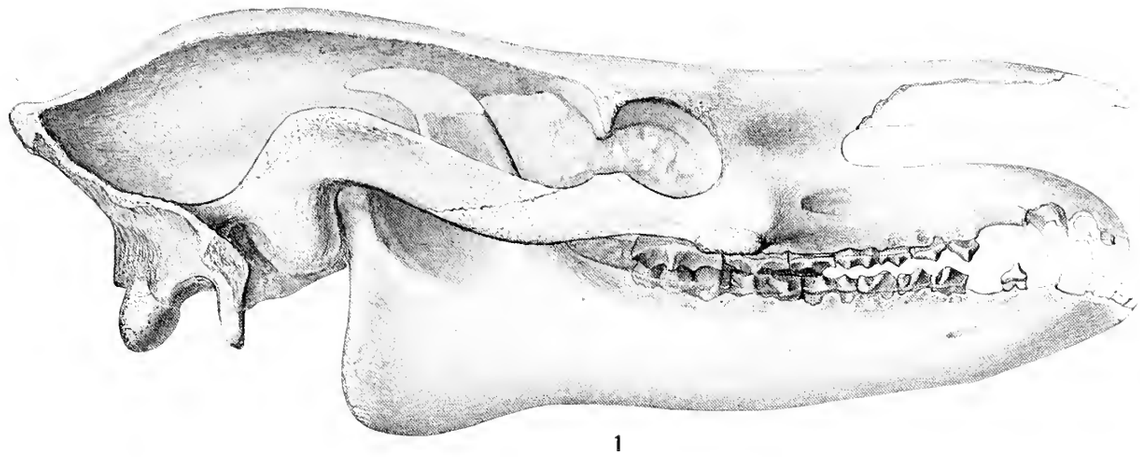
Dolichorhinus intermedius Osborn, C. M. Cat. Vert. Foss., No. 3,117.

FIG. 2. Palatal view, showing the primary position of the postnares, the median vomerine plate, and the cranial foramina.

Dolichorhinus longiceps Douglass, C. M. Cat. Vert. Foss., No. 11,080.

FIG. 3. Palatal view of skull. The excavations indicated on the right choana were probably made by *Dermestes* shortly after the death of the animal.

(All figures one-fourth natural size)



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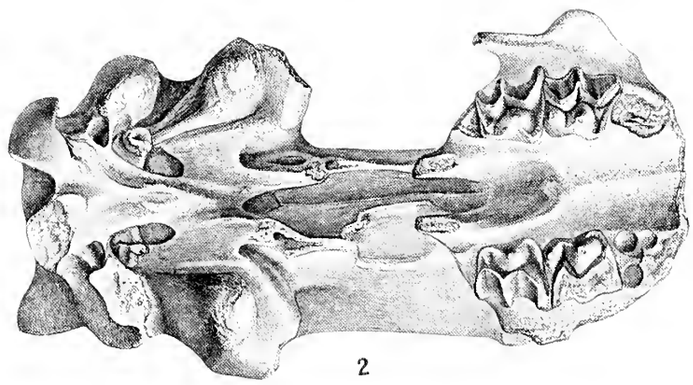

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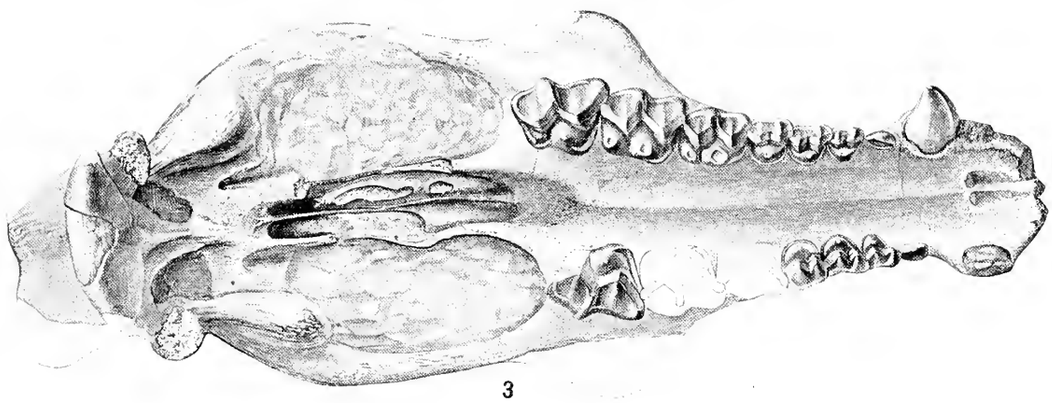


3

Dolichorhinus.

EXPLANATION OF PLATE XLVI.

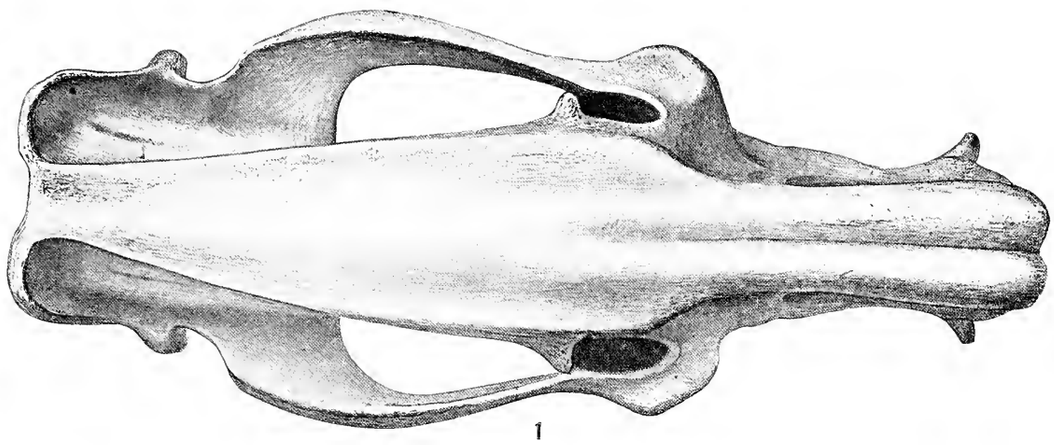
Dolichorhinus longiceps Douglass, C. M. Cat. Vert. Foss., No. 11,081.

FIG. 1. Top view of skull.

FIG. 2. Palatal view of skull, showing at *a* the primary position of the posterior nares; at *b* the second depression, or the anterior portion of the choanæ, and at *c* the location of the posterior nares.

FIG. 3. Side view of skull.

(All figures one-fourth natural size)



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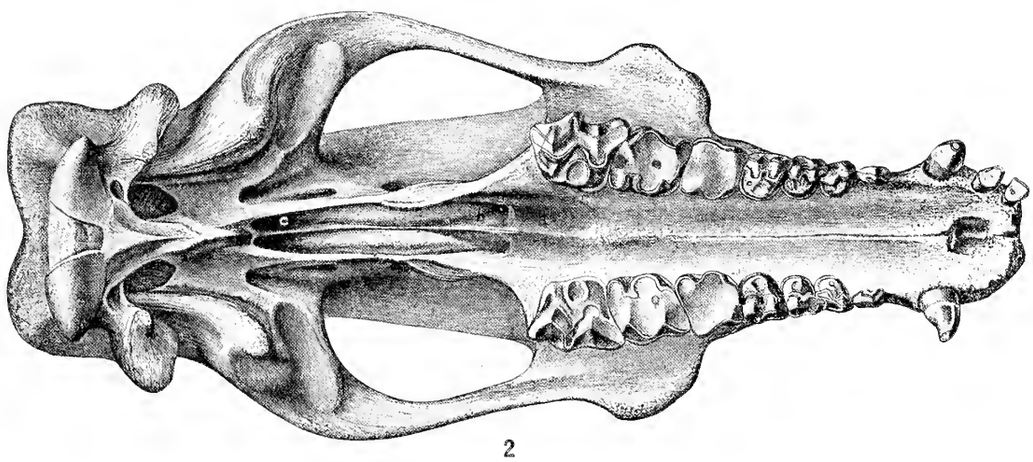

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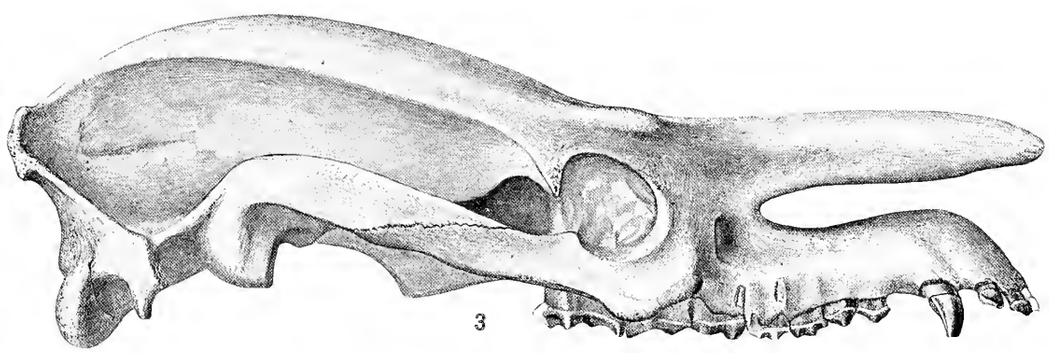


3

Dolichorhinus.

