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34

THE FISHES OF THE FRESH WATERS OF PANAMA

BY

SETH E. MEEK,

Assistant Curator, Department of Zoölogy,

AND

SAMUEL F. HILDEBRAND,

Scientific Assistant, U. S. Bureau of Fisheries.

CHARLES B. CORY,
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BY SETH E. MEEK* AND SAMUEL F. HILDEBRAND.

PREFACE.

The present report is based upon the fresh water species of fishes collected during the "Smithsonian Biological Survey of the Panama Canal Zone." The ichthyological reconnaissance, however, was made co-operatively by the Smithsonian Institution, Field Museum of Natural History and the U. S. Bureau of Fisheries.

With the exception of a small number of specimens contributed by Messrs. H. Pittier and E. A. Goldman of the U. S. Department of Agriculture, the collections were made by the authors during two seasons, viz.; from January to May inclusive, 1911, and from January to March inclusive, 1912. The winter and early spring months were chosen because they represent the dry season in Panama. In 1911 the work was, however, well extended into the rainy season, for during the month of May it rained every day and the streams became so high and muddy that our efforts had to be confined to collecting marine species. It became impossible to dry the nets or our clothing, except by artificial heat, therefore, on May 22 the work was abandoned and resumed the following January.

We are greatly indebted to the Panama Rail Road Company for furnishing free transportation to and from New York and for a free pass on the Panama Rail Road. We are also deeply indebted to the Isthmian Canal Commission, and General George W. Goethals in particular, for extending to us every convenience and assistance possible. To the Darien Gold Mining Company we also owe our deepest gratitude for rendering invaluable aid on our expedition to the Darien region. Without the help thus received it would have been impossible to make so large and thorough a collection as the present one.

Our knowledge of the fresh water fishes of the Isthmus of Panama heretofore was fragmentary. It was based on small collections made at various times, usually not by naturalists, but by tourists and others who possessed a popular interest in the subject. The small collections thus secured were reported upon by various authors, viz.; Kner & Steindachner, Steindachner, Günther, Gill, Evermann & Goldsborough

*Deceased July 6, 1914.

and others. The collection at hand, therefore, is the first large and general one made in the fresh waters of the Isthmus.

The present survey was made after much work had been done on the Canal and natural conditions had been considerably disturbed, but yet before the water was turned into the Canal and before the species from the two slopes were allowed to intermingle. The natural conditions had at the time of our visits been most disturbed in the Rio Grande on the Pacific slope of the Canal Zone. This stream had been thoroughly cut to pieces and in view of this fact it seemed important, in order to obtain a comprehensive knowledge of the fishes of the Canal Zone, to extend the survey to other Pacific slope streams. In this connection it is an interesting fact that several species, namely, *Pimelodella chagresi*, *Plecostomus plecostomus*, *Astyanax fasciatus*, *Brycon argenteus*, *Curimatus magdalenæ*, *Thoracocharax maculatus*, *Priapichthys tridentiger* and *Microleotris panamensis* gen. et sp. nov., taken in streams both east and west of the Rio Grande were not found in it, the presumption being that they once occurred there but that they had disappeared on account of the unfavorable conditions created by the construction of Canal.

Two small preliminary papers containing the descriptions of new species have already been published in the Zoölogical Series of Field Museum of Natural History (Vol. X, 1912 and 1913, pp. 67 and 68, and pp. 77 to 91). In the present and final report we have endeavored to give concise descriptions of all the species known to occur in the fresh waters of Panama, along with keys which we believe will afford ready means of identification. We have avoided technical terms as far as possible and hope that the work may prove of use in the high schools of the Canal Zone, and in other institutions of learning in Panama, as well as to ichthyologists. A complete report on the marine species is in the course of preparation and will be offered later.

The senior author, on account of ill health, was obliged to withdraw from the work during the course of its preparation. His untimely death occurred on July 6, 1914, thus delaying greatly the completion of the report. In the fall of 1915 Prof. C. H. Eigenmann of Indiana University kindly offered the use of his library, collections from Colombia and other South American countries, and his laboratory at the University for the further study of this collection. Advantage was taken of this opportunity, the specimens were shipped to Bloomington, and the study of them was there completed by the junior author, who is much indebted to Prof. Eigenmann for many valuable suggestions and for aid in classifying difficult forms. Without the Colombian collection for comparison, many forms, the relationship of which is now definitely established, would have remained unknown.

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INTRODUCTION.

GENERAL TOPOGRAPHY AND HYDROGRAPHY OF PANAMA.

In the region of the Canal Zone the Atlantic slope is very much broader than the Pacific slope. Following the line of the Panama Canal, it is about 40 miles from the Atlantic coast to the crest of the divide and only 10 miles from thence to the Pacific coast. This, in the Canal Zone region, where the rainfall is heavy,* gives rise to the comparatively large Rio Chagres on the Atlantic slope opposed by rather small coastal streams on the Pacific slope, namely, the Rio Chorrera, Rio Grande, Rio Marte Arnade, Rio Abaco, Rio Juan Diaz and other small streams.

Going eastward or toward Colombia the Pacific slope becomes broader and the Atlantic slope narrower. The increased width of the Pacific slope then gives rise to the rather large Rio Bayano, the mouth of which is about 30 miles east of Panama City, and to the still larger Rio Tuyra which empties into San Miguel Bay, about 100 miles south-east of Panama City. Opposite these streams, on the narrow Atlantic slope, there are only very small coastal streams.

In western Panama the watershed more nearly follows the median line of the Isthmus and no large streams occur on either slope.

There are then three river basins of considerable size in Panama, viz.; the Rio Chagres on the Atlantic slope and the Rio Bayano and the Rio Tuyra on the Pacific slope. Collections were made in all of these streams. The Rio Chagres with its numerous tributaries was quite thoroughly explored, and it is believed that our collections contain, with perhaps very few exceptions, all the species occurring there. Our explorations in the Rio Bayano and the Rio Tuyra basins were not so thorough, and our collections from these rivers are certainly not exhaustive, but sufficient to indicate the nature of their faunas. Besides these large streams, the small streams opposite the Rio Chagres and as far westward as the Rio Chame on the Pacific slope were visited and collections made in each. On the Atlantic slope only a few of the small coastal streams, two at Porto Bello and two at Toro Point, were visited. This then leaves many small streams of western Panama unexplored.

*The rainfall in the Canal Zone region is heaviest on the Atlantic slope and particularly at Porto Bello where during a single day of 24 hours as much as 11 inches of water are known to have fallen. In 1909, 58.07 inches of rain fell during the month of December and the total rainfall for the year was 237.28 inches.

That the faunas of these small streams are of much interest is indicated by the fact that *Hoplosternum punctatum* sp. nov. belonging to a distinctly South American family, of which heretofore no representative was known north of the Rio Atrato Basin in Colombia, was taken in the Rio Marte Arnade, a small stream, about 6 miles east of Panama City, and was not seen elsewhere in Panama. *Gephyrocharax intermedius* sp. nov. was found only in the Rio Chame; *Bryconamericus cascajalensis* sp. nov. only in the Rio Cascajal at Porto Bello; *Rivulus brunneus* Meek & Hildebrand only in a small coastal stream at Toro Point and *Microleotris panamensis* gen. et sp. nov. only in the Rio Juan Diaz and the Rio Chorrera. *Ancistrus chagresi*, which is common in the Rio Chagres Basin, was taken on the Pacific slope only in the Rio Chorrera.

THE RIO CHAGRES AND ITS FAUNA.

The Rio Chagres is but slightly affected by tides at its mouth, as there is a difference of less than two feet between mean high and mean low water on the Atlantic coast of Panama. Ascending this stream, it is found to flow through a low swampy region in its lower course, or as far as Gatun. Here it receives its largest tributary, the Rio Trinidad, which is a sluggish stream winding its way for many miles southward through a low, dense jungle where mosquitoes abound in countless numbers. It reaches the mountains opposite the Rio Chorrera. In the upland regions it is free from rapids, but the current is swift.

At Gatun the Rio Chagres receives another tributary of considerable size, namely, the Rio Gatun, which assumes an easterly course, and is a clean, clear stream, usually with sandy or pebbly bottom and without rapids or falls but with a strong current.

Following again the course of the Rio Chagres from Gatun upward it assumes the general direction of the present Canal, i. e., southeastward until Gamboa is reached where it makes a rather sharp turn to the left and then follows an east by northeast course. As far up as Alhajuela or about 50 miles from its mouth, following the winding course of the stream, the current is swift but no rapids occur. From this point upward it becomes swifter and at intervals rapids appear which can be crossed only when the water is at a low stage. At San Juan, the last native village on the river, the stream forks; the left fork is known as the Rio Pequeni which soon again divides forming the Rio Boqueron and the Rio Pequeni. The fork to the right, going up stream, at the village of San Juan is the Upper Chagres. Following its course the mouth of a large tributary is soon reached. This is the Rio Indio which has a waterfall a short distance above its mouth; below it a large num-



NATIVE PULLING A BOAT ACROSS RAPIDS ON THE UPPER CHAGRES.



FISHING PARTY ON THE RIO GATUN.

ber of specimens of *Joturus pichardi* were obtained with a discharge of dynamite.

The regions through which the upper courses of these streams flow are entirely uninhabited. A traveler in this region is obliged to provide himself with provisions, for nothing can be obtained except fish and game. Large fishes belonging to the genus *Brycon* are plentiful, and there is doubtless also an abundance of game, although no effort was made by us to obtain it. The region is densely wooded and no headway can be made into the jungle without cutting a trail. Large crocodiles and caimans abound, and several species of monkeys may from time to time be seen leaping from tree to tree. On several occasions numbers of monkeys made early morning visits to our camps, chattering profusely in the trees overhead, but upon the first movement or sound from the occupants of the camp the chattering ceased and a grand rush was made for the jungle.

We made the trip up these streams in a wooden dug-out, "poled" by two natives. As it is impossible to paddle a canoe against the strong current in most places, the natives use a pole with an iron shoe at the base. One man stands in the stern of the boat to guide and to push and the other occupies the bow, walking forward, securing a hold and then running back as the boat is pushed along. Even during our expedition, when the streams were at a very low stage it was necessary for us to land and walk past several rapids while our boatmen by means of a rope pulled the boat across them. In coming down stream and crossing rapids considerable skill is required. Our boatmen were very careful either to go faster than the current or slower in order to retain control of the boat. It is then obvious that an expedition on the Upper Chagres and its tributaries should not be undertaken without skillful boatmen who are familiar with the streams.

The waters of the lower Chagres are constantly turbid, but those of its upper tributaries were clear and cool at the time of our expedition. The beds of all of the upper tributaries are pebbly or rocky. Large boulders usually occur at the rapids, making traveling all the more difficult.

The stages of the river often change rapidly owing to freshets in the mountains, the highest water usually occurring during November and December, at the close of the rainy season, and the lowest water during February and March. The rapidity with which the stream at times rises may be seen from the following figures obtained from the records kept by the Isthmian Canal Commission at its hydrographic station at Alhajuela: On December 26, 1909, the river had an elevation of 96.6 feet at 7:00 A. M.; at 7:00 P. M. the elevation was 121 feet. On December 26,

1911, it rose from an elevation of 101.4 feet at 9:00 A. M. to 110 feet by 10:00 A. M. It is evident that at such times all boating on the river must cease.

The fish fauna in the upper courses of the Chagres is rather rich in quantity but rather poor in variety. On the lower courses of the Chagres the larger fishes have become comparatively rare, owing in part at least to the illegal use of dynamite, but the number of species is greater than in the uninhabited region.

The following is a list of species obtained by us in the Rio Chagres Basin: Family *Siluridæ*; *Pimelodella chagresi*, *Rhamdia wagneri*: Family *Loricariidæ*; *Plecostomus plecostomus*, *Chaetostomus fischeri*, *Ancistrus chagresi*, *Loricaria uracantha*: Family *Characidæ*; *Astyanax ruberrimus*, *Bryconamericus emperador*, *Brycon petrosus*, *Brycon chagrensis*, *Gephyrocharax atricaudata*, *Creagrutus notropoides*, *Hyphessobrycon panamensis*, *Pseudocheiroidon affinis* gen. et sp. nov., *Compsura gorgonæ*, *Ræboides guatemalensis*, *Piabucina panamensis*, *Hoplias microlepis*: Family *Gymnotidæ*; *Hypopomus brevirostris*: Family *Pæciliidæ*; *Gambusia cascajalensis*, *Gambusia episcopi*, *Gambusia nicaraguensis*, *Mollienisia sphenops*, *Priapichthys tridentiger*, *Rivulus elegans*: Family *Mugilidæ*; *Agonostomus macracanthus*, *Agonostomus monticola*, *Joturus pichardi*: Family *Cichlidæ*; *Æquidens cæruleopunctatus*, *Cichlasoma maculicauda*, *Neotopolus panamensis*, *Geophagus crassilabris*: Family *Gobiidæ*; *Awaous taiasica*, *Dormitator maculatus*, *Leptophilypnus fluviatilis* gen. et sp. nov., *Microeleotris mindii* gen. et sp. nov., *Eleotris isthmensis* sp. nov., *Eleotris pisonis*, *Guavina guavina*, *Philypnus dormitor*, and *Sicydium salvini*.

The representatives of the family *Siluridæ* occur on both slopes of Panama and southward and seem to be well established species that are not at the present time undergoing any rapid changes in different localities.

Of the family *Loricariidæ*, *Loricaria uracantha* was taken only in the Rio Chagres* and does in fact have no very near relatives. Since the Isthmus of Panama is the northernmost limit of the range of this family and its center of distribution occurs somewhere in South America, this species may be regarded as one of the earliest migrants,† which appears to have changed remarkably under the new environment. *Chaetostomus fischeri* is really a Pacific slope fish in Panama, but it seems to have reached this region before the last gap between the Rio Chagres and the Pacific slope streams was closed. It has apparently not thrived

**Loricaria uracantha* is recorded from the Pacific slope of Panama, but it was not seen there by us.

†In our discussion on distribution, Panama is regarded as a very remote center of distribution. See Meek, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1914, p. 134.



NATIVES "POLING" A BOAT ACROSS RAPIDS ON THE UPPER CHAGRES.



FISHING PARTY ON A TRAIL THROUGH THE JUNGLE.

well in the Chagres, as it is very rare there, nor has it undergone any changes different from those of the Pacific slope. *Ancistrus chagresi*, by whatever route it may have reached the Rio Chagres, is now abundant there and may also be regarded as one of the early migrants. It was found on the Pacific slope only in the small Rio Chorrera, the upper tributaries of which are opposite those of the Rio Trinidad. It, therefore, seems probable that this species crossed from one stream into the other before the gap between them became closed. The other representative of this family, *Plecostomus plecostomus*, is of wide distribution and occurs on both slopes of Panama and southward.