EXPLANATION OF PLATE XLVII.

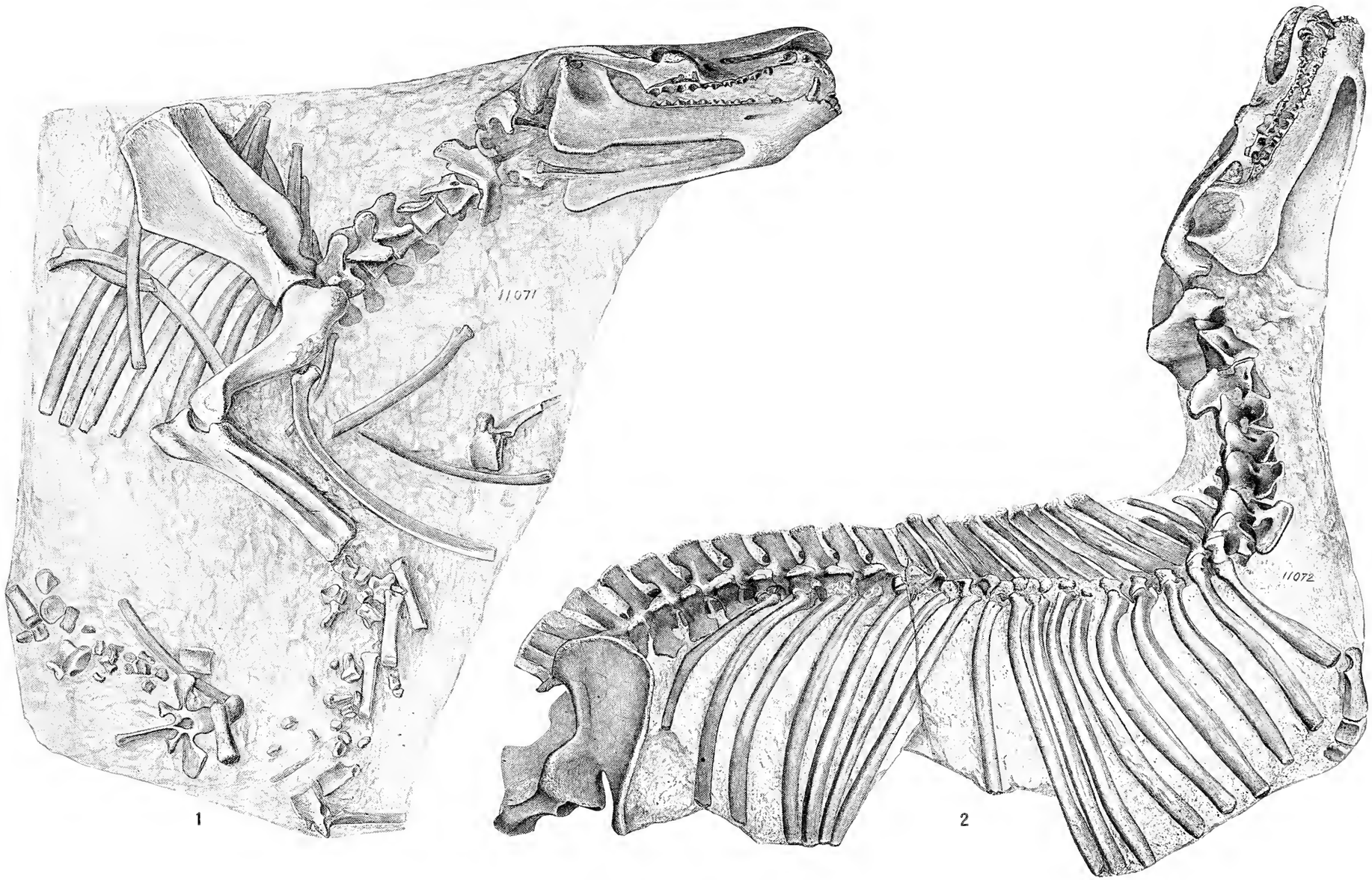
Dolichorhinus longiceps Douglass, C. M. Cat. Vert. Foss., No. 11,071.

Fig. 1. Portion of skeleton as found in the quarry.

Dolichorhinus longiceps Douglass, C. M. Cat. Vert. Foss., No. 11,072.

Fig. 2. Portion of skeleton as found in the quarry. The forelimb of No. 11,072 was removed before the drawing was made in order to show the anterior part of the thorax. The two skeletons are represented on the plate in very nearly their relative positions in the quarry.

(Figures one-ninth natural size)



Dolichorhinus longiceps Douglass.

EXPLANATION OF PLATE XLVIII.

Dolichorhinus longiceps Douglass, C. M. Cat. Vert. Foss., No. 11,071.

FIG. 1. Ulnar view of coössified radius and ulna.

FIG. 2. External view of scapula.

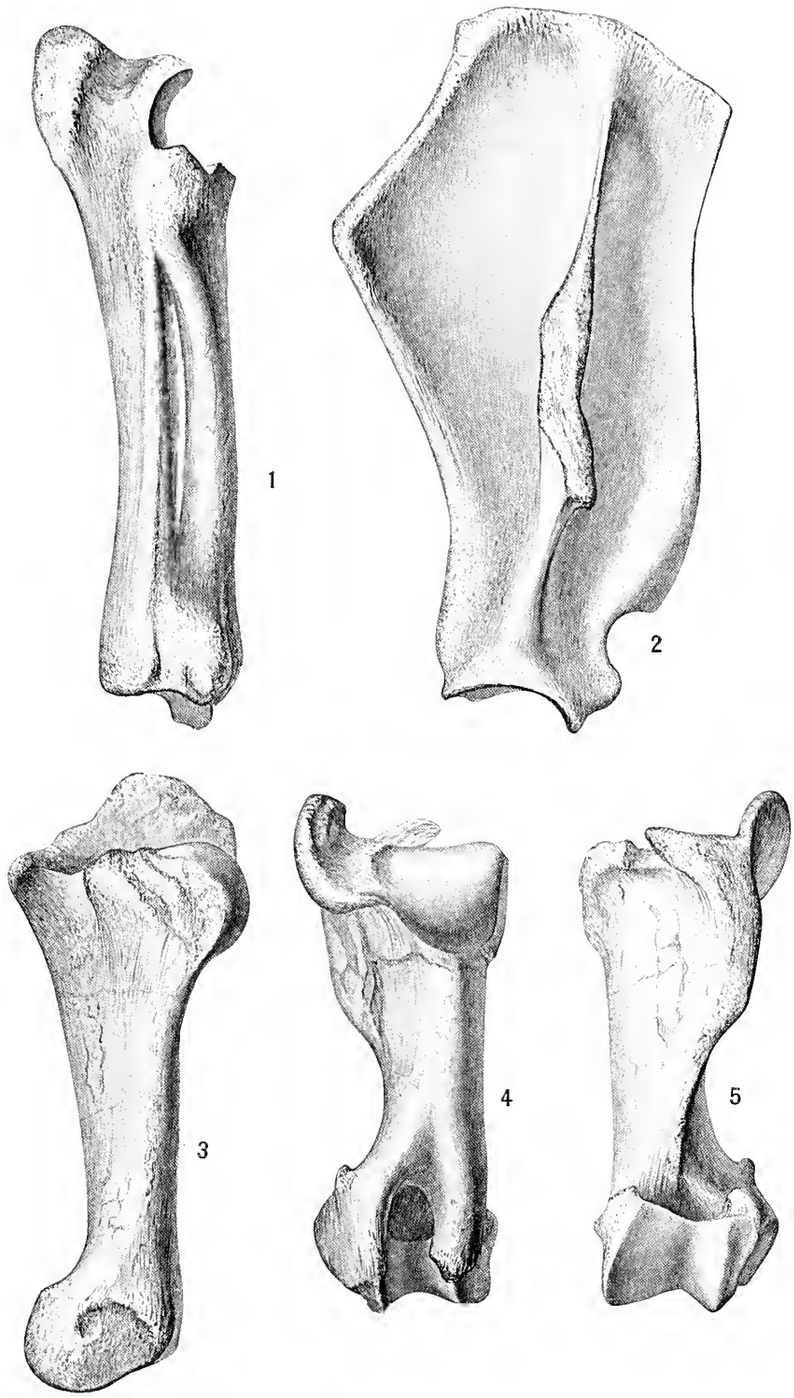
FIG. 3. Radial view of humerus.

Dolichorhinus longiceps Douglass, C. M. Cat. Vert. Foss., No. 11,072.

FIG. 4. Posterior view of humerus. Near the head is a line across the shaft, which indicates a line of breakage and distortion in the vertical direction.

FIG. 5. Anterior view of the same humerus. Shaft shortened by distortion.

(All figures one-fourth natural size)



Dolichorhinus.

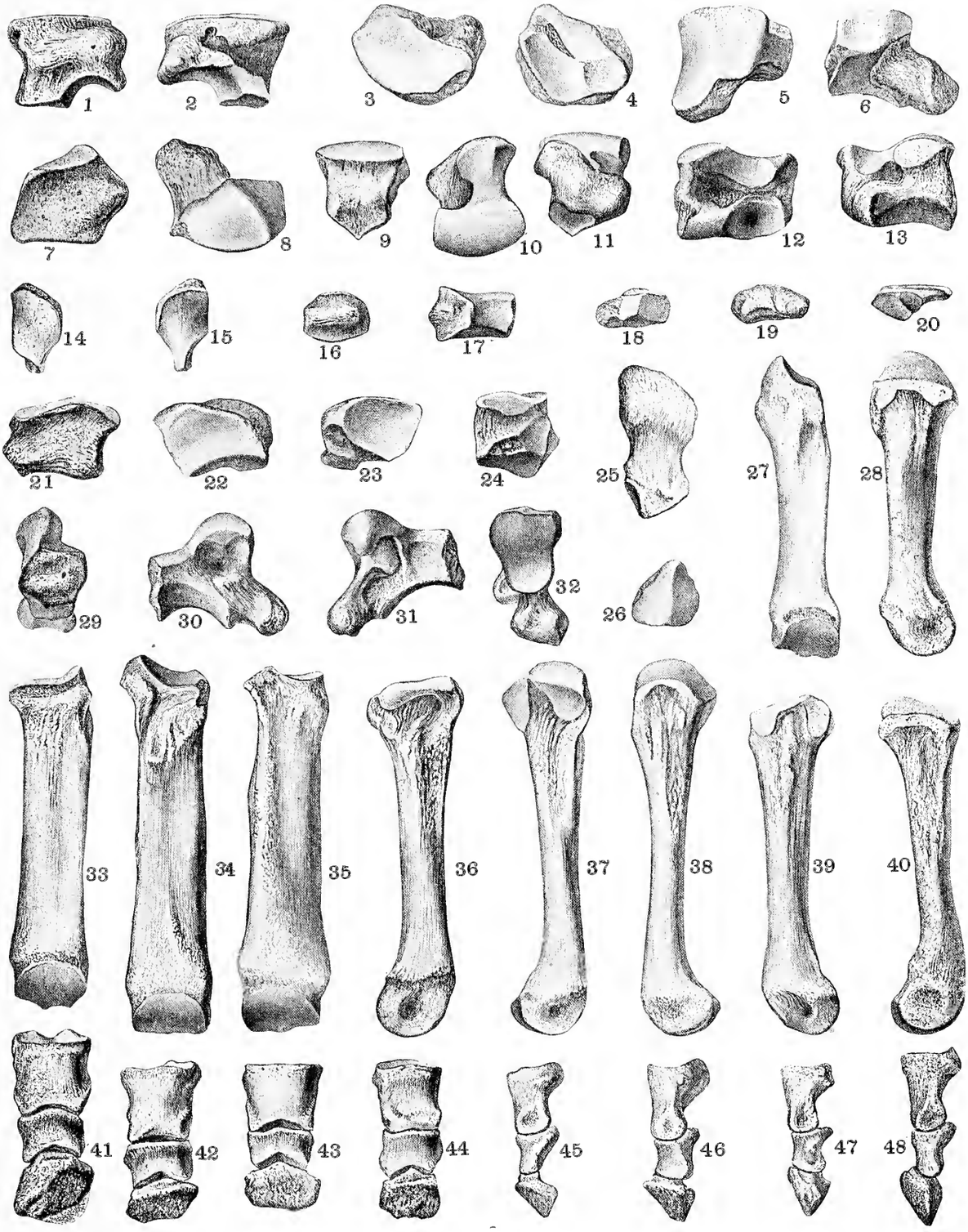
EXPLANATION OF PLATE XLIX.

Dolichorhinus longiceps Douglass, C. M. Cat. Vert., Foss. No. 11,071.

FIG. 1. Anterior view of scaphoid.
FIG. 2. Posterior view of scaphoid.
FIG. 3. Proximal view of scaphoid.
FIG. 4. Distal view of scaphoid.
FIG. 5. Proximal view of unciform.
FIG. 6. Radial view of unciform.
FIG. 7. Anterior view of unciform.
FIG. 8. Proximal view of unciform.
FIG. 9. Anterior view of lunar.
FIG. 10. Proximal view of lunar.
FIG. 11. Posterior view of lunar.
FIG. 12. Radial view of lunar.
FIG. 13. Ulnar view of lunar.
FIG. 14. Distal view of trapezoid.
FIG. 15. Proximal view of trapezoid.
FIG. 16. Anterior view of trapezoid.
FIG. 17. Ulnar view of trapezoid.
FIG. 18. Ulnar view of trapezium.
FIG. 19. Radial view of trapezium.
FIG. 20. Oblique radial view of trapezium.
FIG. 21. Anterior view of cuneiform.
FIG. 22. Proximal view of cuneiform.
FIG. 23. Distal view of cuneiform.
FIG. 24. Radial view of cuneiform.
FIG. 25. Ulnar view of pisiform.
FIG. 26. Proximal end of pisiform, showing articulations for cuneiform and ulna.
FIG. 27. Anterior view of metacarpal V.
FIG. 28. Radial view of metacarpal V.
FIG. 29. Anterior view of magnum. M*
FIG. 30. Radial view of magnum. M*
FIG. 31. Ulnar view of magnum. M*
FIG. 32. Distal view of magnum. M*
FIG. 33. Anterior view of metacarpal IV.
FIG. 34. Anterior view of metacarpal III.
FIG. 35. Anterior view of metacarpal II.
FIG. 36. Ulnar view of metacarpal II.
FIG. 37. Ulnar view of metacarpal III.
FIG. 38. Radial view of metacarpal III.
FIG. 39. Radial view of metacarpal IV.
FIG. 40. Ulnar view of metacarpal IV.
FIG. 41. Dorsal view of phalanges, digit III.
FIG. 42. Dorsal view of phalanges, digit IV.
FIG. 43. Dorsal view of phalanges, digit II.
FIG. 44. Dorsal view of phalanges, digit V.
FIG. 45. Lateral view of phalanges, digit V.
FIG. 46. Lateral view of phalanges, digit IV.
FIG. 47. Lateral view of phalanges, digit II.
FIG. 48. Lateral view of phalanges, digit III.

(All figures one-half natural size)

* Some characters represented in the illustrations of this bone are taken from the magnum of C. M. Cat. Vert. Loss., No. 2865.



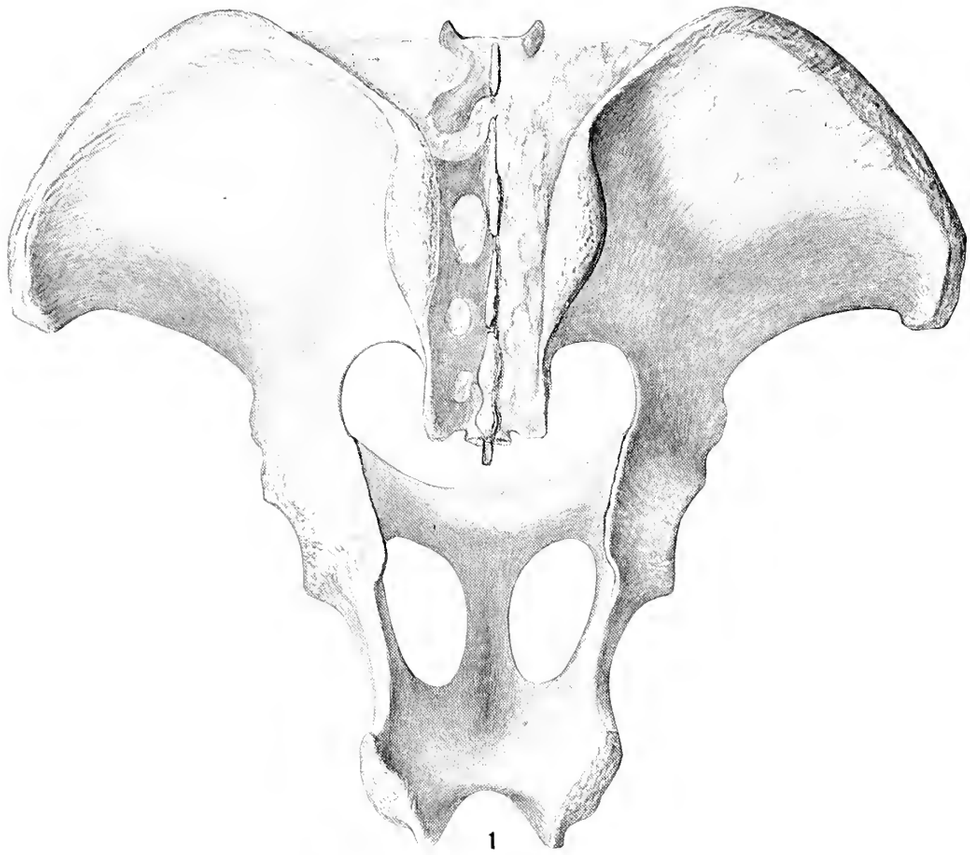
Dolichorhinus longiceps Douglass.