Among the characins evolution seems to be rather actively at work in a number of species. *Brycon chagensis*, *Brycon petrosus*, *Creagrutus notropoides* and *Ræboides guatemalensis* all have closely related opposites or relatives on the Pacific slope, but the influence of the different environment during their period of separation has brought forth certain definite and marked changes. *Hyphessobrycon panamensis* alone of all the characins from the Rio Chagres has no near relative elsewhere in Panama. The genus, however, reappears in Colombia. The Panama representative was probably one of the early migrants reaching the Chagres before the last passage between this river and the Pacific streams was closed. If it actually reached the Atlantic slope by that route, then we are obliged to conclude that the species was unable to maintain itself on the Pacific slope and while it became extinct there it thrived on the Atlantic. The rest of the species of the *Characidae* known from the Chagres are common to both slopes of Panama. Of these *Astyanax ruberrimus* at least also occurs throughout Colombia, and *Hoplias microlepis* while replaced by *H. malabaricus* in the Rio Tuyra Basin and in Colombia, oddly enough again reappears on the western slope of Ecuador.

The single representative of the family *Gymnotidae* is of wide distribution, and does not appear to be undergoing any rapid changes.

The representatives of the family *Paciliidae* are common to both slopes, with the single exception of *Gambusia nicaraguensis* which can scarcely be regarded a fresh water form, as it seldom occurs above brackish water.

Of the family *Mugilidae* three species occur in the Rio Chagres. Two of them at least are common to both slopes of Panama and Central America as well as to the West Indies.

Of the family *Cichlidae* there are two species, *Æquidens cæruleopunctatus* and *Geophagus crassilabris*, that are of rather wide distribution and are found everywhere in the streams of Panama. *Cichlasoma maculicauda* is found only on the Atlantic slope of Panama and north-

ward to Guatemala. *Nectroplus panamensis* is known only from the Rio Chagres, although there are representatives of the genus in Costa Rica and other parts of Central America. The last two species may be regarded as migrants from Central America.

The fresh and brackish water representatives of the family *Gobiidae* alone seem to have Panama as a center of distribution. They appear to have yielded to the different environment of the two slopes and only one species, *Sicydium salvini*, an upland form, is now common to both slopes. *Awaous taiasica*, *Dormitator maculatus*, *Microeleotris mindii* sp. nov., *Eleotris pisonis* and *Philypnus dormitor* all have very near relatives on the Pacific slope, differing sufficiently so that usually they can be distinguished quite readily.

THE RIO BAYANO AND ITS FAUNA.

The Rio Bayano is a broad stream at its mouth and owing to the excessively high tides on the Pacific coast of Panama, varying from 20 to 30 feet between high and low water, the current changes twice daily for 30 or more miles up stream. Throughout this entire distance the river is broad and muddy, but the head of steam boat navigation is not far above the mouth of the Rio Mamoni which empties into the main stream about 20 miles from the sea. The lower course of the Bayano has large quiet bays where the crocodile is very abundant. There are places where on a sunny day an observer may stand in one position and count a hundred or more noses of these beasts projecting above the water. Many marine species of fishes run up and down the lower part of this stream with the tides.

The Rio Mamoni has a much greater fall than the main stream and soon rises above tide level. It then becomes, at least during the dry season, a clear stream with a rocky or pebbly bottom. About 10 or 15 miles above its mouth is situated the town of Chepo which is one of the oldest and best known towns of Panama outside of the limits of the Canal Zone. During the dry season this stream is quite small at this village. It was so low during our visit that we were obliged, in order to reach Chepo, to leave our dug-out behind and travel overland the last 5 or 6 miles. In this region of savanas this was not difficult. We did not explore the stream beyond Chepo, although it extends for many miles back into the mountains, and very probably supports forms of fishes not obtained by us.

Following again the course of the main stream for from 10 to 15 miles above the mouth of the Mamoni another tributary of considerable size is reached. This is the Rio Calobre which flows through a densely wooded and uninhabited region. The lower portion of this stream is

also subject to a flow of water in opposite directions for a few miles above its mouth. The water, however, is fresh, as the back water entering it is the fresh water from the main stream which is being held back by the onrush of the tide. This stream too is rocky above the head of tide and its fish fauna is quite rich in species but not in quantity.

Time did not permit us to follow the course of the main stream beyond the mouth of the Calobre. It would at any rate at the time have been impossible for us to explore the upper tributaries of the Bayano, as they lie within the San Blas region controlled by the hostile San Blas Indians, who do not permit a white man to enter their territory. These streams must, therefore, remain unexplored until these Indians learn that the white man is not their enemy.

The fish fauna of the Rio Bayano Basin is essentially that of the Rio Tuyra. The following species were obtained by us in the Rio Bayano Basin: Family *Siluridæ*; *Pimelodella chagresi*, *Rhamdia wagneri*: Family *Loricariidæ*; *Chaetostomus fischeri*, *Ancistrus spinosus* sp. nov., *Oxyloricaria citurensis*, *Oxyloricaria panamensis*: Family *Characidæ*; *Astyanax ruberrimus*, *Astyanax fasciatus*, *Bryconamericus emperador*, *Brycon argenteus*, *Brycon striatulus*, *Gephyrocharax atricaudata*, *Curimatus magdalena*, *Hoplias microlepis*, *Luciocharax beani*, *Piabucina panamensis*, *Pseudocheirodon affinis* gen. et sp. nov., *Compsura gorgona*, *Ræboides occidentalis* sp. nov., *Thoracocharax maculatus*: Family *Gymnotidæ*; *Hypopomus brevirostris*: Family *Pæciliidæ*; *Gambusia episcopi*, *Mollienisia sphenops*, *Priapichthys dariensis*, *Priapichthys tridentiger*: Family *Mugilidæ*; *Agonostomus monticola*: Family *Cichlidæ*; *Æquidens cæruleopunctatus*, *Cichlasoma calobrense*, *Cichlasoma tuyrense*, *Geophagus crassilabris*: Family *Gobiidæ*; *Awaous transandeanus*, *Dormitator latifrons*, *Hemieleotris latifasciatus*, *Eleotris pictus*, and *Philypnus maculatus*.

The following species of more northern distribution reach their southernmost limit in the Rio Bayano; *Piabucina panamensis*, *Gambusia episcopi*, *Priapichthys tridentiger*, *Agonostomus monticola*, *Joturus pichardi** and *Hemieleotris latifasciatus*. The following species are not known north of this river basin; *Chaetostomus fischeri*, *Ancistrus spinosus* sp. nov., *Loricaria variegatus*, † *Oxyloricaria citurensis*, *Oxyloricaria panamensis*, *Cichlasoma calobrense* and *Cichlasoma tuyrense*. *Plecostomus plecostomus*, although found on both slopes of Panama and northern South America, is not recorded from the Rio Bayano, and was not taken in this river by us, but it doubtless occurs there. According

*This species was not taken by us, but it is recorded from the Rio Bayano by Jordan & Gilbert under the name *Joturus stipes*.

†This species was not taken here by us but the type is from the Rio Mamoni.

to our present knowledge there is not a single species whose habitat is limited to this river basin alone, as all species occurring here are found also in streams either to the eastward or westward of it.

THE RIO TUYRA AND ITS FAUNA.

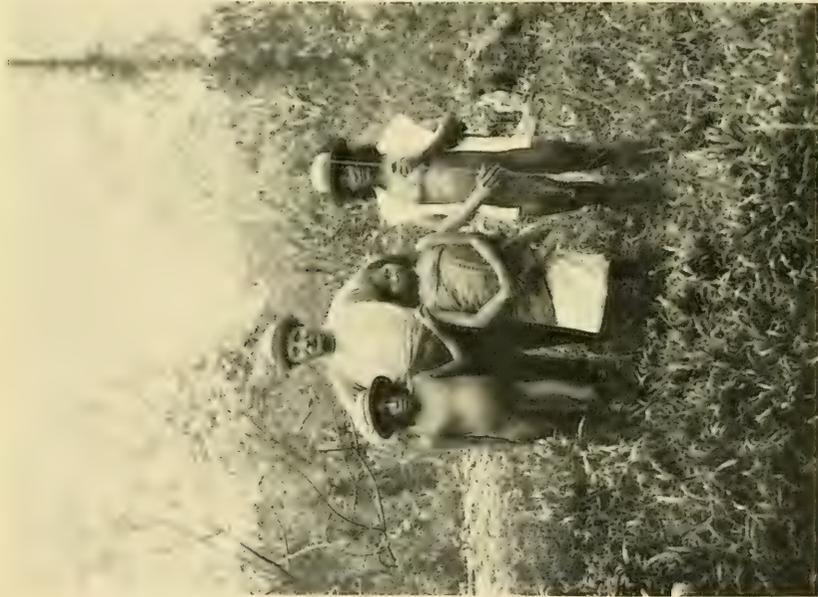
This river like the Bayano is subject to the high tides of the Pacific coast. It empties into San Miguel Bay, and for many miles inland it is a broad expanse of water in which the current changes twice daily. The head of steam boat navigation is at El Real about 75 miles above its mouth. The head of tide is at Pinogana about 15 miles above El Real.

Several miles below El Real is the mouth of the Rio Chucunaque, a tributary nearly as large as the main stream. This stream lies almost wholly within the San Blas region. Its exploration was therefore not undertaken.

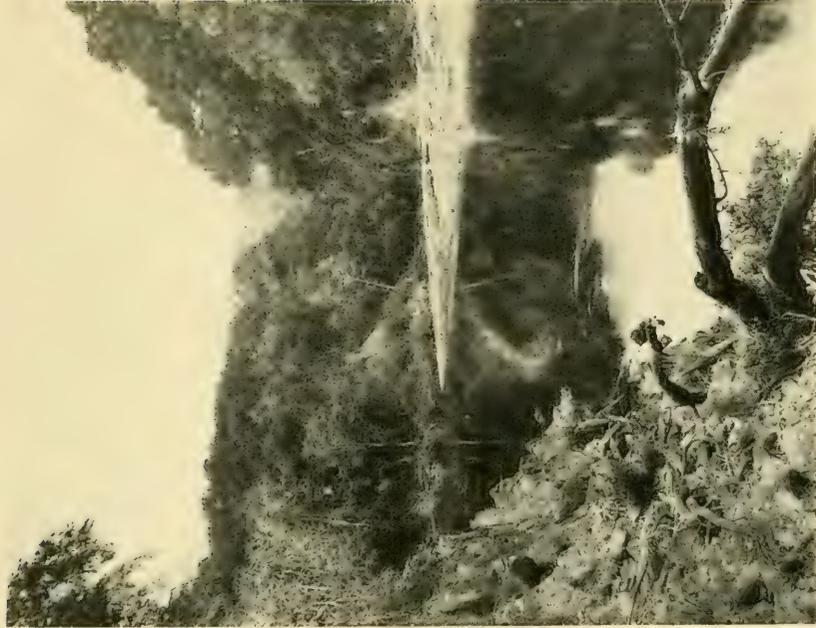
The main stream was followed as far as Boca de Cupe, about 30 miles above the head of steamboat navigation. This distance was traveled in the native wooden dug-out. This stream has rather swift current above the head of tide, but there are no strong rapids, such as occur in the Rio Chagres. Before reaching Boca de Cupe the mouths of three tributaries of rather large size are reached, namely the Rio Aruza, Rio Yape, and the Rio Capeti. An overland trip from Boca de Cupe was made to the upper part of the Aruza, and the other two were followed only a short distance above their mouths. Interesting collections were obtained from each. At the native village of Boca de Cupe, located at the mouth of the Rio Cupe, the main stream was fished as well as the smaller tributary.

From Boca de Cupe the Darien Gold Mining Company has constructed a small tramway to its mines in the mountains at Cana, a distance of about 30 miles. This was followed and some of the small streams en route were fished. At Cana the small Rio Cana and the somewhat larger Rio Setiganti were visited and rather extensive collections made in each. An overland trip of about 10 miles was made from Cana to the Rio Grande another one of the upper tributaries of the Rio Tuyra. These small mountain streams are all very rocky and collecting is difficult. Most of the streams were clear and cool at the time of our visit, but the Rio Cana was very turbid with a reddish sediment on its bed. However, a number of very interesting forms not seen elsewhere were secured from the latter.

Some of the upper tributaries of the Rio Tuyra and those of the Rio Atrato of the Atlantic slope of Colombia come very close together and the water shed between the two basins is very low. We were informed by the employees of the Darien Gold Mining Company that the Indians



AN INDIAN FAMILY OF THE RIO TUYRA BASIN. THE LATE DR. S. E. MEEK IN REAR. (NOTE THE FISHING SPEAR HELD BY THE HEAD OF THE FAMILY.)



SCENE ON THE UPPER CHAGRES.

of this region, during the rainy season when the streams are high, often drag their canoes from the head waters of one basin to those of the other, and inasmuch as the fishes of the two streams are much alike it seems very probable that within comparatively recent times a gap remained somewhere along this water shed.

The following species were obtained in the Rio Tuyra Basin: Family *Siluridæ*; *Ageneiosus caucanus*, *Pimelodella chagresi*, *Pimelodus clarias punctatus*, *Rhamdia wagneri*, *Trachycorystes amblops*: Family *Loricariidæ*; *Leptoancistrus canensis*, *Lasiancistrus planiceps*, *Chaetostomus fischeri*, *Ancistrus spinosus* sp. nov., *Plecostomus plecostomus*, *Loricaria fimbriata*, *Loricaria capetensis*, *Loricaria filamentosa latiura*, *Loricaria variegata*, *Oxyloricaria citurensis*, *Oxyloricaria panamensis*: Family *Pygidiidæ*; *Pygidium striatus*: Family *Cyclopidæ*; *Cyclopium pirrense*: Family *Characidæ*; *Apareiodon dariensis*, *Astyanax ruberrimus*, *Astyanax fasciatus*, *Bryconamericus emperador*, *Brycon argenteus*, *Brycon striatulus*, *Gephyrocharax atricaudata*, *Creagrutus simus*, *Curimatus magdalenæ*, *Hemibrycon dariensis* sp. nov., *Hoplias malabaricus*, *Luciocharax beani*, *Piabucina festæ*, *Phanagoniates macrolepis*, *Pseudocheiroduon affinis* gen. et sp. nov., *Compsura gorgonæ*, *Ræboides occidentalis* sp. nov., *Thoracocharax maculatus*: Family *Gymnotidæ*; *Eigenmannia virescens*, *Hypopomus brevirostris*, *Sternarchus rostratus*, *Sternopygus dariensis* sp. nov.: Family *Pæciliidæ*; *Mollienisia caucana*, *Priapichthys dariensis*, *Priapichthys tridentiger cana*: Family *Cichlidæ*; *Æquidens cæruleopunctatus*, *Cichlasoma calobrense*, *Cichlasoma tuyrense*, *Cichlasoma umbriferum*, *Geophagus crassilabris*: Family *Gobiidæ*; *Awaous transandeanus*, *Philypnus maculatus*.