EXPLANATION OF PLATE L.

FIG. 1. *Dolichorhinus longiceps* Douglass. C. M. Cat. Vert. Foss., No. 3,840. Dorsal view of pelvis and sacrum. The sacrum is partly covered by matrix in the specimen, and this is indicated in the illustration.

FIG. 2. Do. Side view of pelvis and sacrum.

(Figures are one-fourth natural size)



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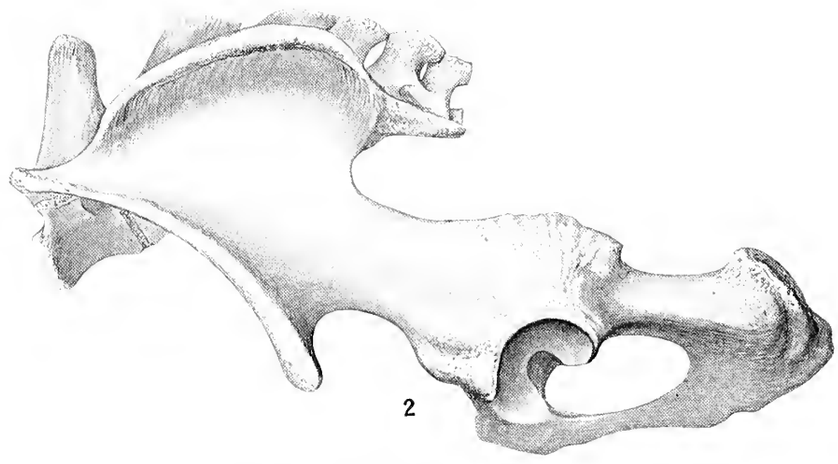


2

Dolichorhinus longiceps Douglass.

EXPLANATION OF PLATE LI.

FIG. 1. *Dolichorhinus longiceps* Douglass, C. M. Cat. Vert. Foss., No. 3,840. Ventral view of pelvis and sacrum.

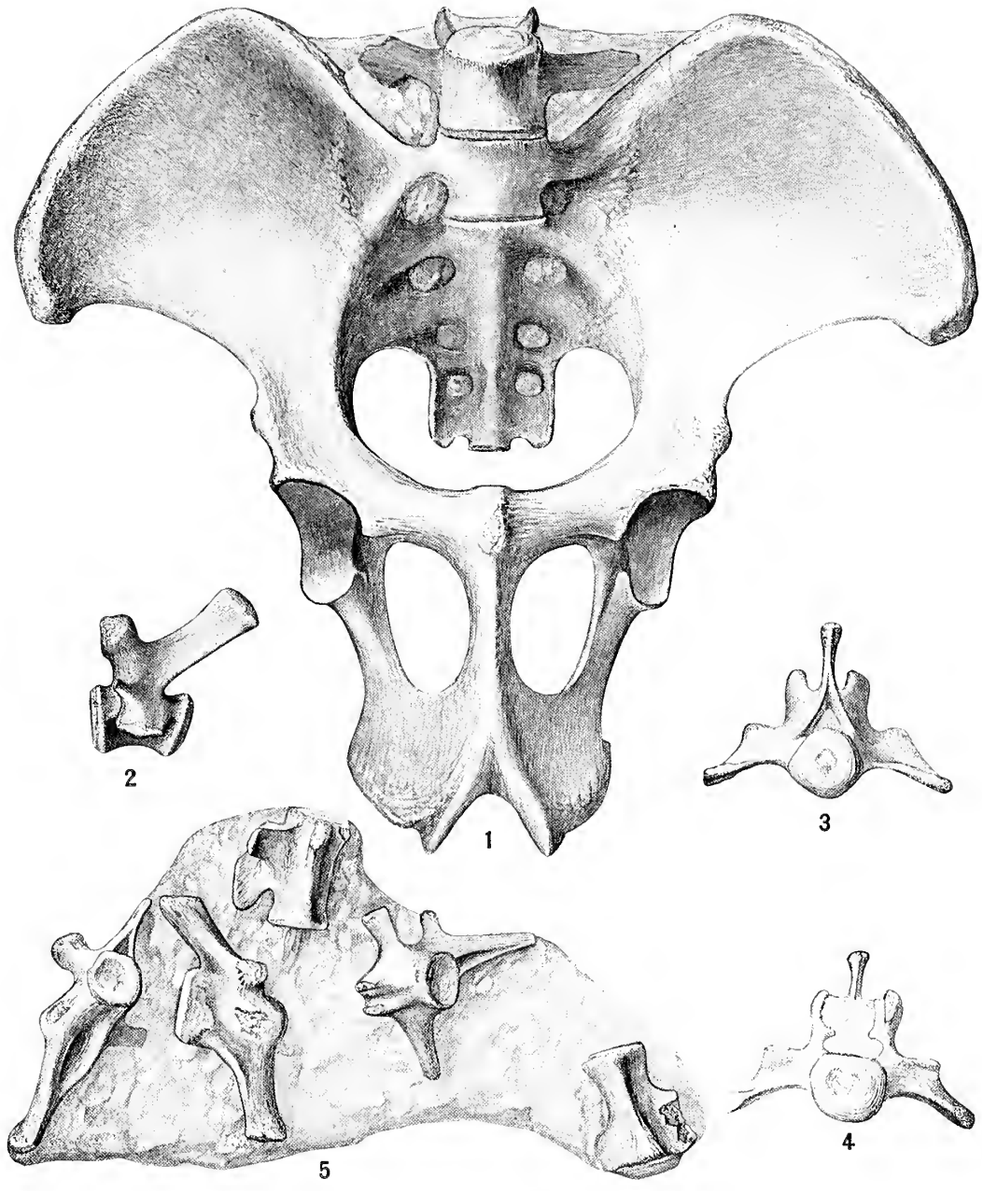
FIG. 2. *Dolichorhinus longiceps* Douglass, C. M. Cat. Vert. Foss., No. 11,072. Lateral view of first caudal.

FIG. 3. Do. Posterior view of first caudal.

FIG. 4. Do. Anterior view of first caudal.

FIG. 5. Do. Views of anterior caudals as found in the quarry.

(Fig. 1 is one-fourth natural size. All the other figures are one-half natural size.)



Dolichorhinus longiceps Douglass.

EXPLANATION OF PLATE LII.

FIG. 1. *Dolichorhinus longiceps* Douglass, C. M. Cat. Vert. Foss., No. 11,071. Anterior view of femur.

FIG. 2. Do. Posterior view of femur.

FIG. 3. *Dolichorhinus longiceps* Douglass, C. M. Cat. Vert. Foss., No. 11,072. Anterior view of femur.

FIG. 4. *Dolichorhinus longiceps* Douglass, C. M. Cat. Vert. Foss., No. 11,071. Anterior view of patella.