Among the family *Siluridæ* there are again the two species, *Pimelodella chagresi* and *Rhamdia wagneri*, occurring everywhere in Panama. *Ageneiosus caucanus* is common to the Rio Tuyra and the Rio Atrato, and the other two species of this family, while not identical, are very closely related to Atrato forms, from which they are slowly changing under the different environment. The genera *Ageneiosus*, *Pimelodus* and *Trachycorystes* all reach the northern limit of their range in the Rio Tuyra.

Under the family *Loricariidæ*, there is again the widely distributed species *Plecostomus plecostomus*, and *Chaetostomus fischeri*, the latter occurring on both slopes of Panama and quite surely also in Colombia. *Loricaria fimbriata* and *Loricaria filamentosa latiura* also occur on the Atlantic slope of Colombia and *Oxyloricaria panamensis* occurs on both slopes of Colombia and in Ecuador and reaches its northern limit in the Rio Bayano. *Ancistrus spinosus* sp. nov., *Loricaria variegata* and *Oxyloricaria citurensis* also are found in the Rio Bayano. *Leptoancistrus*

canensis, *Lasiancistrus planiceps* and *Loricaria capetensis*, all originally described in one of our preliminary papers (1913), remain peculiar to this stream. The last two, however, have very near relatives on the Atlantic slope of Colombia.

The families *Pygidiidæ* and *Cyclopidæ* are each represented by a single species; both are described as new in our preliminary paper (1913). This in both instances represents the northernmost record for these families. The Panama representatives have very near relatives in Colombia.

In the family *Characidæ* there are the following species that appear to be peculiar to the Rio Tuyra; *Apareiodon dariensis*, *Creagrutus simus* and *Hemibrycon dariensis* sp. nov. While distinct, all have near relatives in Colombia, and may therefore be regarded as among the latest migrants. *Phanagoniates macrolepis*, *Piabucina festæ* and *Hoplias malabaricus* do not occur in other streams of Panama, but their range extends southward into Colombia or beyond. The rest of the representatives of this family are found in other streams of Panama and five of them occur also in the Rio Chagres, viz.; *Astyanax ruberrimus*, *Bryconamericus emperador*, *Gephyrocharax atricaudata*, *Compsura gorgonæ* and *Pseudocheirodon affinis* gen. et sp. nov. Only the first one of these is known from south of the Rio Tuyra. *Brycon striatulus*, *Brycon argenteus* and *Thoracocharax maculatus* also appear to reach the southern extreme of their range in the Rio Tuyra. They, however, possess very near relatives in Colombia. The genus *Brycon* seems to be yielding to the effects of different conditions, and now consists of several rather closely related species.

In the family *Gymnotidæ*, *Sternarchus rostratus* seems to be common to the Rio Tuyra and the Rio Atrato. *Sternopygus dariensis* sp. nov. is limited to the Rio Tuyra Basin. The other two species are of wide distribution. *Eigenmannia virescens*, however, is not known north of the Rio Tuyra.

The *Paciliidæ* are comparatively rare in this river basin and the species are few. *Mollienisia caucana* reaches its northern limit of distribution in the Rio Tuyra; the variety *Priapichthys tridentiger cana* seems to be peculiar to this stream; and *Priapichthys dariensis* is known from this river basin and westward on the Pacific slope of Panama.

In the family *Cichlidæ* there is a single species, *Cichlasoma umbriferum*, that seems to be peculiar to this stream. *Cichlasoma tuyrense* and *Cichlasoma calobrense* are common to this stream and the Rio Bayano. The other two species of this family are of rather wide distribution and occur on both slopes of Panama and southward.

The two representatives of the family *Gobiidae* taken here by us are widely distributed on the Pacific slope of tropical America.

GENERAL CONCLUSIONS WITH RESPECT TO DISTRIBUTION.

We regard Panama as a very remote center of distribution and believe that the fresh water fishes have mostly migrated to this region within comparatively recent geologic times.

The fish fauna of Panama is essentially that of South America, and most of the forms seem to have entered from that direction. The families *Loricariidae*, *Pygidiidae*, *Cyclopidae*, *Callichthyidae*, as well as several of the representatives of the families *Siluridae*, *Characidae*, *Gymnotidae* and *Cichlidae* known from South America reach their northern limit of distribution in Panama. The extreme likeness of the fauna of the Pacific slope of Panama and that of the Atlantic slope of Colombia, and in particular the close similarity of the fishes of the Rio Tuyra and the Rio Atrato strongly indicate that the last gap between these two streams was closed within comparatively recent times. As previously stated the watershed between the upper tributaries of these streams is still very low and the natives continue to drag their canoes from the head waters of one stream to those of the other.

Several species of the family *Loricariidae*, as well as some of the South American forms of the families *Siluridae*, *Characidae* and *Cichlidae*, have found their way into the Rio Chagres. These seem to us to have reached this river before the last gap between the Rio Chagres and the streams of middle Panama was closed, rather than to have migrated directly from the Colombian streams. If this is the case, the last gap between the Chagres and one of the Pacific slope streams opposing it must have been closed earlier than the last passage between the Rio Tuyra and the Rio Atrato, for the similarity between the fishes of the two slopes in the region of the Canal Zone is not nearly so great as it is farther eastward (Rio Atrato — Rio Tuyra). It then is very probable that only the earliest migrants succeeded in reaching the Rio Chagres Basin.

The representatives of the family *Pæciliidae* may have entered Panama from Central America, as the majority of the species resemble Central American forms more than they do South American. The fresh water representatives of the family *Mugilidae* have evidently migrated to this region from the north and reach the southern limit of their range in the Rio Chagres and the Rio Bayano.

The fresh water species of the family *Gobiidae* are more numerous in Panama than elsewhere. Most of them still frequent brackish water and it is probable that they evolved from marine shore forms, which have worked their way up streams and into fresh water.

FOOD FISHES OF PANAMA.

The most important food fishes of the fresh waters of Panama are the characins belonging to the genus *Brycon*. These fishes reach a larger size than any of the other fresh water species. They are of good flavor, but the flesh is penetrated by numerous small bones. This fish is used both in the fresh and smoked state. The species of the genus *Hoplias* reach a rather large size and are of some value as food but are considered of inferior flavor. The catfish, *Rhamdia wagneri*, is everywhere considered a good food fish. In the Darien region the Indians quietly wade around in the creeks to seek out their hiding places and take them with a spear. A few of the *Loricariidæ* are also used as food to a limited extent.

The fresh water species of the family *Mugilidæ* are food fishes of some value. The largest species, *Joturus pichardi*, occurring only at the base of waterfalls, reaches a length of about two feet. It takes the hook quite readily and is considered the best game fish of the streams of Panama. The members of the family *Cichlidæ*, are used to some extent, but are of relatively little importance, their size seldom exceeding a length of 12 inches. A few species of *Gobiidæ*, those of the genera *Philypnus* and *Guavina*, are sometimes eaten, but are of little importance.

There is little fishing carried on on the rivers of Panama, yet in the more thickly populated regions the larger species are comparatively rare, while in the unsettled regions they are rather abundant. Little or nothing has of course been done to protect the fisheries. The natives have learned the use of dynamite in killing fishes, and this destructive method probably, to a large measure, accounts for the diminished supply in the populated regions.

NOTES OF EXPLANATION.

The plan that has been followed is to give the name of each species, the name of the original describer, and a brief synonymy. The synonymy includes all the names that have become synonyms, together with references to literature of local interest, and often a reference to a general work is given. Then follows a diagnostic description; then a brief statement of the size and number of specimens at hand, where taken, and what, if anything, is known of the habits, food, etc., and finally in a very brief statement the range of distribution is given.

The proportions given in the text for the different species are based upon measurements accurately made with calipers and slide rule.

Unless there were not enough specimens at hand, not fewer than ten were measured, and in many instances where the measurements were of special importance a much larger series was used, selecting as a rule as wide a range in size as possible. The counts of fin rays, scales, etc., are based upon similar series.

Such an expression as the following, occurring at the beginning of the description of nearly every species, "Head 2 to 3.5; depth 3 to 3.8," signifies that the length of the head, measured from the end of the snout to the bony margin of the opercle, is contained 2 to 3.5 times and that the greatest depth of the body is contained 3 to 3.8 times in the length of the body from the end of the snout to the base of the caudal fin. In giving the number of fin rays Arabic numerals are used to indicate the number of soft rays and Roman numerals the number of spines. For example, D. IV-I, 16 signifies that in this instance there are two dorsal fins, the first being composed of four spines and the second of one spine and sixteen soft rays. If these spines and soft rays were included in a single fin instead of in two fins, the result would be written thus; D. V, 16.

For the purpose of ready identification artificial keys to the families, genera and species are introduced. In using them, first determine which of the major groups the species is in and then take up the regular order of letters under each group. If the characters of the specimen in hand do not agree with those given under the single letter, look under the same double letters, ignoring all intervening matter.

A SYSTEMATIC CATALOGUE OF THE FRESH WATER FISHES OF PANAMA.

All of the fishes of the fresh waters of Panama belong to the class *Pisces* (fishes) and to the subclass *Teleostomi* (the true fishes), which possess a bony skeleton; a well developed skull; gill-opening a single slit on each side; nostrils at least two, not median; fins well developed, usually paired; alimentary canal more or less convoluted.

KEY TO THE FAMILIES OF FRESH WATER FISHES OF PANAMA.

- a. Scales wanting, body smooth or with bony plates; one to 6 pairs of barbels or whiskers more or less developed about the mouth and nostrils.
- b. Body wholly naked (naked in Panama species) or with a single series of bony plates along side.
- c. Adipose fin present.
- d. Mouth terminal or subterminal; the lips not reverted and not forming a disc. *Siluridæ*, p. 239.
- dd. Mouth inferior; the lips reverted, forming an oval sucking disc. *Cyclopidæ*, p. 265.
- cc. Adipose fin wanting. *Pygidiidæ*, p. 266.
- bb. Body mostly or wholly covered with bony plates.
- e. Sides and back and often the ventral surface covered with bony plates; mouth wholly inferior; the lips reverted, forming a sucking disc. *Loricariidæ*, p. 246.
- ee. Sides with 2 series of bony plates; mouth terminal or subterminal; the lips not reverted nor developed into a sucking disc. *Callichthyidæ*, p. 263.
- aa. Scales usually present (present in all of the Panama species); no whiskers about the mouth and nostrils.
- f. Fins without spines.
- g. Body compressed or subterete, not eel-shaped; dorsal fin present.
- h. Adipose fin usually present (wanting in *Phanagoniates* and *Hoplias*); head naked, usually more or less compressed; lateral line complete or not (wanting in *Piabucina*). *Characidæ*, p. 267.
- hh. Adipose fin wanting; head partly scaly, usually depressed, flat above; lateral line wanting. *Pæciliidæ*, p. 313.
- gg. Body more or less eel-shaped; dorsal fin wanting or represented by a mere filament. *Gymnotidæ*, p. 306.

- ff. Fins with spines.
- i. Body elongate, not very deep; dorsal fins 2, separate or more or less united; lateral line incomplete or wanting.
- j. Scales large, dorsal fins well separated; caudal fin forked; ventral fins abdominal, far apart. *Mugilidæ*, p. 332.
- jj. Scales if present (present in all of the Panama species) moderate or small; dorsal fins separate or united; caudal fin rounded; ventral fins thoracic, close together or united to form a sucking disc. *Gobiidæ*, p. 349.
- ii. Body deep, compressed; scales moderate; lateral line interrupted under base of dorsal, reappearing lower down on caudal peduncle; dorsal fin single, composed of spines and rays. *Cichlidæ*, p. 338.

Order I. Nematognathi.

THE CATFISHES.

Fishes without scales, the body smooth or provided with bony plates, and with whiskers about the mouth. Parietals and supra-occipitals confluent; the four anterior vertebræ co-ossified; no mesopterygium; suboperculum wanting or modified into the uppermost branchiostegal.

Family I. Siluridæ.

Body naked or with a single series of plates along middle of sides; mouth terminal or subterminal; opercle well developed; gill-openings usually wide; maxillary a mere vestige; caudal vertebræ not compressed; air-bladder well developed, lying free in the abdominal cavity; dorsal fin over abdominal portion of vertebral column; adipose fin present, long or short; anal fin not very long, its origin far behind that of dorsal.

KEY TO THE GENERA.

- a. Eye with a free orbital margin; adipose fin longer than anal.
- b. Occipital process failing to reach dorsal plate; adipose fin much longer than head. *Rhamdia*, p. 239.
- bb. Occipital process reaching dorsal plate; adipose fin shorter or not very much longer than head.
- c. Fontanel not continued beyond eyes; humeral process spine-like. *Pimelodus*, p. 241.
- cc. Fontanel continued beyond eyes; humeral process broad, not spine-like. *Pimelodella*, p. 242.
- aa. Eye without a free orbital margin; adipose fin shorter than anal.
- d. Barbels 6, a pair of maxillary barbels and 2 pairs of mandibular barbels; caudal fin obliquely truncate, emarginate or rather deeply concave. *Trachycorystes*, p. 243.
- dd. Maxillary barbels present, very small, especially in the female; no mandibular barbels; caudal fin forked. *Ageneiosus*, p. 244.

1. Genus *Rhamdia* Bleeker.

Rhamdia Bleeker, Verhand. Natuurk. Vereen. Nederl. Indie, IV, 1858, 197 (sp.); Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 101 (type *Pimelodus quelen* Quoy & Gaimard).

Body elongate; mouth terminal or with lower jaw the shorter; jaws with villiform teeth; no teeth on vomer or palate; nostrils remote from each other; no nasal barbels; barbels 6; occipital process small or wanting, not reaching the dorsal plate; eye with a free orbital margin; dorsal fin with 1 slender spine and 5 to 8 branched rays; adipose fin long, adnate to the back. To this genus belongs a large number of fresh-water catfishes, inhabiting streams from southern Mexico to Peru and the Rio de la Plata. One species only occurs in the Panama Canal Zone region.

1. *Rhamdia wagneri* (Günther).

Pimelodus cinerascens (non Günther) Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München, 1865, 49 (Panama).

Pimelodus wagneri Günther, Trans. Zool. Soc. London, 1868, 474 (Atlantic and Pacific rivers of Panama); Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1879 (Rio Mamoni, Chepo, Panama).

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

Rhamdia wagneri Eigenmann & Eigenmann, Occ. Pap. Cal. Ac. Sci. I, 1890, 133 (Gorgona, Rio Chagres; Rio Obispo, Panama; Turbo, Atlantic coast, Cent. America); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 151; Regan, Biol. Cent. Amer., Pisces, 1907, 131 (Shirures, Costa Rica; western Ecuador).