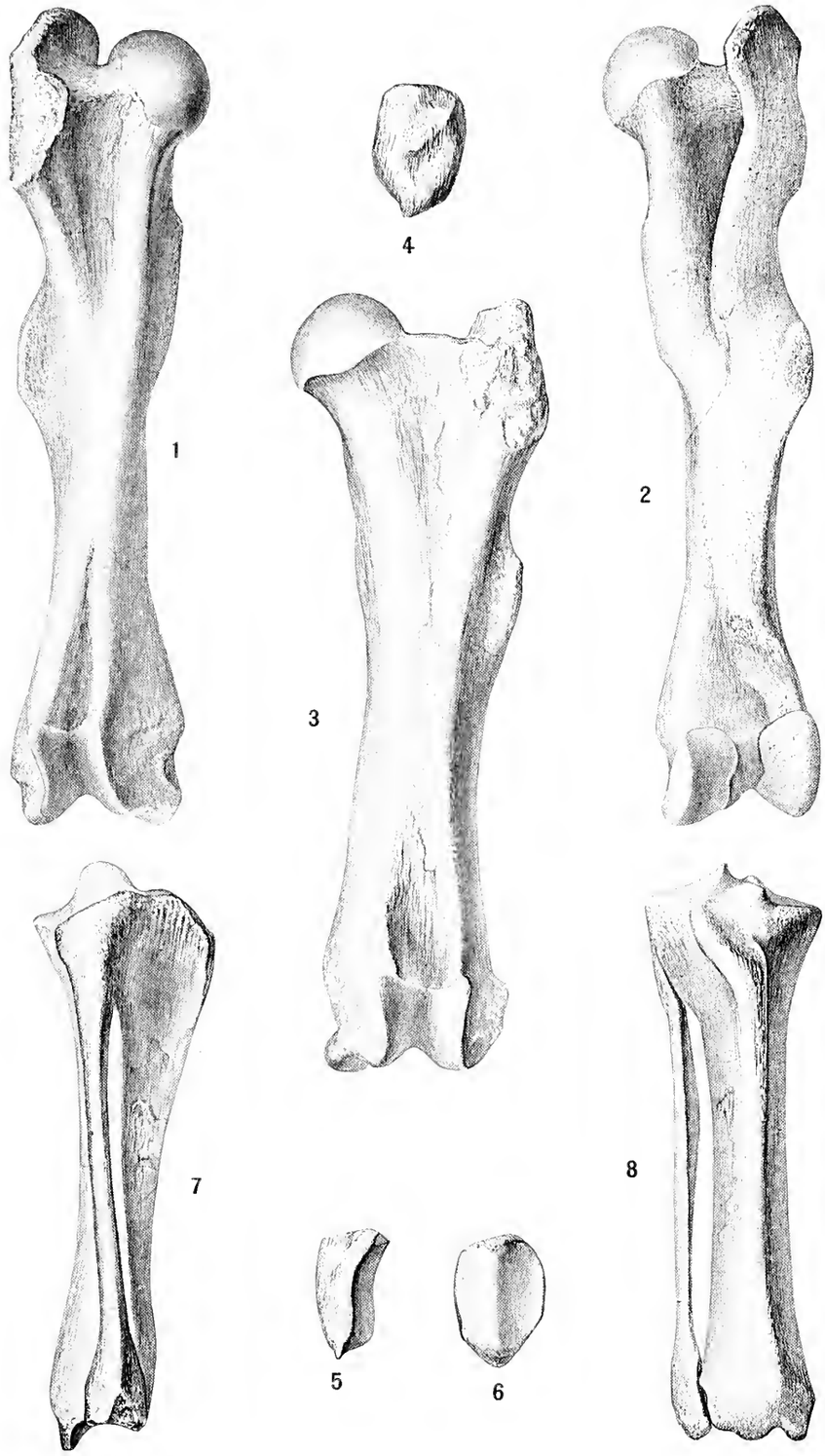
FIG. 5. Do. Lateral view of patella.

FIG. 6. Do. Posterior view of patella.

FIG. 7. Do. Fibular view of tibia and fibula.

FIG. 8. Do. Anterior view of tibia and fibula.

(All figures one-fourth natural size)

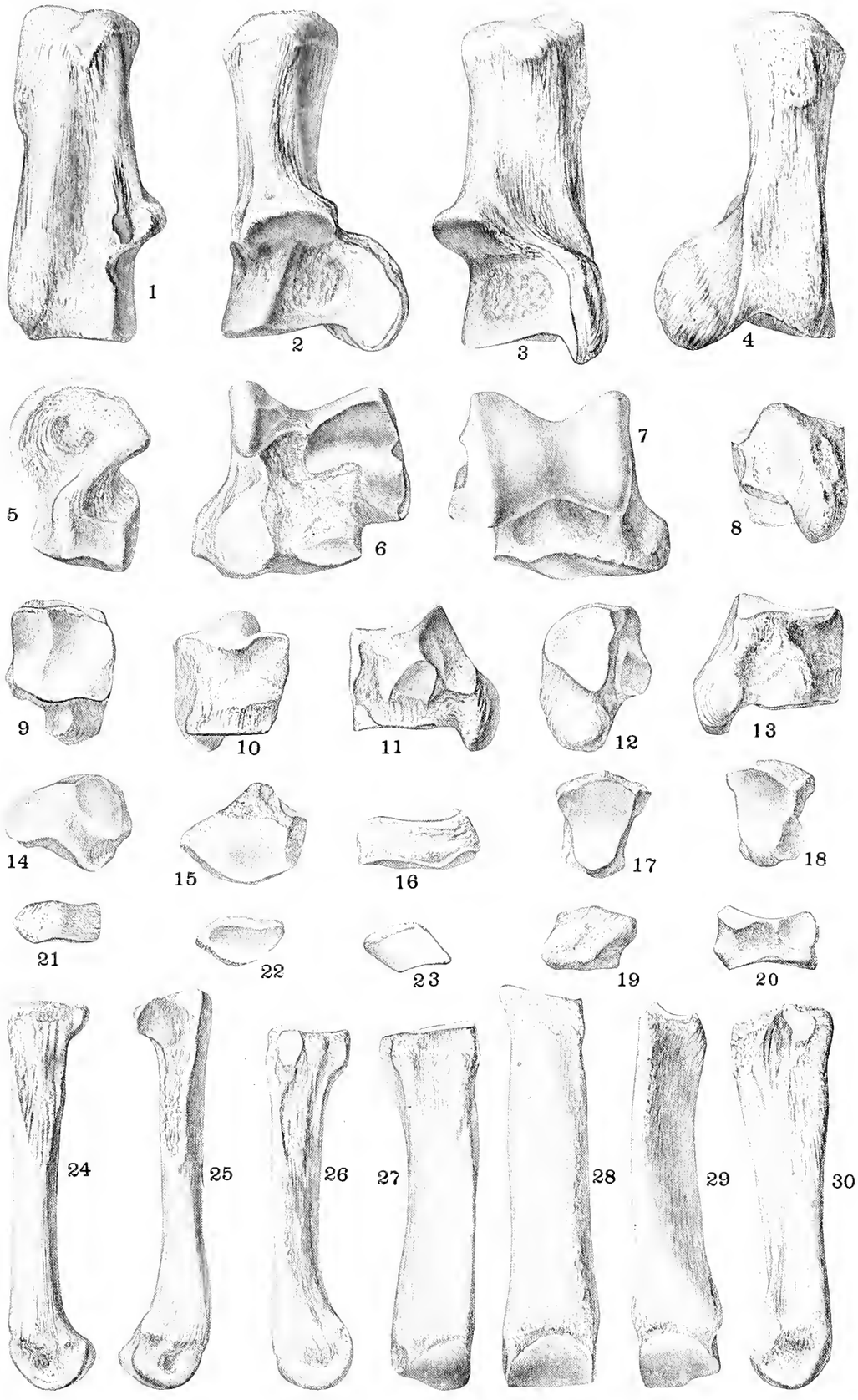


Dolichorhinus longiceps Douglass.

EXPLANATION OF PLATE LIII.

FIG. 1. *Dolichorhinus longiceps* Douglass, C. M. Cat. Vert. Foss., No. 11,071. Fibular view of calcaneum.
FIG. 2. Do. Dorsal view of calcaneum.
FIG. 3. Do. Tibial view of calcaneum.
FIG. 4. Do. Plantar view of calcaneum.
FIG. 5. Do. Tibial view of astragalus.
FIG. 6. Do. Plantar view of astragalus.
FIG. 7. Do. Dorsal view of astragalus.
FIG. 8. Do. Plantar view of cuboid.
FIG. 9. Do. Proximal view of cuboid.
FIG. 10. Do. Dorsal view of cuboid.
FIG. 11. Do. Tibial view of cuboid.
FIG. 12. Do. Distal view of cuboid.
FIG. 13. Do. Fibular view of cuboid.
FIG. 14. Do. Distal view of navicular.
FIG. 15. Do. Proximal view of navicular.
FIG. 16. Do. Dorsal view of navicular.
FIG. 17. Do. Distal view of ectocuneiform.
FIG. 18. Do. Proximal view of ectocuneiform.
FIG. 19. Do. Dorsal view of ectocuneiform.
FIG. 20. Do. Tibial view of ectocuneiform.
FIG. 21. Do. Tibial view of entocuneiform.
FIG. 22. Do. Proximal view of entocuneiform.
FIG. 23. Do. Distal view of entocuneiform.
FIG. 24. Do. Tibial view of metatarsal III.
FIG. 25. Do. Fibular view of metatarsal III.
FIG. 26. Do. Tibial view of metatarsal IV.
FIG. 27. Do. Dorsal view of metatarsal IV.
FIG. 28. Do. Dorsal view of metatarsal III.
FIG. 29. Do. Dorsal view of metatarsal II.
FIG. 30. Do. Fibular view of metatarsal II.