Head 3.6 to 4.55; depth 5.1 to 6.55; D. I, 6; A. 11 to 13.

Body elongate, compressed posteriorly; head depressed; profile gently elevated anteriorly, nearly straight; snout broad, its length 2.25 to 2.5 in head; eye 5.45 to 7.5; interorbital 2.4 to 2.94; mouth broad, its width greater than length of snout; the upper jaw a little in advance of the lower; maxillary barbels varying considerably in length, reaching opposite base of ventrals to opposite or past base of anal; teeth in the jaws in villiform bands; none on palatines or vomer; head covered with skin; occipital process narrow, not extending to the small dorsal plate; fontanel long and narrow, extending past anterior margin of eye; dorsal fin with a poorly developed spine; origin of dorsal not quite half as far from tip of snout as from base of caudal; adipose fin notably longer than head, its base 2.65 to 3.3 in body; caudal fin forked, the lower lobe the larger, rounded; anal fin short, its origin somewhat nearer base of caudal than base of pectorals; ventral fins inserted behind vertical from base of last dorsal ray, failing to reach origin of anal; pectoral fins rather short, the spine rather weak, and without barbs except in young, its length 1.8 to 2.45 in head.

Color bluish black above, pale below; sides yellowish green and with a single dark band in young. Dorsal fin with a dark band across middle and a lighter one below it.

Numerous specimens of this species were collected. It is found in all the streams of Panama. The specimens at hand vary in length from 45 to 350 mm. It is considered a food fish of some importance. In the Rio Tuyra Basin the Indians quietly wade around in the streams and seek their hiding places and take them with a spear. In this they are so adept that they seldom miss their aim.

Habitat: Streams of both slopes of Central America, from Costa Rica southward to Ecuador.

2. Genus *Pimelodus* Lacépède.

Pimelodus Lacépède, Hist. Nat. Poiss., V, 1803 (species of several genera); Cuvier, Règne Animal, II, 1817, 203 (species having a single band of teeth in upper jaw); Lütken, Dan. Vidensk-Selsk., Skr., (5) XII, 1875, 163 (type *Pimelodus maculatus* Lacépède = *Silurus clarias* Bloch).

Pseudariodes Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 99 (type *Pseudariodes clarias* Bloch).

Pseudorhamdia Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 101 (type *Pseudorhamdia maculata* Lacépède = *Silurus clarias* Bloch).

Body elongate, head covered with thin skin, granulose; occipital process reaching dorsal plate; humeral process broad; fontanel not continued beyond anterior margin of eyes; eye with a free orbital margin; one pair of maxillary barbels; 2 pairs of mandibular barbels; caudal fin forked.

2. *Pimelodus clarias punctatus* (Meek & Hildebrand).

Megalonema punctatum Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 77 (Rio Tuyra, Marrigante, Panama).

Megalonema robustum Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 78 (Rio Tuyra, Marrigante, Panama).

Head 3.9 to 4.1; depth 4.4 to 5.25; D. I, 6; A. 11 to 13.

Body elongate, compressed; dorsal region elevated; head not much wider than deep, its width 1.34 to 1.6 in its length; snout not very broad, its length 2.04 to 2.25 in head; eye 4.7 to 6; interorbital 2.94 to 4; width of mouth a little less than length of snout; maxillary barbels reaching opposite anal or to base of caudal; occipital process rather wide, not fully united with the dorsal plate, its greatest width greater than eye, except in young of less than 150 mm. in length; teeth in villiform bands, none on palatines or vomer; gill-membranes free from the isthmus; humeral process rather narrow, pointed slightly upward; dorsal spine equal to or a little longer than head, a rudimentary spine at its base;

origin of dorsal slightly nearer adipose than tip of snout; adipose fin shorter than head, 4.8 to 5.5 in length of body; caudal fin deeply forked, the upper lobe the longer; anal fin without distinct spine, its origin behind origin of adipose; ventral fins inserted under posterior rays of dorsal; pectoral spine with hooks on both sides in young, becoming smoother with age, 1 to 1.23 in head.

Color bluish above, pale silvery below. Young with numerous round specks or spots on head and side, which become fewer with age and wholly disappear in specimens of 200 mm. and more in length. Fins unmarked.

We have 8 specimens of this species, ranging in length from 142 to 300 mm. All are from the lower Rio Tuyra, some of them from below the head of tide water.

This fish is probably not distinct from *P. clarias* (Bloch) of which there are at hand numerous specimens from the Rio Atrato and Rio Magdalena. However, we do not find the dark spots, so characteristic in the young from the Rio Tuyra, present in the specimens from the more southern streams. The occipital process apparently is also slightly wider in the Rio Tuyra specimens. Our specimens may, therefore, be considered a variety of *P. clarias* with dark spots present in all except the adults.

Habitat: Rio Tuyra Basin.

3. Genus *Pimelodella* Eigenmann & Eigenmann.

Pseudorhamdia (non Bleeker) Steindachner, Sitzb. K. Ak. Wiss. Wien,

LXXIV, 1876, 604 (type *Pimelodus lateristriga* Müller & Troschel).

Pimelodella Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd. Ser., I,

1888, 131 (type *Pimelodus cristatus* Müller & Troschel).

This genus differs from *Pimelodus* in having a narrower and more spine-like humeral process and the fontanel extends farther back, notably past anterior margin of eye. Only a single species is found in the waters of Panama.

3. *Pimelodella chagresi* (Steindachner).

Pimelodus (*Pseudorhamdia*) *chagresi* Steindachner, Sitzb. K. Ak. Wiss.

Wien, LXXIV, 1876, 584 (Rio Chagres and its tributaries).

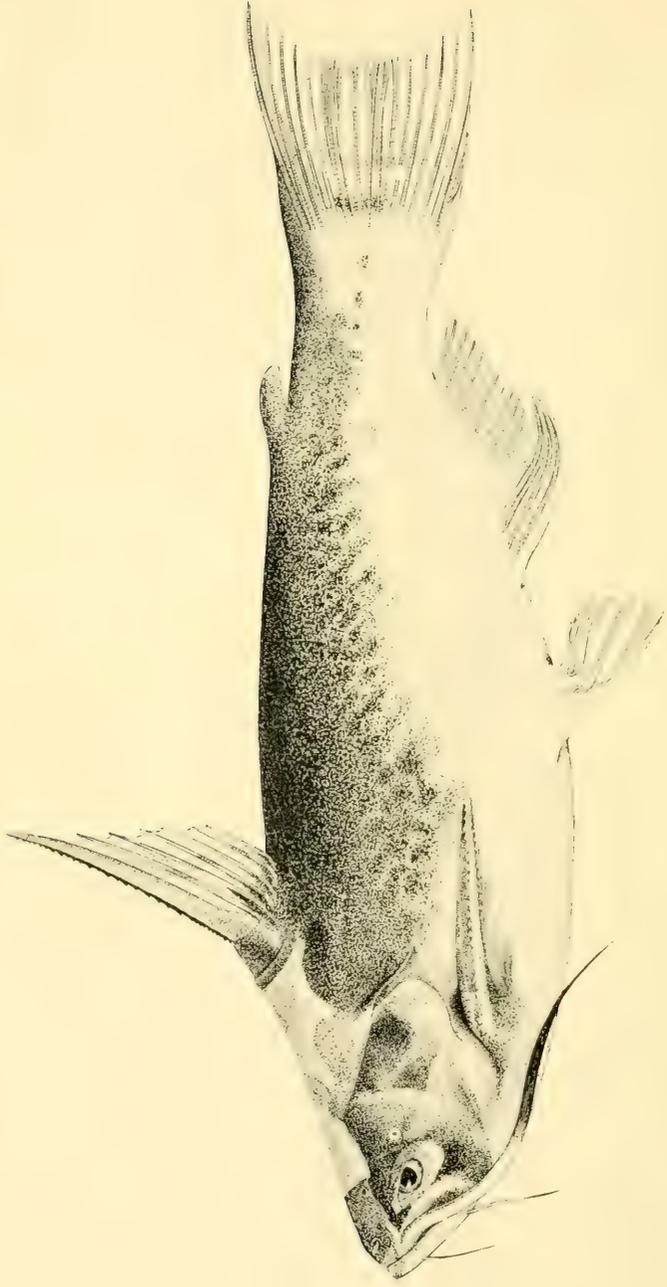
Pimelodella chagresi Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd.

Ser., I, 1888, 134 (Rio Obispo), and Occ. Pap. Cal. Ac. Sci., I, 1890,

160 (Rio Chagres and its tributaries).

Head 3.8 to 4.7; depth 5.2 to 6.2; D. I, 6; A. 11 or 12.

Body elongate, compressed, the dorsal region moderately elevated; head rather narrow; snout tapering, 2.3 to 2.7 in head; eye 3.85 to 4.6;



TRACHYCORYSTES AMBLOPS (Macleod & Hildebrand).
From a specimen 138 mm. in length.

interorbital 4.13 to 4.73; mouth narrower than length of snout; upper jaw a little in advance of the lower; maxillary barbels usually reaching to or somewhat past origin of anal; teeth in villiform bands, none on vomer or palatines; occipital process long and narrow, reaching dorsal plate; fontanel long and narrow, reaching backward to or a little beyond posterior margin of pupil; origin of dorsal about midway between tip of snout and origin of adipose; dorsal spine a little longer than eye and snout; adipose fin varying in length, but always longer than head, 3 to 3.95 in length of body; caudal fin deeply forked, the upper lobe much the longer, notably longer than head; anal fin without a spine, its origin a little behind origin of adipose; ventral fins failing to reach origin of anal, inserted just behind vertical from base of last dorsal ray; pectoral fins rather short, the spine without hooks on its distal third or fourth, but with strong hooks on basal portion, its length 1.2 to 1.63 in head.

Color greenish, with a jet black lateral band and another pair of bands on each side of median line of back, extending from nape to upper surface of caudal peduncle. Fins unmarked.

This species is represented by numerous specimens, ranging in length from 40 to 142 mm. Common on both slopes of Panama.

This species can inflict most painful wounds with its fin spines, which bear poison glands at the base.

Habitat: Both slopes of Panama.

4. Genus *Trachycorystes* Bleeker.

Trachycorystes Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 88 (type *Trachycorystes typus* Bleeker = *Auchenipterus trachycorystes* Cuvier & Valenciennes).

Parauchenipterus Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 88 (type *Parauchenipterus galeatus* Linnæus).

Body elongate or robust, covered with naked skin; occipital firmly joined to dorsal plate; lower jaw usually projecting; mandibular barbels in 2 pairs, one pair of maxillary barbels; teeth in villiform bands, none on vomer or palatines; eye small, lateral, covered with skin; dorsal with a spine and from 4 to 6 rays; adipose fin shorter than anal; caudal fin obliquely truncate, emarginate or rather deeply concave, the lobes round or pointed; outer margin of pectoral spine serrate.

4. *Trachycorystes amblops* (Meek & Hildebrand).

Felichthys amblops Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 77 (Rio Tuyra, Marrigante, Panama).

Head 3.7 to 4.35; depth 3.85 to 5.25; D. I, 5; A. 17 to 20.

Body rather robust; profile from snout to dorsal straight and gently elevated in female, concave in adult males; head depressed, its width 1 to 1.8 in its length; posterior part of body rather strongly compressed; snout short, broad, about equal to diameter of eye; eye 4.4 to 6.65 in head; interorbital 1.53 to 1.63; mouth broad; a pair of maxillary barbels, with a bone extending to anterior margin of eye in female, almost or quite to gill-opening in male; chin with 2 pairs of barbels; teeth in the jaws in bands; gill-opening small; dorsal plate rather broad; humeral process narrow, pointed slightly upward; dorsal spine in female somewhat shorter than head, notably longer than head in the male, with barbels on its anterior margin, at least in young and in males; origin of dorsal more than half as far from tip of snout as from tip of adipose; adipose fin over posterior part of anal; caudal fin forked, both lobes pointed, equal to or longer than head; anal fin rather low, with heavy membrane on its base, length of its base shorter than width of head; ventral fins reaching origin of anal; dorsal fin not nearly reaching base of ventrals, the spine usually about equal to length of head.

Color dark above, pale below; sides variously spotted or marked with black. Usually with a dark spot or elongate blotch on middle of side below dorsal; some specimens with roundish black spots on sides of head and caudal peduncle. Fins unmarked. Our largest specimen much darker than the others.

There are 8 specimens in the present collection, ranging in length from 87 to 192 mm. All are from the lower Rio Tuyra. One specimen is from several miles above and the others from several miles below the head of the tide.

This species is very closely related to *T. fisheri* Eigenmann, from which it differs mainly in the shape of the caudal, which has a much more concave margin, and longer and more pointed lobes. It also differs from the latter in the more posterior position of the dorsal and in the shorter anal.

Habitat: Rio Tuyra Basin.

5. Genus *Ageneiosus* Lacépède.

Ageneiosus Lacépède, Hist. Nat. Poiss., V, 1805, 132 (type *Ageneiosus armatus* Lacépède).

Pseudogeneiosus Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 108 (type *Ageneiosus brevifilis* Cuvier & Valenciennes).

Body elongate; snout much longer than eye, with maxillary barbels only; eyes lateral; the orbit without a free margin; occipital process

firmly joined to the dorsal plate; humeral process wanting; gill-membranes joined to the isthmus; dorsal fin with a rather weak spine and 6 or 7 rays, its origin in advance of ventrals; adipose fin very short; anal fin long.

5. *Ageneiosus caucanus* Steindachner.

Ageneiosus caucanus Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1880, 61, Pl. VI, figs. 1 & 2 (Rio Cauca); Eigenmann & Eigenmann, Occ. Pap. Cal. Ac. Sci., I, 1890, 306.

Head 3.5 to 3.8; depth 6.1 to 7.45; D. I, 6; A. 32 to 40.

Body elongate, compressed; profile from snout to dorsal deeply concave in large males, only slightly concave in females; head low; snout very broad, much depressed, its length 1.77 to 2 in head; eye small, lateral, covered by a membrane, 5 to 10 in head; interorbital width 1.88 to 2.46; mouth wide, its width greater than length of snout; a pair of maxillary barbels present, very small in the female; with a stiff bone, extending to or beyond angle of mouth in the male; teeth in villiform bands, the one in upper jaw about as wide as eye, none on vomer or palatines; upper surface of head with a few rather prominent ridges and striations, covered with thin skin; a long narrow frontal fontanel; dorsal spine in the female rather weak and shorter than snout, much longer in the male, and with strongly developed barbs on its anterior side; origin of dorsal not much behind base of pectorals, a little more than half as far from tip of snout as from tip of adipose; adipose fin small, its base not longer than eye, over posterior fifth of anal; caudal fin forked, the lobes of about equal length; anal fin long, its base equal to or longer than head, the spine much more strongly developed in the male than in the female; ventral fins usually not quite reaching origin of anal; pectoral fins failing to reach ventrals, the spine 1.93 to 2.25 in head.