(All figures one-half natural size)



Dolichorhinus longiceps Douglass.

EXPLANATION OF PLATE LIV.

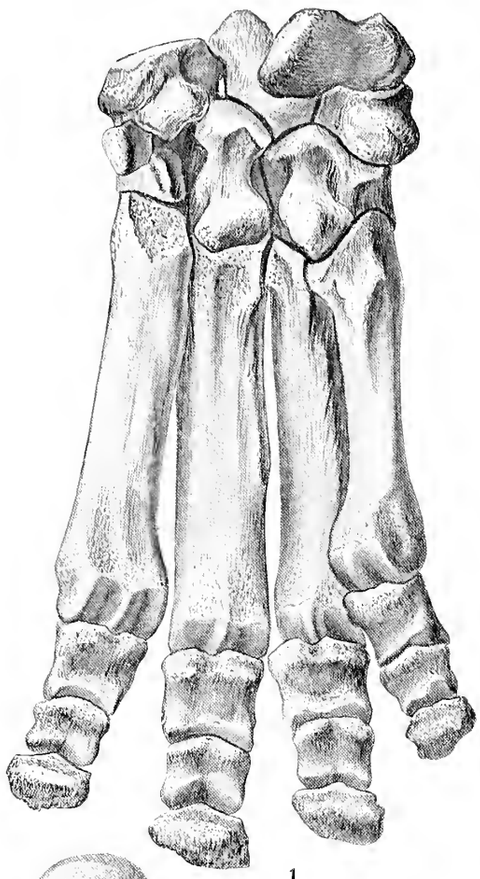
FIG. 1. *Dolichorhinus longiceps* Douglass, C. M. Cat. Vert. Foss., No. 11,071. Palmar view of manus.

FIG. 2. Do. Dorsal view of manus.

FIG. 3. Do. Dorsal view of pes.

FIG. 4. Do. Plantar view of pes.

(All figures one-half natural size)



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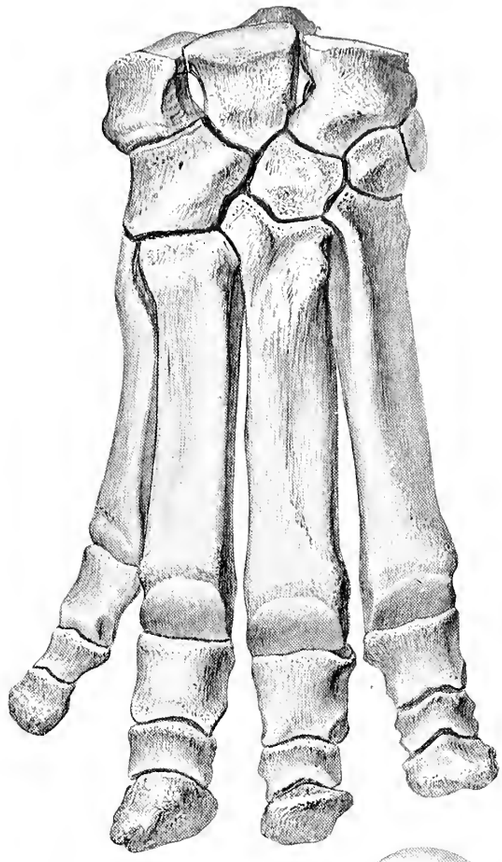

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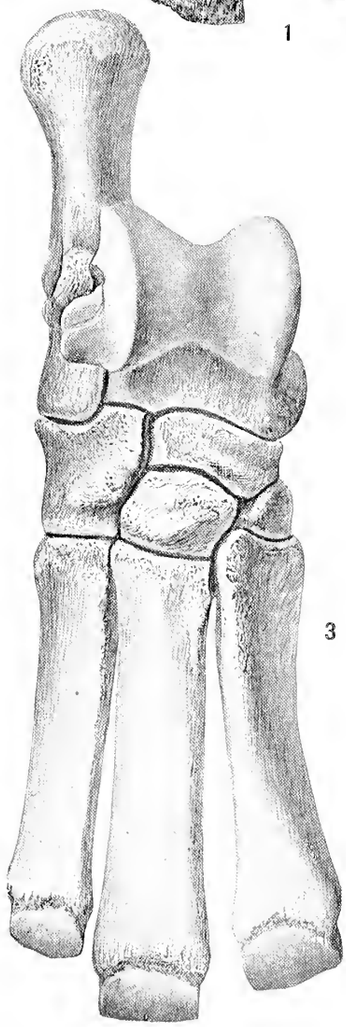

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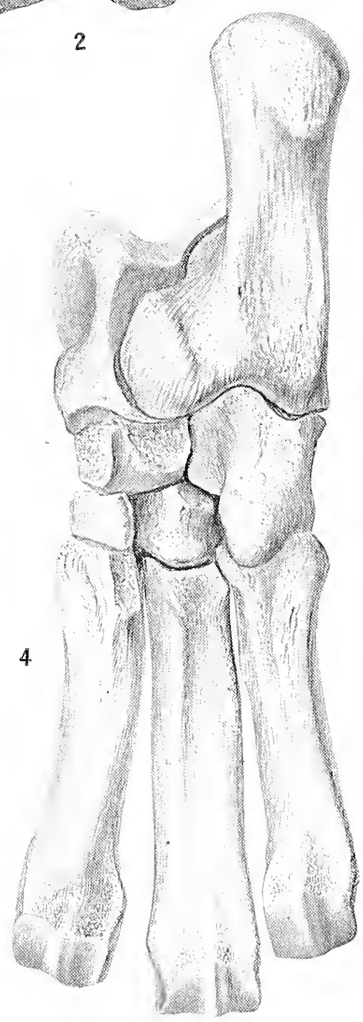


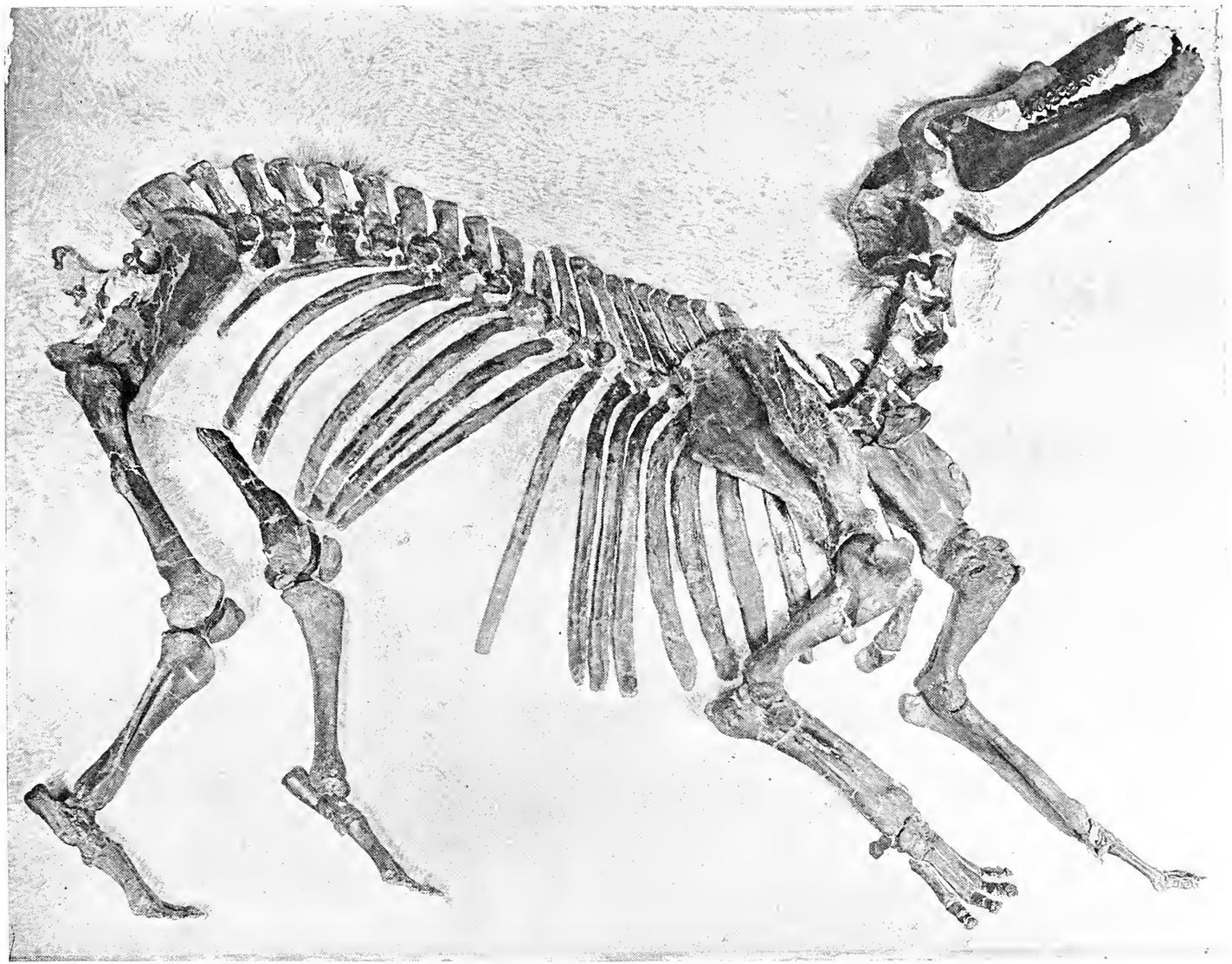
4

Dolichorhinus longiceps Douglass.

EXPLANATION OF PLATE LV.

Articulated skeleton of *Dolichorhinus longiceps* Douglass. Combination of two skeletons Nos. 11,071, and 11,072, C. M. Cat. Vert. Foss. On exhibition in gallery of Fossil Mammals.

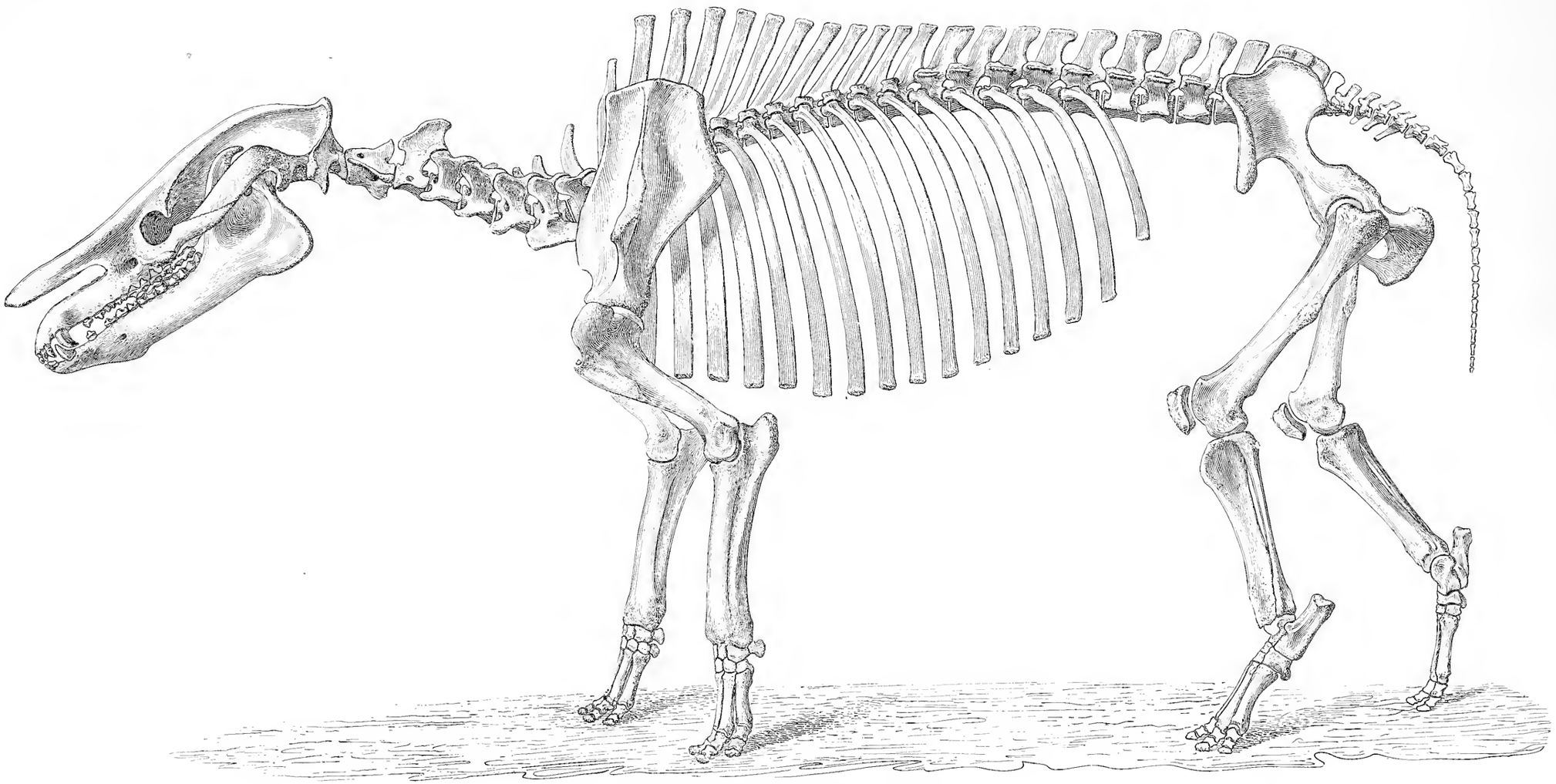
(One-ninth natural size)



Articulated skeleton of *Dolichorhinus longiceps* Douglass.

PLATE LVI.

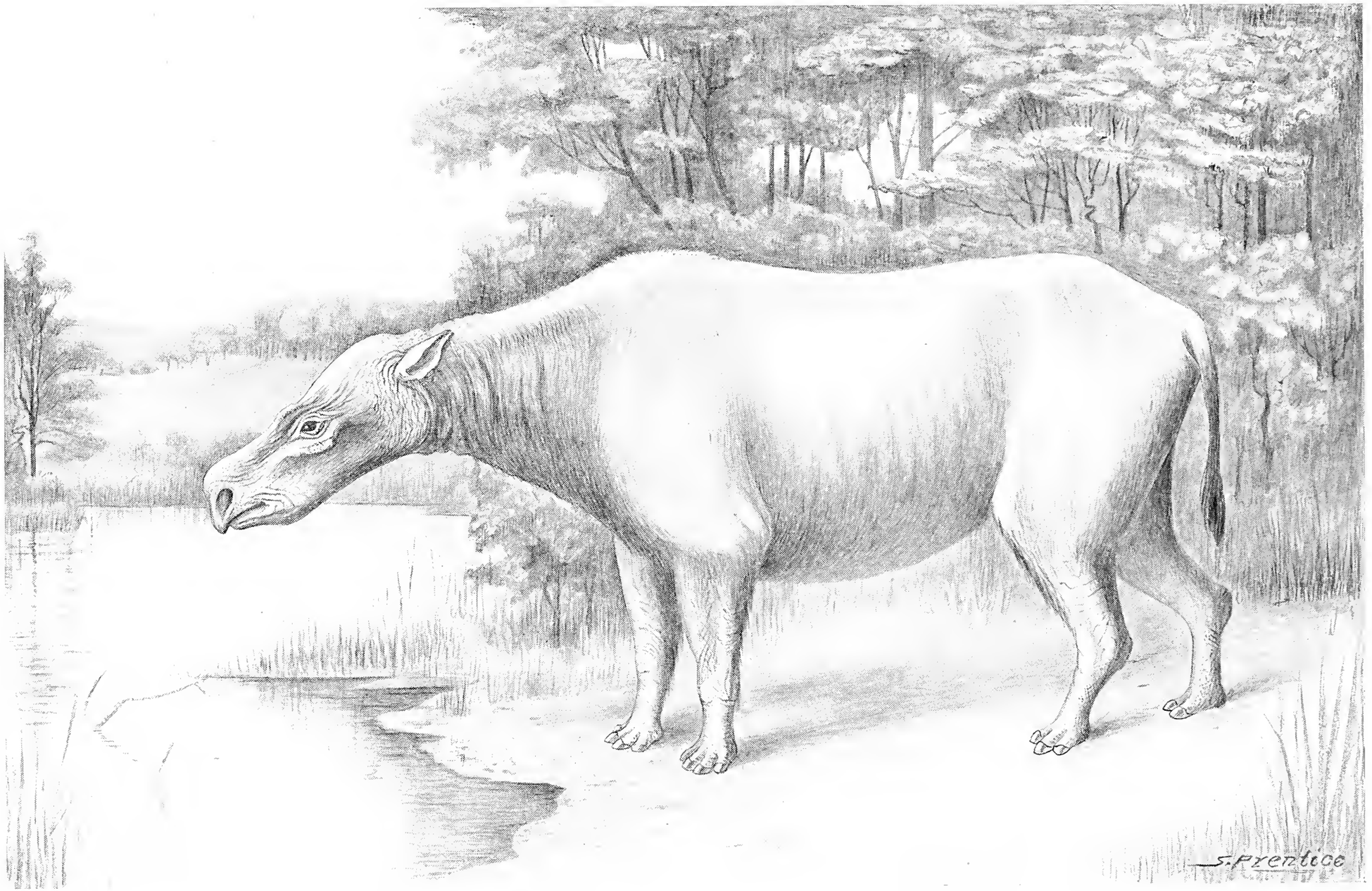
Dolichorhinus longiceps Douglass.
Restoration of Skeleton.
(One-ninth natural size)



Restored Skeleton of *Dolichorhinus longiceps* Douglass.