Color yellowish creamy. The back in some specimens uniform bluish black. In others this color is broken up into stripes, or blotches. Sides with dark spots varying notably in size among the individuals. There is usually a series of spots forming a row from just above angle of gill-opening backward. Dorsal fin usually with dark spots. Caudal fin with a dark longitudinal bar on its upper lobe and a single blotch on the lower lobe. In very large examples both lobes bear several dark blotches, but no definite bar. Anal and ventrals unmarked; pectorals with or without a few dark blotches.

There are 45 specimens of this species in the Panama collection. They range from 130 to 460 mm. in length. All are from the lower Rio Tuyra, some of them from below the head of tide water and others from as far up as Boca de Cupe.

We have at hand for comparison a few large male specimens from the Rio San Juan, Colombia. With these our specimens seem to agree in all characters of specific importance.

Habitat: Rio Tuyra Basin, Panama, and south to Ecuador.

Family II. Loricariidæ.

Sides and back and sometimes the lower surface covered with bony plates, these often provided with teeth-like spines; mouth wholly inferior, provided with reflected, disk-like lips; premaxillaries not protractile; maxillary bone thin, bearing a barbel which is partly united with the oval disk; no mental or nasal barbels; teeth if present hooked and in a single series; no teeth on palatines; no frontal or occipital fontanel; nostrils close together; gill-membranes broadly joined to the isthmus; dorsal fin present, situated on the abdominal portion of the spinal column and not connected with the occipital by processes; adipose fin, if present, composed of a spine and a membrane; anal fin usually present, short; alimentary canal very long, coiled.

MEASUREMENTS.

In the present work the length of head in this family is measured to the margin of the temporal plates which usually extend to above base of pectorals; the total length of body is measured to tip of longest ray of caudal, exclusive of filament, if present; the standard length as usual is measured to base of caudal fin; by the mandibular ramii are meant the two bones bearing teeth, forming the posterior border of the mouth and corresponding to the lower jaw in other fishes.

KEY TO THE GENERA.

- a. Body rather short, robust; caudal peduncle short, compressed; adipose fin usually present.
- b. Adipose and anal fins present.
- c. Scutes on back and sides distinctly carinate; opercle firmly attached to the interopercle and not independently movable.
Plecostomus, p. 247
- cc. Scutes on back and sides without prominent ridges or carinations; opercle more or less freely movable.
- d. Margin of snout naked, with or without tentacles.
- e. Snout without tentacles; mandibular ramus about equal to interorbital.
Chatostomus, p. 249.

- ee. Margin of snout bearing tentacles, long and numerous in the male, short and few in female; mandibular ramus much narrower than interorbital. *Ancistrus*, p. 250.
- dd. Margin of snout with granules and bristles; mandibular ramus notably shorter than interorbital. *Lasiancistrus*, p. 253.
- bb. Adipose and anal fins wanting; margin of snout granular, bearing short bristles; mandibular ramus nearly equal to interorbital. *Leptoancistrus* gen. nov., p. 254.
- aa. Body long and slender; caudal peduncle very long, strongly depressed; adipose fin wanting.
- f. Eye with a distinct orbital notch; teeth usually bifid, and in small or moderate numbers. *Loricaria*, p. 255.
- ff. Eye without an orbital notch; teeth setiform, numerous. *Oxyloricaria*, p. 261.

6. Genus *Plecostomus* Gronow.

Plecostomus Gronow, Mus. Ichth., I, 1754, 24 (sp.); Gronow, Zooph. Gronov., 1763, 127; Bleeker, Nederl. Tijdschr. Dierk. I, 1863, 77 (type *Plecostomus brasiliensis* Bleeker = *Loricaria plecostomus* Linnæus).

Hypostomus Lacépède, Hist. Nat. Poiss., V, 1803, 144 (type *Hypostomus guacari* Lacépède).

Body elongate; back and sides completely covered with carinate bony scutes; first scute of lower lateral series separating the second scute entirely from the temporal plate; lower surface of head and abdomen naked or covered with small granular scales; snout granular; opercle with or without marginal bristles, firmly attached to the interopercle and not capable of independent movement; premaxillaries and dentaries of about equal length, each with slender bifid teeth; adipose fin present; caudal fin emarginate. A large genus of which but one species is represented in the rivers of Panama.

6. *Plecostomus plecostomus* (Linnæus).

Loricaria plecostomus Linnæus, Syst. Nat., Ed. 12, I, 1766, 508 (America).

Hypostomus guacari Lacépède, Hist. Nat. Poiss., V, 1803, 145 (America).

Loricaria flava Shaw, Gen. Zool., V, 1805, 38, Pl. 101.

Hypostomus plecostomus Schomburgk, Fishes Brit. Guiana, I, 1841, 139 (Rio Branco).

Hypostomus robinii Gill, Ann. Lyc. Nat. Hist. N. Y., VI, 1858, 46 (Trinidad).

Plecostomus brasiliensis Bleeker, "Silures de Suriname," 1864, 7 (Surinam).

Plecostomus plecostomus Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd Ser., I, 1888, 169.

Plecostomus seminudus Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd Ser., I, 1888, 169 (Brazil).

Plecostomus boulengeri Eigenmann & Kennedy, Proc. Ac. Nat. Sci. Phila., 1903, 502 (Paraguay).

Head 3 to 3.44; depth 4.4 to 5.3; D. I, 7; A. I, 4; lateral scutes 25 to 28.

Body anteriorly depressed, wider than deep; caudal peduncle posteriorly compressed; dorsal profile anteriorly convex; ventral surface straight, flat; head low and wide; snout broad, its margin granulate except a small triangular area at tip, 1.6 to 1.75 in head; eye 5.25 to 10; interorbital 2.2 to 2.9; mouth wholly inferior; the lips broad, expanded, forming a sucking disc; a single short barbel at angle of mouth; teeth placed on the ramii of the jaws, slender, bifid, curved inward near tip; the ramus of lower jaw 2 to 3.35 in interorbital; occipital and temporal plates each with a median ridge, the former bordered posteriorly by only a single scute; scutes on upper surface of body carinate, spinulose; 3 scutes in advance of dorsal; 6 or 7 between dorsal and adipose; 13 to 15 from anal to base of caudal; ventral surface in advance of vent mostly covered with small granular scales; dorsal fin inserted in advance of anal, nearer tip of snout than adipose fin, its base a little shorter than head, its spine usually about length of head, 2.9 to 3.75 in length; adipose fin well developed, situated somewhat nearer base of caudal than base of last ray of dorsal; caudal fin emarginate, the lobes produced, the lower one usually the longer; anal fin small, its origin a little behind base of last ray of dorsal; ventral fins rather large, reaching well past origin of anal; pectoral fins long, reaching far beyond base of ventrals, the spine much enlarged in adults, bearing recurved spinules.

Color above dark green; head and ventral surface with green spots, these varying notably in size among individuals; fins usually bluish green, with large spots of pale green, those on lower fins arranged so as to form more or less distinct bars.

This species is represented by 150 specimens, ranging in length from 40 to 400 mm. It was found fairly common on both slopes of Panama, except in the Rio Bayano Basin where no specimens were obtained.

This fish lives in rocky streams and is difficult to catch with a seine. Most of our specimens were secured by the use of a set net, in which they readily become entangled.

Habitat: Both slopes of Panama, south to Uruguay.

7. Genus *Chætostomus* Tschudi.

Chætostomus Tschudi, Fauna Peruana, Pisc., XV, 1840, 489 (type *Chætostomus loborhynchus* Tschudi).

Body elongate, anteriorly depressed, wider than deep, ventral surface flat; head low, broad; snout obtuse, with a naked margin and without spines or tentacles; plates on head rather smooth, without ridges or carinations; back and sides covered with spinulate but not carinate scutes; lower surface of head and abdomen naked; mandibular ramus nearly equal to interorbital width. Adipose fin present. This genus is represented by a single species in Panama.

7. *Chætostomus fischeri* Steindachner.

Chætostomus fischeri Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1879, 162, Pl. IV (Rio Mamoni, near Chepo); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 16; Regan, Trans. Zool. Soc. London, XVII, Pt. III, 1904, 248.

Head 3 to 3.25; depth 5.15 to 6; D. I, 8; A. I, 5; lateral scutes 24 or 25.

Body anteriorly depressed; caudal peduncle posteriorly compressed; dorsal profile convex; ventral surface straight and flat; head low and wide, its upper surface spinulate, but without ridges or carinations; snout obtuse, its margin without granules, spines or tentacles, 1.5 to 1.65 in head; eye 6.7 to 9.3; interorbital 2.95 to 3.6; mouth wholly inferior, broad; the lips expanded, papilose, forming a sucking disc, the lower lip with small lobes along its posterior margin and a small barbel on its lateral margin near angle of mouth; teeth situated on the ramii of the jaws, small, numerous, slender, bifid and curved inward near the tips, the ramus of lower jaw 1 to 1.3 in interorbital; interopercle with 1 or 2 short spines; back and sides completely covered with spinulate but not carinate scutes, 6 scutes between dorsal and adipose, 10 or 11 from anal to base of caudal; lower surface of head and abdomen completely naked; dorsal fin inserted a little in advance of base of ventrals, somewhat nearer tip of snout than adipose fin, its base equal to distance from the base of its last ray to tip of adipose, its spine 1.15 to 1.45 in head; adipose fin well developed, inserted slightly nearer base of upper ray of caudal than base of last ray of dorsal; caudal fin emarginate, the lower rays the longest; anal fin small, its origin a little behind last ray of dorsal; ventral fins reaching past origin of anal; pectoral fin large, reaching beyond middle of ventrals; the spines of all the fins with spinules.

Color uniform black above; abdomen white. Tips of dorsal and caudal reddish in life.

Of this species 62 specimens, ranging from 30 to 260 mm. in length, were preserved. It is common in the Rio Tuyra Basin, but only a few specimens were obtained in the Rio Bayano and a single specimen in the Rio Chagres. The last was speared at night by torch light by a native at Alhajuela.

This species lives among the rocks, apparently preferring the rapid courses of streams. In clear water it may often be seen huddled close to the rocks to which it is able to attach itself by means of its sucking mouth and flat ventral surface. It feeds on algæ and other plants. Its alimentary canal is convoluted and many times the length of the body. It is prepared as food by the natives of Darien, by boiling it in water.

Habitat: Both slopes of Panama.

8. Genus *Ancistrus* Kner.

Ancistrus Kner, Denkschr. K. Ak. Wiss. Wien, VII, 1853, 272 (sp.);

Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 77 (type *Hypostomus cirrhosus* Cuvier & Valenciennes).

Thysanocara Regan, Ann. & Mag. Nat. Hist., Ser. 7, XVII, 1906, 95 (type *Hypostomus cirrhosus* Cuvier & Valenciennes).

Body anteriorly broad; caudal peduncle posteriorly compressed; margin of snout naked, bearing tentacles; the naked margin broad in males and with many tentacles, narrow in the females and with few short tentacles; preopercle independently movable, bearing spines; the premaxillaries and dentaries of about equal length, the mandibular ramus much narrower than interorbital; plates on head and scutes on body without prominent ridges or carinations; adipose fin well developed.

KEY TO THE SPECIES.

- a. Fins moderately elevated, the posterior rays of the dorsal failing to reach adipose when deflexed; base of dorsal scarcely equal to the distance from the base of the last ray to the tip of the spine of the adipose; pectoral fins failing to reach the middle of the ventrals, the spine notably shorter than the head; second scute behind occipital without a distinct median suture.

chagresi, p. 251.

- aa. Fins strongly elevated, the posterior rays of dorsal reaching past origin of adipose when deflexed; base of dorsal equal to the distance from the base of the last ray to the base of caudal; pectoral fins reaching to or past the middle of ventrals, the spine longer than head; second scute behind occipital with an evident median suture.

spinus sp. nov., p. 252.

8. *Ancistrus chagresi* Eigenmann & Eigenmann.

Ancistrus cirrhosus (non Cuvier & Valenciennes) Kner & Steindachner, Abhandl. K. Beyer. Ak. Wiss. München, X, 1864, 61 (Rio Chagres).

Chatostomus cirrhosus Günther, Trans. Zool. Soc. London, 1866, 478 (Rio Chagres).

Ancistrus chagresi Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd Ser., II, 1889, 47 (Rio Chagres), and Occ. Pap. Cal. Ac. Sci., I, 1890, 446.

Xenocara chagresi Regan, Trans. Zool. Soc. London, XVII, Pt. 3, 1904, 256 (Rio Chagres).

Head 2.55 to 2.9; depth 4.7 to 5.75; D. I, 7; A. I, 3 or 4; lateral scutes 24 to 26.

Body anteriorly broad, depressed; caudal peduncle posteriorly compressed; dorsal profile anteriorly gently convex; ventral surface straight and flat; head broad, the interorbital width nearly equal to depth of body, 2.05 to 2.3 in head; snout obtuse, the margin naked; naked portion broad in the males and narrow in females, in the former with well developed tentacles on the margin and a V-shaped patch above near tip of snout; tentacles varying much in number and length among individuals; females with only a few short tentacles along or a little below the margin of snout; length of snout 1.6 to 1.75 in head; eye 7 to 11; mouth rather wide; the lips expanded, with straight margin; barbel on lateral margin of lower lip minute; the premaxillaries quite as long as the dentaries; mandibular ramus 2.45 to 3.2 in interorbital width; teeth slender, bifid, curved inward near the tips; interopercle with from 9 to 15 spines of various lengths, which also vary much among individuals, longer in the male than in the female; sculpture of head without ridges or carinations; scutes on back and sides not carinate, but with strong serrations on their margins; occipital bordered by 3 scutes; the second median scute without a distinct median suture; 6 or 7 scutes between dorsal and adipose, 11 or 12 from anal to base of caudal; lower surface of head and abdomen naked; dorsal fin moderately elevated, the posterior rays when deflexed failing to reach adipose by at least one row of scutes, the spine 1.2 to 1.5 in head; base of dorsal scarcely equal to distance from base of last ray to tip of the spine of the adipose; adipose fin well developed; caudal fin with a straight oblique or slightly concave margin, the lower rays the longest; anal fin small, its origin at vertical from base of last ray of dorsal; ventral fins reaching past origin of anal; pectoral fins reaching past base of ventrals, but failing to reach the middle of these fins, the spine notably shorter than head.

Color uniform dark above or occasionally with small greenish spots on head and predorsal region; abdomen usually with pale green spots

which vary in size, shape and number among individuals; fins all brownish green with pale green spots.

The Panama collection contains 56 specimens, ranging from 45 to 255 mm. in length. Fifty-four of these are from the Rio Chagres Basin. The other two were taken in the Rio Chorrera, a small stream on the Pacific slope west of Panama City.

Habitat: Rio Chagres and Rio Chorrera, Panama.

9. *Ancistrus spinosus* sp. nov.

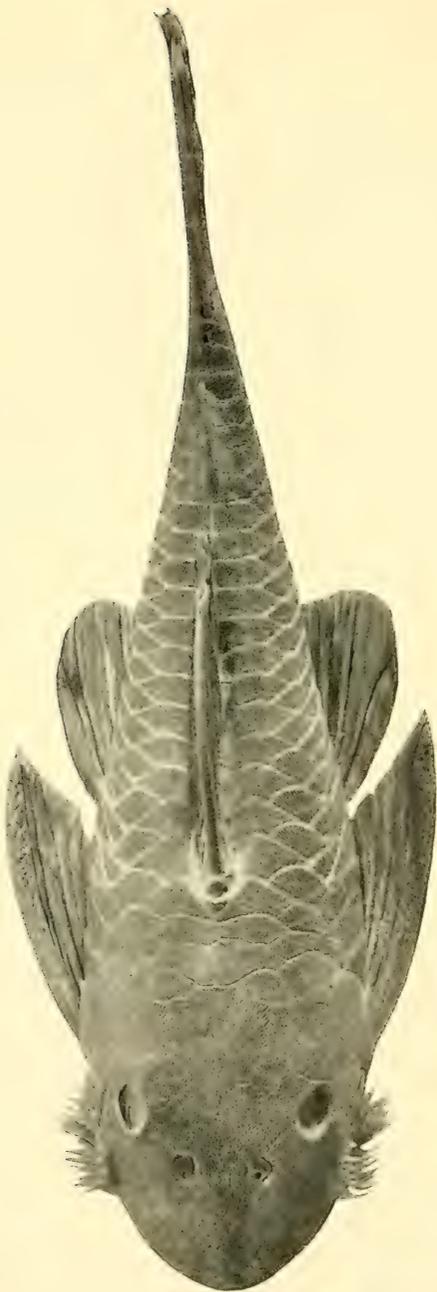
Type No. 8942, F. M. N. H.; length 135 mm.; Rio Calobre, tributary of the Rio Bayano, Panama.

Head 2.65 to 2.77; depth 4.6 to 4.7; D. I, 7; A. I, 4; lateral scutes 24.

Body broad anteriorly; caudal peduncle posteriorly compressed; head broad; interorbital width nearly equal to the depth of body, 1.95 in head; snout obtuse, the naked portion narrow in the female and with only 4 small tentacles, much wider in the male with a fringe of tentacles along the margin and a V-shaped patch on the upper surface at the tip; length of snout 1.63 to 1.7 in head; eye 8.75; mouth wide; the lips expanded; the lower lip with a small barbel, shorter than eye, on its lateral margin; the premaxillaries and dentaries equal in length; mandibular ramus 3.1 to 3.6 in interorbital width; teeth slender, bifid, curved inward near the tips; interopercle with from 8 to 12 spines, curved outward and forward near the apices, longer in the male than in the female; sculpture of head without ridges or carinations; scutes on back and sides not carinate, their margins very strongly serrate, especially in the male; occipital posteriorly bordered by 3 scutes; the second median scute with an evident median suture; 6 scutes between dorsal and adipose; 11 or 12 between anal and base of caudal; lower surface of head and abdomen naked; dorsal fin very high, the posterior rays when deflexed reaching past origin of adipose, the spine 1.15 to 1.2 in head; base of dorsal equal to distance from the base of its last ray to base of caudal; adipose fin well developed; caudal fin with a nearly straight oblique margin, the lower rays the longest; anal fin small, its origin slightly behind vertical from base of last ray of dorsal; ventral fins reaching well beyond base of anal; pectoral fins very long, reaching to or past the middle of ventral, the spine a little longer than the head.

Color uniform dark above. The male plain brownish below; the female with faint pale spots on abdomen; fins in male plain brownish, in female with faint pale spots.

Apparently a rare species. There are at hand only 2 specimens, a male and female, respectively 130 and 135 mm. in length. The male was taken at the mouth of the Rio Yape, tributary of the Rio Tuyra;



LASIANCISTRUS PLANICEPS (Meek & Hildebrand).
From a specimen 133 mm. in length.

and the female, which we designate as the type, was taken in the Rio Calobre, tributary of the Rio Bayano.

Differing from *A. chagresi* principally in the higher fins. The male specimen has but 6 rays in the dorsal, but this may be due to an injury, as the fin apparently was mutilated sometime during the fish's career.

9. Genus *Lasiancistrus* Regan.

Lasiancistrus Regan, Proc. Zool. Soc. London, XVII, Pt. III, 1904, 224 & 237 (type *Chatostomus heteracanthus* Günther).

Body broad anteriorly; caudal peduncle posteriorly compressed; head without prominent ridges, the plates not carinate; scutes on back and sides spinulate but not carinate; lower surface of head and abdomen naked; margin of snout with granules and bristles; premaxillaries quite as long as the dentaries; mandibular ramus notably shorter than interorbital width; preopercle more or less freely movable, armed with rather strong spines, the apex of each spine bent outward and forward; D. I, 7; adipose fin well developed.

10. *Lasiancistrus planiceps* (Meek & Hildebrand).

Ancistrus planiceps Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 79 (Rio Tuyra, Boca de Cupe, Panama).

Head 2.6 to 2.9; depth 5.3 to 6.9; D. I, 7; A. I, 5; lateral scutes 24 or 25.

Body broad, low, depressed anteriorly; caudal peduncle posteriorly compressed; dorsal profile nearly straight from eyes to dorsal; ventral surface anteriorly broad and flat; head low and very wide; snout moderately acute, its margin with granules and bristles, 1.6 to 1.85 in head; eye 7 to 10; interorbital 2.25 to 2.45; mouth of moderate width, the lips expanded, forming a sucking disc; the margin of lower lip nearly smooth, with a very small barbel, shorter than eye, on its lateral margin behind angle of mouth; teeth small, bifid and curved inward near the tips; premaxillaries a little longer than the dentaries; the mandibular ramus 3 to 4 in interorbital width; interopercle with about 20 spines which vary greatly in length among individuals; sculpture of head without carinations and without ridges, except for a broad, low ridge on median line of snout; scutes on back and sides spinulate, the first median scute behind occipital anteriorly convex, broadest at median line of back; 7 scutes between dorsal and adipose, 11 or 12 between anal and base of dorsal; lower surface of head and abdomen completely naked; dorsal fin high, the posterior rays when deflexed failing to reach adipose by 1 or 2 rows of scutes, its spine longer than snout and eye, 1.3 to 1.5

in head; origin of dorsal slightly nearer adipose than tip of snout; adipose well developed, inserted a little nearer base of caudal than base of last dorsal ray; caudal fin with an oblique or slightly concave margin, the lower rays the longest; anal fin small, its origin behind last ray of dorsal; ventral fins reaching well past origin of anal; pectoral fins very long, reaching beyond the middle of ventrals, longer than head.

Color uniform dark above; ventral surface of head and abdomen brownish, with or without bluish spots. Fins with dark spots on the rays and pale ones on the interradiar membranes, sometimes forming wavy bars on the fins. The spots most distinct in our largest specimens.

There are 31 specimens in the Panama collection, ranging from 35 to 235 mm. in length. All are from the Rio Tuyra Basin.

We have for comparison 4 specimens (paratypes) from Cartago, Atlantic slope of Colombia, of the rather closely related species, *L. caucanus* Eigenmann (Indiana University Studies, No. 16, 1912, 11). The latter differs from *L. planiceps* in the slightly deeper body, lower dorsal and pectoral fins, in the shape of the first median scute behind occipital, and in color.

10. Genus *Leptoancistrus* gen. nov.

Type *Acanthicus canensis* Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 80.

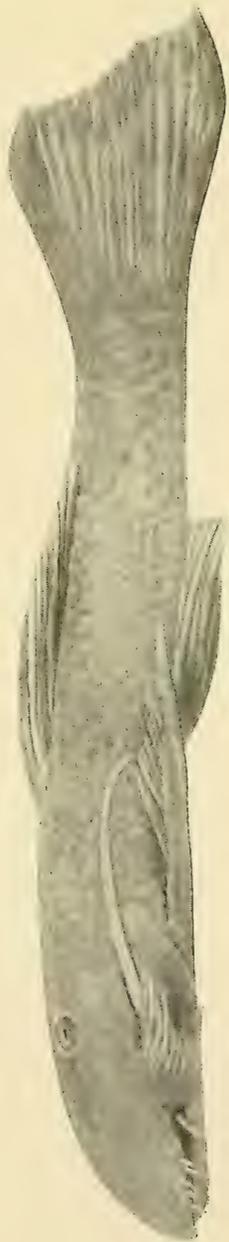
Body anteriorly low and broad; snout granular to its margin, bearing short bristles; head and body without prominent ridges or carinations; interopercle freely movable, bearing spines which cannot be retracted under the opercle; premaxillaries and dentaries of about equal length; the mandibular ramus nearly equal to interorbital width; the first scute of lower lateral series separating the second scute from the temporal plate; adipose and anal fins wanting.

11. *Leptoancistrus canensis* (Meek & Hildebrand).

Acanthicus canensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 80 (Rio Cana, Cana, Panama).

Head 2.53 to 2.83; depth 5.5 to 6.45; D. I, 8; lateral scutes 22 or 23.

Body very broad anteriorly, more than twice as wide as deep; caudal peduncle posteriorly compressed; head low and very broad; snout broadly semicircular, granular to the margin, the latter bearing short bristles, its length 1.45 to 1.7 in head; eye very small, 7.5 to 10; interorbital 3 to 3.63; mouth wide; the lips expanded, the margin of the upper following margin of snout; the margin of lower lip fringed, with a minute barbel opposite angle of mouth; teeth slender, bifid, curved



LEPTOANCISTRUS CANENSIS (Meek & Hildebrand).
From a specimen 65 mm. in length.

inward near the tips; premaxillaries and the dentaries of about equal width; mandibular ramus about equal in length to interorbital width, 3.25 to 4 in length of head; interopercle freely movable, bearing about 8 enlarged spines and several short ones, the longest spine usually reaching lower third and occasionally to the middle of pectoral; head and snout without prominent ridges or carinations; scutes on body spinulose, but not carinate; ventral surface of head and abdomen naked, also nearly the entire ventral surface of caudal peduncle, the median line posteriorly crossed by a single scute; occipital bordered by 2 scutes; 3 median scutes in advance of dorsal; dorsal fin moderately elevated, the spine 1.65 to 2.15 in head, its origin a little in advance of ventrals, nearer tip of snout than base of caudal; base of dorsal about equal to length of snout; adipose fin wanting; caudal peduncle above with a low keel; caudal fin obliquely truncate, the lower rays the longest; anal fin wanting; ventral fins moderately developed, equal to or slightly longer than snout; pectoral fins large, reaching base of anal in young, and to or past middle of ventrals in adult.

Color dark gray above; pale below. Fins with dark spots on rays, most numerous on dorsal and caudal on which they form more or less distinct bars.

There are at hand 52 specimens of this species. They vary in length from 25 to 75 mm. All are from small mountain streams near Cana in the upper Rio Tuyra Basin.

11. Genus *Loricaria* Linnæus.

Loricaria Linnæus, Syst. Nat., Ed. X, 1758, 307; Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 80 (type *Loricaria dura* Linnæus = *Loricaria cataphracta* Linnæus).

Body elongate, usually depressed throughout; snout pointed or rounded; ventral surface flat, the abdomen wholly or in part covered with bony or granular plates, or sometimes with small granules or entirely naked; orbit with posterior notch; teeth bifid, not setiform, in small or moderate numbers; caudal fin emarginate, one or both of the outer rays often produced.

KEY TO THE SPECIES.

- a. Ventral surface of abdomen completely armed with bony plates.
- b. Lateral keels 2, becoming united on the 15th or 16th scute; predorsal scutes feebly carinate; abdomen with several series of small plates between the enlarged lateral ones; no naked area behind pectoral; maxillary barbel shorter than eye. *uracantha*, p. 256.

- bb. Lateral keels 3, the upper one present on 8th or 9th scute, the other two approximated on the 16th to 18th scute; predorsal scutes strongly carinate; abdomen with 2 series of plates between the enlarged lateral series; a naked area behind pectoral; maxillary barbel longer than eye. *filamentosa latiura*, p. 257.
- aa. Ventral surface of abdomen partly naked.
- c. Lateral keels 2; margin of lower lip with long fringes; maxillary barbel reaching to or past gill-opening; 3 or 4 teeth on each side in upper jaw. *variegata*, p. 258.
- cc. Lateral keels 3; lower lip with short fringes; maxillary barbel never reaching gill-opening; 8 to 10 teeth on each side in upper jaw.
- d. Anterior rays of dorsal reaching past posterior rays when deflexed, the longest ray notably longer than head; anterior rays of anal reaching past posterior rays when deflexed, the longest ray longer than width of head. *capetensis*, p. 259.
- dd. Rays of dorsal reaching equidistant when deflexed, the longest ray not quite as long as head; rays of anal reaching equidistant when deflexed, the longest equal to width of head.

fimbriata, p. 260.

12. *Loricaria uracantha* Kner & Steindachner.

Loricaria uracantha Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München, X, 1866, 56, Pl. VI, figs. 3, 3a, 3b (New Granada; Rio Chagres); Günther, Trans. Zool. Soc. London, 1866, 393 and 478 (Atlantic and Pacific rivers of Panama); Eigenmann & Eigenmann, Occ. Pap. Cal. Ac. Sci., I, 1890, 370 (Atlantic and Pacific slopes of Panama); Regan, Trans. Zool. Soc. London, XVII, Pt. III, 1904, 278 (Panama).

Loricaria bransfordi Gill, Proc. Ac. Nat. Sci. Phila., 1876, 338 (Panama).

Head 4.3 to 4.9; depth 9.5 to 14; D. I, 7; A. I, 6; lateral scutes 28 or 29.