PLATE LVII.

Dolichorhinus longiceps Douglass.
Restoration by Sidney Prentice, showing possible appearance in life.
(Greatly reduced)



Restoration of *Dolichorhinus longiceps* Douglass.

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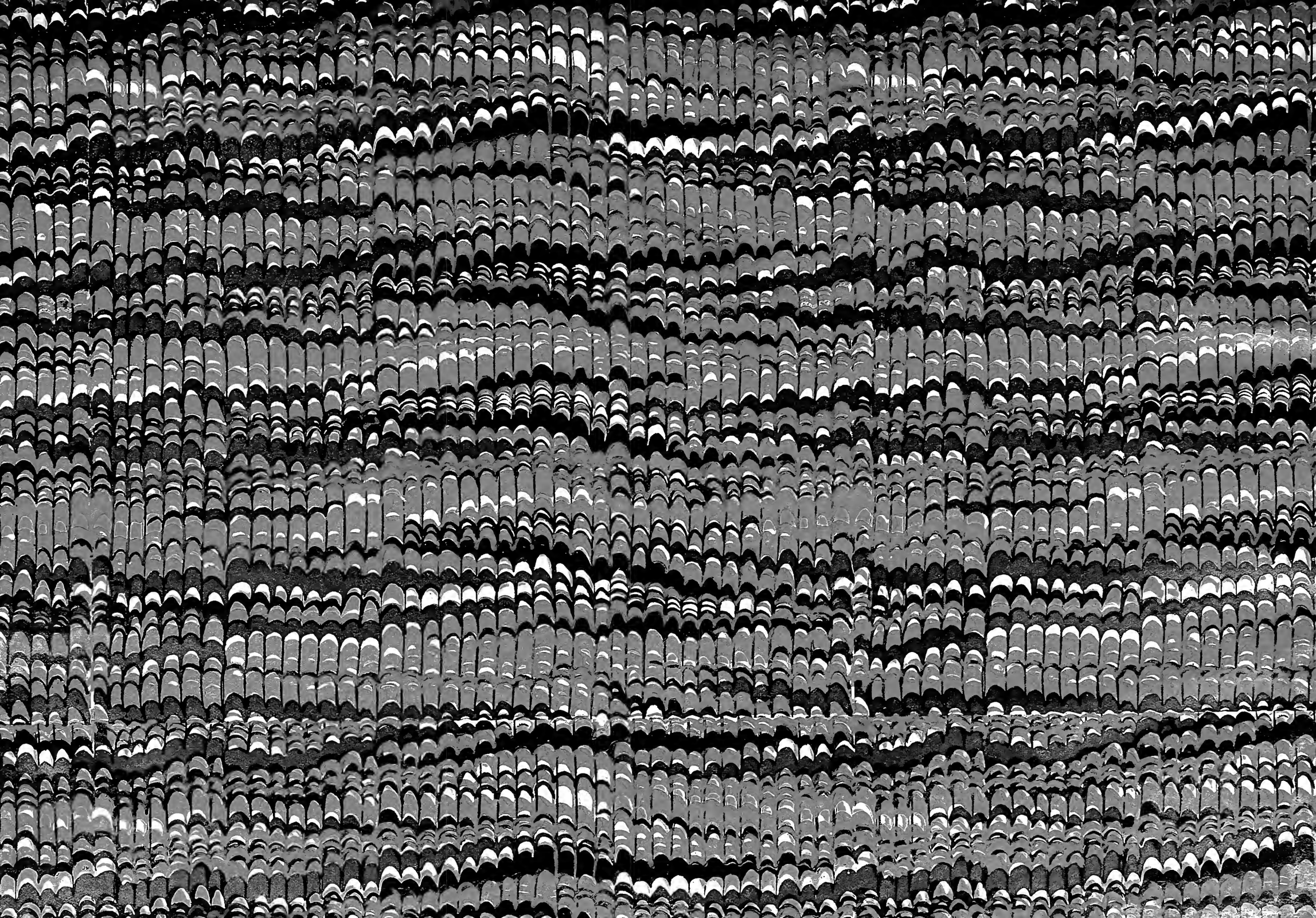

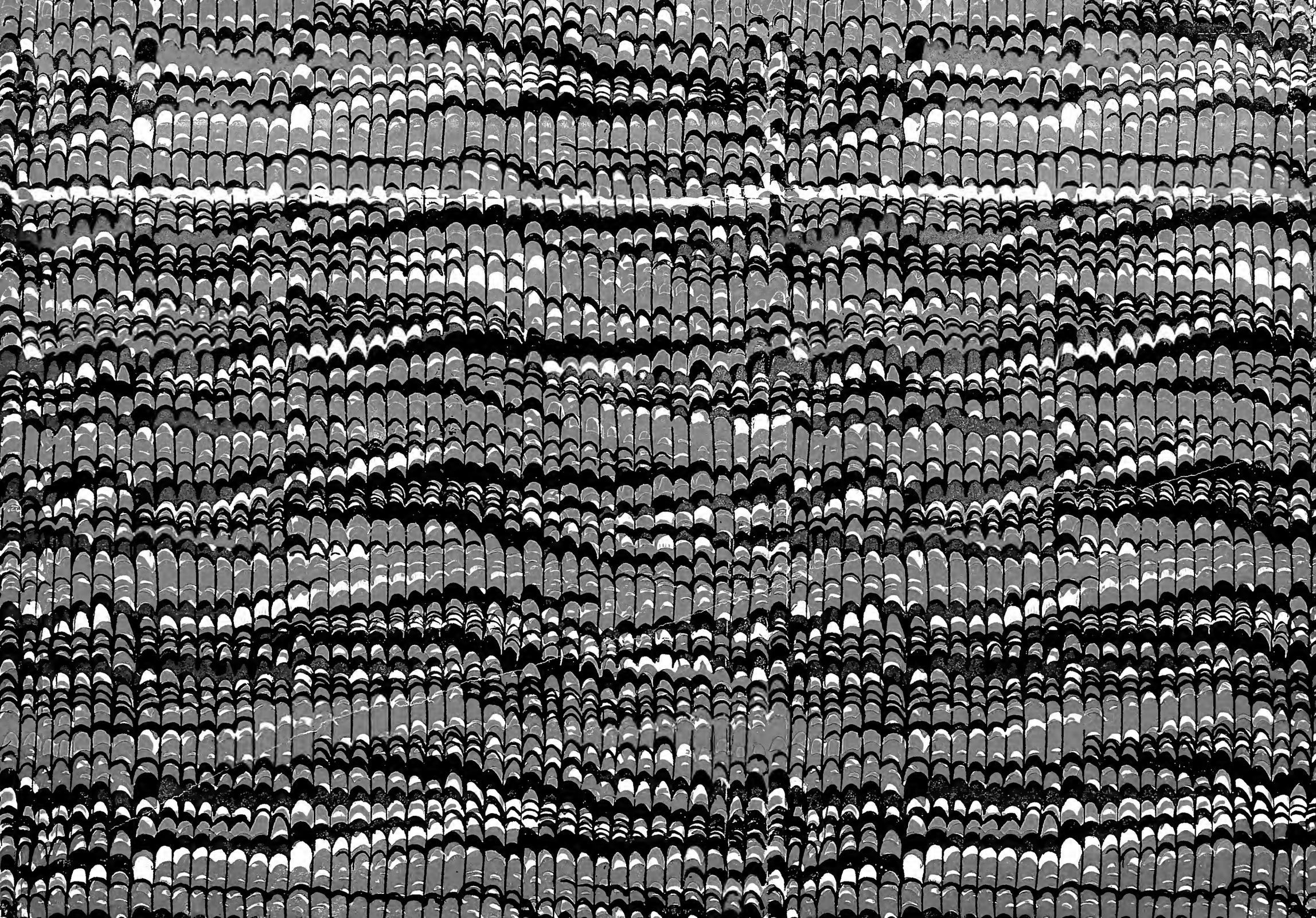

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