Body low, depressed throughout; caudal peduncle much broader than deep; head very low; snout obtuse, its margin granulate, or with very numerous short bristles in large males, the length 2 to 2.15 in head; a distinct orbital notch; eye 7 to 9.5 in head; interorbital with a ridge over each eye, 3.7 to 4.6 in head; mouth rather narrow; premaxillaries with about an equal number of bifid teeth, from 6 to 10 on each side; the lips large, papillose, the margin of the lower lip fringed; the barbel shorter than eye; lower surface of head naked, the rest of the head and body completely covered with bony scutes or plates; 2 lateral keels anteriorly, becoming completely united on the 15th or 16th scute; occipital and predorsal scutes carinate; scutes on chest and abdomen

mostly small, those between the ventral fins enlarged, a single large plate in advance of vent, bordered anteriorly by 3 enlarged scutes; 5 to 7 rows of small plates across the belly; 16 or 17 scutes from anal to base of caudal; origin of dorsal over or slightly behind base of ventrals; dorsal spine usually about equal to width of head; margin of caudal fin concave, the upper rays the longest; the upper spine enlarged, bearing a filament which is usually lost in preserved specimens; anal fin small, its origin a little in advance of the tips of the deflexed dorsal rays; ventral fins reaching nearly or quite to origin of anal; pectoral fins of about the same length as the ventrals, not quite reaching the base of the latter, 1.3 to 1.77 in head, with short bristles in adult male.

Color brownish above, pale below; the back with 5 or 6 dark cross-bars, the first one at nape very indistinct or wanting, the second under base of dorsal. Fins yellowish green, with dark spots on the rays.

There are numerous specimens in the present collection, ranging from 50 to 185 mm. in length. Although this species has been recorded from both slopes of Panama, our extensive collecting produced none from the Pacific side. We are therefore inclined to doubt the validity of the Pacific slope records. Our specimens are all from the Rio Chagres and its tributaries.

A common species, inhabiting shallow water with swift current, on either sandy or pebbly bottom.

In the National Museum we have examined presumably the type of *L. bransfordi* Gill, which evidently is an adult male of this species. The adult male has a broad head and many short bristles on margin of snout and pectoral fins.

Habitat: Panama.

13. *Loricaria filamentosa latiura* Eigenmann & Vance.

Loricaria filamentosa latiura Eigenmann & Vance, in Eigenmann, Indiana Univ. Studies, No. 16, 1912, 13 (Boca de Certegai, Colombia).

Loricaria tuyrensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 81 (Rio Capeti, Panama).

Head 4.1 to 4.6; depth 8.7 to 11.5; D. I, 7; A. I, 5; lateral scutes 30 or 31.

Body broad, strongly depressed throughout; caudal peduncle broad, its width at last anal ray 3.6 to 4 in its length; head low and broad, its width at gill-opening equal to or slightly less than head from that point to tip of snout; snout rather acute, granular to its margin, its length 1.75 to 1.83 in head; orbital notch distinct; eye 7.2 to 9 in head; mouth small; teeth bifid; each jaw with from 8 to 10 teeth on each side; lips papillose, fringed, barbel longer than eye, but failing quite notably

to reach gill-opening; temporal and occipital plates and predorsal scutes carinate; sides anteriorly with 3 keels, the upper one present on 8th or 9th scute, the second and third coming very close together, but not completely united, on the 16th to the 18th scute; ventral surface of head naked; abdomen completely armed, with a series of broad plates on each side and two narrower median rows; a naked area behind base of pectorals; vent anteriorly bordered by a single plate, which in turn is anteriorly again bordered by 3 or 4 smaller plates; 16 to 18 scutes from anal to base of caudal; origin of dorsal over base of ventrals; the anterior rays of dorsal reaching equidistant or slightly past the posterior rays when deflexed, the spine a little longer than the head; caudal fin with rather deeply concave margin, the upper spine produced in a filament; anal fin small, its margin convex, the anterior rays the longest, longer than width of head; ventral fins reaching well past origin of anal; pectoral fins of about the same length as the ventrals, reaching well past the base of the latter, 1.25 to 1.4 in head.

Color dark grayish brown above, slightly lighter below. The fins usually with dark spots on all of the rays.

This species is represented by 19 specimens, ranging from 265 to 355 mm. in length.

We have at hand the paratypes of this species with which we find our specimens to be identical.

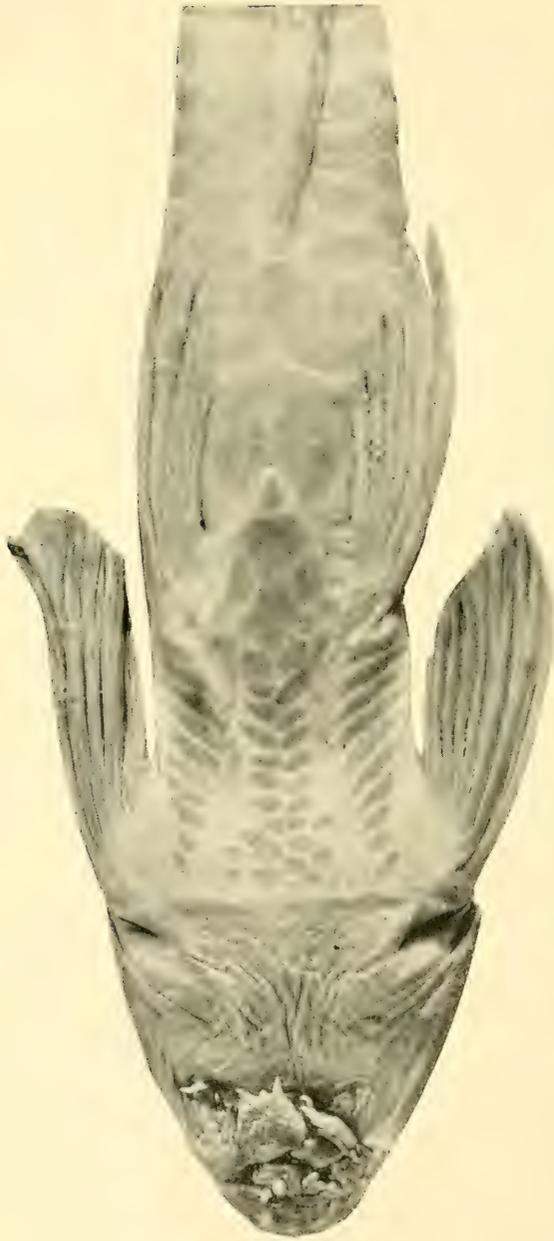
Habitat: Rio Tuyra and Rio Atrato basins.

14. *Loricaria variegata* Steindachner.

Loricaria variegata Steindachner, Denkschr. K. Ak. Wiss. Wein, XLI, 1879, 163, Pl. III (Rio Mamoni, near Chepo, Panama); Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd Ser., II, 1889, 36; Eigenmann & Eigenmann, Occ. Pap. Cal. Ac. Sci., 1890, 382.

Head 4.45 to 4.95; depth 12 to 14; D. I, 7; A. I, 5; lateral scutes 32 or 33.

Body much depressed throughout; head low and broad; snout rather acute, granulate to the margin, its length 1.75 to 2 in head; orbital notch distinct; eye 8.65 to 10.7 in head; interorbital 5.2 to 6; mouth narrow; upper jaw with only 3 or 4 teeth on each side, lower jaw with about 6 on each side; the lips papillose, with long fringes, the outer fringe or barbel of lower lip reaching to or past gill-opening; temporal and occipital plates, and predorsal scutes carinate; sides anteriorly with 2 keels, becoming united on the 14th or 15th scute; ventral surface of head naked; abdomen with a lateral series of scutes, bordered by a naked area, and then with a median row of quadrate, granular plates anteriorly, increased to 2 or 3 rows in advance of vent, which is bordered



LORICARIA CAPETENSIS Meek & Hildebrand.
From a specimen 103 mm. in length.

anteriorly by 2 slightly enlarged plates; a cross row of small plates varying from a few to several in number between pectorals; 18 or 19 scutes from anal to base of caudal; origin of dorsal over or slightly in advance of ventrals, the anterior rays of dorsal reaching past tips of the posterior rays when deflexed, not much shorter than head; caudal fin truncate, the upper rays the longest; the upper spine with a filament; anal fin small, the spine a little shorter than greatest width of head; ventral fin reaching a little past origin of anal, the spine somewhat produced, fleshy at tip; pectoral fins of about the same length as the ventrals, reaching nearly or quite to the base of the latter, 1.25 to 1.7 in head.

Color grayish above, pale below; upper surface sprinkled with small brownish dots and lines; 2 or 3 series of dusky spots sometimes present on the ventral surface of caudal peduncle; fin rays with dark spots, these most numerous on pectorals where they are not only present on the rays but on the interradial membranes also.

There are 6 specimens, ranging from 235 to 265 mm. in length, in the present collection. All are from the lower Rio Tuyra Basin. Although the type of this species was taken in the Rio Mamoni, no specimens were secured there by us.

15. *Loricaria capetensis* Meek & Hildebrand.

Loricaria capetensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 80 (Rio Capeti, tributary Rio Tuyra, Panama).

Head 4.8 to 4.9; depth 12 to 12.5; D. I, 7; A. I, 5; lateral scutes 30 or 31.

Body depressed throughout; head of moderate width; snout rather acute, its margin granulate, 1.8 to 1.9 in head; interorbital 5.6; mouth narrow; teeth bifid, the inner cusp much longer than the outer, each jaw with about 8 teeth on each side; the lips papillose, each with rather short fringes or tentacles, the longest not nearly reaching gill-opening; temporal and occipital plates and predorsal scutes striate and carinate; sides anteriorly with 3 keels, the third or upper one present on 11 or 12 scutes, the other 2 coming very close together, but not completely united on the 19th to 22nd scute; ventral surface of head naked; abdomen with a lateral row of plates, bordered on each side by a naked area, the median line with 2 or 3 rows of small granular plates, enlarged between the ventrals; a single enlarged plate in advance of vent; 17 or 18 scutes from anal to base of caudal; origin of dorsal slightly behind base of ventrals; the anterior rays reaching past the posterior when the fin is deflexed, the longest ray notably longer than head; caudal fin truncate, the upper spine produced into a filament, about equal to length of body

without head; anal fin small, the anterior rays reaching past the tips of the posterior when deflexed, the longest ray notably longer than width of head; ventral fins reaching origin of anal; pectoral fins a little longer than the ventrals, reaching notably past the origin of the latter, 1.2 to 1.25 in head.

Color grayish above, pale below; back with 4 or 5 indistinct cross-bars, the first one under base of dorsal. Fins with dark spots on the rays.

There are only 2 specimens in the present collection, the type and paratype, respectively 164 and 162 mm. in length. These were taken at the mouth of the Rio Capeti, tributary of the Rio Tuyra.

Evidently very closely related to *L. filamentosa seminuda* Eigenmann & Vance. We have unfortunately no specimens of *seminuda* at hand, but through the kindness of Dr. Eigenmann we were enabled to examine some photographs of this variety. These indicate that *L. capetensis* has the abdominal plates much more weakly developed, leaving more of the abdomen naked. The head appears to be narrower. Its width at gill-opening is equal to its length from that point to tip of snout in *L. capetensis*; in *L. filamentosa seminuda* the width of head at this point is greater than its length from there to tip of snout. Our specimens are somewhat smaller than the one from which the photographs at hand were made, and it may be that the differences indicated are due to age. In that case *L. capetensis* would become a synonym of the latter.

16. *Loricaria fimbriata* Eigenmann & Vance.

Loricaria fimbriata Eigenmann & Vance, in Eigenmann, Indiana Univ.

Studies, No. 16, 1912, 12 (Boca de Certegai & Bernal Creek, Colombia).

Head 3.6 to 4.5; depth 12.3 to 13.5; D. I, 7; A. I, 5; lateral scutes 30 or 31.

Body depressed throughout; head of moderate width; snout acute, its margin granulate, 2.1 to 2.4 in head; orbital notch small; eye 5 to 6.65 in head; interorbital 5.5 to 6; mouth small, teeth bifid, the inner cusp much the longer, each jaw with about 8 teeth on each side; the lips papillose, the margins serrate; barbel short; temporal and occipital plates and predorsal scutes striate and carinate; sides anteriorly with 3 keels, the upper one present on about 11 scutes, the other 2 coming very close together, but not completely united, on the 20th or 21st scute; ventral surface of head naked; abdomen laterally with a series of inconspicuous granular plates and a few very small ones on median line of belly; 17 or 18 scutes from anal to base of caudal; origin of dorsal

over base of ventrals; the rays of dorsal reaching equidistant when fin is deflexed, the longest rays slightly shorter than head; caudal fin with concave margin, the upper lobe the longer, upper spine produced in a filament; anal fin small, the anterior rays not reaching beyond the posterior when deflexed, the longest ray equal to width of head; ventral fins reaching origin of anal; pectoral fins slightly longer than the ventrals, reaching a little past the base of the latter, 1.3 to 1.9 in head.

Color grayish; pale below; back with 5 or 6 dark cross-bars. Fins with dark spots on the rays.

Of this species there are 4 specimens, ranging in length from 50 to 80 mm. All are from the mouth of the Rio Capeti, tributary of the Rio Tuyra.

We have for comparison a paratype of this species, with which our specimens agree perfectly.

This species differs from *L. capetensis* in the smaller and more delicate scutes on abdomen, and in the shorter and differently shaped dorsal and anal fins.

12. Genus *Oxyloricaria* Bleeker.

Oxyloricaria Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 81 (type *Loricaria barbata* Kner).

This genus differs from *Loricaria* in the more numerous and setiform teeth and in the absence of the orbital notch.

KEY TO THE SPECIES.

- a. Snout somewhat produced, pointed, its upper profile concave; lateral scutes 33 to 35; caudal fin with a dark longitudinal bar on each lobe. *panamensis*, p. 261.
- aa. Snout broadly obtuse, its upper profile convex; lateral scutes 30 or 31; no dark bars on caudal fin. *citirensis*, p. 262.

17. *Oxyloricaria panamensis* (Eigenmann & Eigenmann).

Loricaria rostrata (non Spix) Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1879, 165 (Rio Mamoni, Panama).

Loricaria panamensis Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd. Ser., II, 1889, 34, and Occ. Pap. Cal. Ac. Sci., I, 1890, 365 (Panama).

Loricaria aurea Steindachner, Anz. K. Ak. Wiss. Wien., 1900, 206, and Denkschr. K. Ak. Wiss. Wien, LXXII, 1902, 138, Pl. V, fig. 1 (Rio Magdalena).

Loricaria frenata Boulenger, Ann. & Mag. Nat. Hist., Ser. 7, IX, 1902, 69 (N. W. Ecuador).

Oxyloricaria panamensis Regan, Trans. Zool. Soc. London, XVII, Pt. III, 1904, 301 (Rio Magdalena; Panama).

Oxyloricaria frenata Regan, Trans. Zool. Soc. London, XVII, Pt. III, 1904, 302, Pl. XVIII, fig. 2 (N. W. Ecuador).

Oxyloricaria dariensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 81 (Rio Tuyra and Rio Bayano basins, Panama).

Head 4.06 to 5.3; depth 8.5 to 13; D. I, 7; A. I, 5; lateral scutes 33 to 35.

Body long, slender, depressed throughout; head without ridges; snout produced, pointed, its margin granular or with short bristles at sides in male, its upper profile concave, 1.57 to 1.7 in head; eye 7.5 to 9.55; interorbital 3.1 to 4.2; lips reverted, papillose; maxillary barbel shorter than eye; predorsal plates 3, without carinations; lateral keels anteriorly obscure, coming close together in young and uniting in the adult on the 17th to the 20th scute; 19 or 20 scutes from anal to base of caudal; dorsal fin anteriorly much elevated, notably longer than head, its origin over base of ventrals; caudal fin forked, both lobes produced, the outer ray bearing a filament; anal fin high, the undivided ray or spine longer than head; ventral fins reaching opposite or past base of anal; pectoral fins reaching opposite lower third or lower half of ventrals, the spine usually equal to length of head.

Color plain olive above; pale below. Anterior rays of dorsal black, the black sometimes more or less broken up into spots; caudal fin with a dark longitudinal bar on each lobe; other fins all with more or less dusky on interradiation membranes.

Of this species we have 86 specimens, ranging in length from 50 to 260 mm. One small specimen is from the Rio Calobre, tributary of the Rio Bayano and all the others are from the Rio Tuyra Basin, where it is quite common.

A study of specimens from Colombia and Ecuador along with our specimens shows that there are quite a number of synonyms under this species. The fact that the lateral keels in the young are not completely united while in the adult they are, in part at least accounts for the numerous names that have been proposed.

Habitat: Pacific slope of Panama, both slopes of Colombia, south to Ecuador.

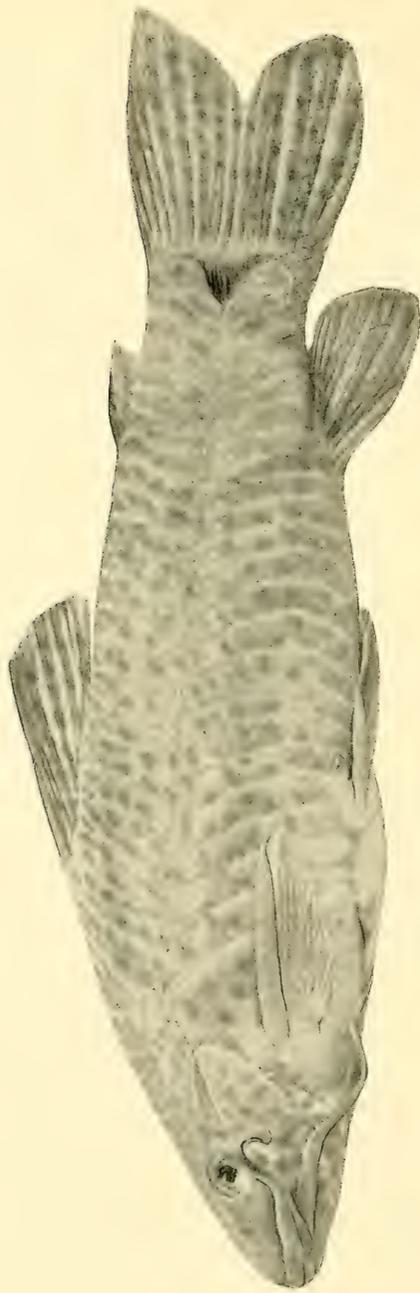
18. *Oxyloricaria citurensis* Meek & Hildebrand.

Oxyloricaria citurensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 82 (Rio Cupe, Cituro, Panama).

Head 4.55 to 5.1; depth 8.5 to 10; D. I, 7; A. 6; lateral scutes 30 or 31.



OXYLICARIA CITURENSIS Meek & Hildebrand.
From a specimen 188 mm. in length without caudal filament.



HOPLOSTERNUM PUNCTATUM sp. nov.
From a specimen 95 mm. in length.

Body depressed; anterior profile straight or gently convex; head without ridges; snout not produced, broadly obtuse, its margin granular, with short bristles on sides in male, its length 1.7 to 1.8 in head; eye without orbital notch, 6.5 to 8.7; interorbital 3.1 to 3.6; lips reverted, papillose; maxillary barbel shorter than eye; predorsal plates 3, without carinations; lateral keels anteriorly obscure or wanting, coalesced on 15th or 16th scute; 17 or 18 scutes from anal to base of caudal; 5 to 8 rows of small plates on belly between lateral series; dorsal fin anteriorly not greatly elevated, not much longer than head, its origin over base of ventrals; caudal fin forked, the outer ray of both lobes produced, the upper one bearing a filament; anal fin anteriorly moderately elevated, the spine somewhat shorter than head; ventral fins reaching to or a little past origin of anal; pectoral fins reaching a little beyond base of ventrals, 1.05 to 1.23 in head.

Color dark grayish brown, with obscure darker blotches above; pale below. Fins usually with indistinct dark markings.

This species is represented by many specimens, ranging from 40 to 250 mm. in length. This fish was found only in the Rio Bayano and Rio Tuyra basins. It is rare in the former but abundant in the latter.

This species is rather closely related to *O. tamanæ* Regan, from which it differs in having from 5 to 8 longitudinal rows of plates on belly between the lateral series, instead of only 3. The snout in the present species is more obtuse and the fins are lower.

Family III. Callichthyidæ.

Sides with 2 series of lateral scutes; mouth terminal, lower lip not reverted; air bladder vestigiary, one on each side of the coalesced vertebræ and entirely surrounded by a bony capsule, the cavity communicating with the exterior by means of a long narrow slit in the temporal plate. Caudal vertebræ normal, the neural and hæmal spines spine-like, separated from each other.

13. Genus *Hoplosternum* Gill.

Hoplosternum Gill, Ann. Lyc. Nat. Hist. N. Y., VI, 1858, 395 (type *Callichthys lævigatus* Valenciennes = *Callichthys littoralis* Hancock).

Body with 2 lateral series of scutes, overlapping along median line, forming a depression; gill-membranes confluent with the skin of the isthmus; two pairs of nuchal plates between humeral and coracoid process; coracoids exposed; 2 pairs of maxillary barbels; no mandibular

barbels; a naked area along ventral surface; adipose fin with a spine; ventral fins inserted below or anterior to the dorsal fin; dorsal spine low; pectoral spine serrate on its inner margin, its surface covered with bristles.

19. *Hoplosternum punctatum* sp. nov.

?*Callichthys* (*Hoplosternum*) *thoracatus* (non Cuvier & Valenciennes)
Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1880, 66 (Cauca,
near Caceres).

Type No. 8943, F. M. N. H.; length 110 mm.; Rio Marte Arnade,
six miles east of Panama City.

Head 2.96 to 3.26; depth 3.1 to 3.54; D. I, 7 or 8; A. I, 6; lateral
scutes, 25 above lateral line and 23 or 24 below it.

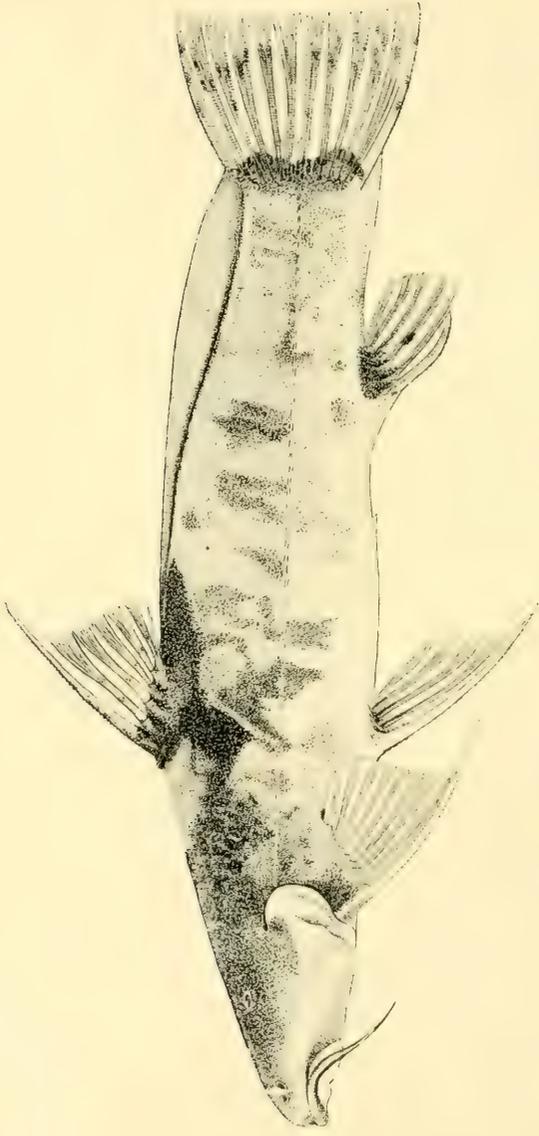
Body rather robust; dorsal region moderately elevated; anterior
profile straight or gently convex; head broader than deep; snout obtuse,
its length 2.2 to 2.36 in head; eye lateral, 7.45 to 8; interorbital 1.6 to
1.67; mouth subterminal, rather small, its width less than length of
snout; barbels varying in length, the longest reaching from lower third
to opposite distal third of pectoral spine; the lower lip with 2 fleshy
lobes; fontanel elongate in young, oval to nearly circular in adult;
occipital failing to reach fontanel; the scutes without carinations; 5
or 6 azygous plates in front of adipose spine; coracoids close together
anteriorly, or overlapping in the male, separated posteriorly by a
V-shaped naked area; distance between pectorals equal to or slightly
shorter than length of coracoid plates; dorsal fin inserted notably
nearer tip of snout than adipose; dorsal spine about equal to length of
snout; adipose with a rather strong spine, the membrane adnate to the
back; caudal fin with concave margin, but not as deep as in *H. magda-
lenæ*; anal fin small, its origin by 2 scutes in advance of adipose; ventral
fins about as long as snout and eye, a naked area between them, extend-
ing back to vent; pectoral fins failing to reach base of ventrals except
in young, the spine with serrations on the back side, its length 1.56 to
1.73 in head.

Color brownish black above, somewhat paler below. Entire body,
except upper surface of head and dorsal region, with small, roundish
black spots. These spots are also present on the rays of the dorsal and
caudal fins. Base of caudal with a black bar, followed by a yellowish bar.

Of this species we have 4 specimens, ranging in length from 85 to 110
mm. The largest we designate as the type. These were taken in the
Rio Marte Arnade, a small coastal stream about 6 miles east of Panama.
This is the only place where this fish was seen. Our specimens were
taken during April, 1911. During March the following year this stream



HOPLOSTERNUM PUNCTATUM sp. nov.
From a specimen 95 mm. in length.



CYCLOPIUM FIRRENSE Meek & Hildebrand.
From a specimen 138 mm. in length.

was again visited and thoroughly fished, but no more specimens were secured.

This fish differs from *H. magdalene* Eigenmann in the more anterior position of the dorsal, the less deeply concave margin of the caudal fin, the fewer azygous plates in front of adipose spine, the shorter coracoids, and in coloration.

Callichthys (Hoplosternum) thoracatus Steindachner (non C. & V.) from the Cauca appears to be very closely related to this species, if not identical with it.

The present species is the most northern representative of the genus.

Family IV. Cyclopidæ.

Naked fishes with robust or elongate bodies; dorsal fin on anterior portion of body; usually an adipose fin with or without a spine, or represented by a movable spine attached by a membrane to the caudal peduncle; teeth in jaws in more than one series.

These fishes inhabit mountain streams of the Andes of Peru to Venezuela and Panama.

14. Genus *Cyclopium* Swainson.

Cyclopium Swainson, Nat. Hist. Fishes, II, 1839, 305 (type *Pimelodus cyclopium* Humboldt).

Body elongate, naked, compressed anteriorly; teeth small; eye small, superior; adipose fin a movable spine attached to caudal peduncle by a membrane, or a long fin with or without a small embedded spine; ribs moderately developed; caudal fin truncate or slightly emarginate, the outer rays slightly produced.

Small, naked fishes inhabiting mountain streams of the Andes of Ecuador, Peru, Colombia, Venezuela, and eastern Panama.

20. *Cyclopium pirrense* Meek & Hildebrand.

Cyclopium pirrense Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 83 (Rio Cana, Cana, Panama).

Head 3.3 to 3.6; depth 5 to 6; D. I, 5; A. I, 5.

Body robust, compressed posteriorly; head depressed, broad, its width equalling its length; anterior teeth of upper jaw pointed, those of the lower bicuspid; snout 1.8 to 2 in head; interorbital 3.4 to 4.1; origin of dorsal over ventrals, its distance from tip of snout 2.2 to 2.4 in body; maxillary barbel reaching slightly past eye; nostrils with a triangular

flap; first dorsal ray with its tip produced, its length 1.1 to 1.4 in head, the tips of first dorsal rays reaching slightly past those of the last rays when the fin is deflexed; pectoral spines produced, their tips reaching to or past middle of ventrals, their length .7 to .9 in head; ventrals 1 to 1.2; adipose fin long, without trace of spine; caudal peduncle deep, 1.7 to 1.9 in head; last anal ray to caudal 1.5 to 1.7 in head; caudal emarginate, the outer rays produced.

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

This species was quite abundant in the Rio Cana at Cana. Longest specimen 130 mm. This species ranges farther north than any of the other species of the family.

Family V. *Pygidiidæ*.

Small fishes with naked bodies, usually villiform teeth, remote nares, skull covered with skin and muscles, no adipose fin, and a rudimentary air bladder enclosed in the lateral processes of the coalescent vertebræ. The family is represented by a number of genera, but only one species is known to inhabit Panama.

15. Genus *Pygidium* Meyen.

Pygidium Meyen, Reise in Peru, I, 1835, 475 (type *Pygidium fuscum* Meyen).

Body elongate, subterete; mouth terminal or subterminal; teeth in bands in both jaws; maxillary with 2 pairs of barbels; a single pair of nasal barbels; eyes superior; dorsal over or behind ventrals; its origin over or in advance of origin of anal; without spine; no adipose fin; opercle and preopercle with small spines; body naked; gill-membranes nearly free from the isthmus or forming a free fold across it.

Small fishes inhabiting mountain streams from Central Chili to Panama and southeastern Brazil and central Argentina.

21. *Pygidium striatum* Meek & Hildebrand.

Pygidium striatum Meek & Hildebrand, Field. Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 78 (Rio Cana, Cana, Panama).

Head 4.9 to 5.75; depth 6.35 to 7.35; D. 8; A. 6.

Body elongate; head depressed; body posteriorly compressed; snout broad, its length 2.08 to 2.9 in head; eye very small, wholly superior,

without free orbital margin, about 11 to 14 in head; interorbital 3.5 to 4.2; mouth rather wide, its width nearly as great as length of snout; upper jaw projecting; the longest maxillary barbel reaching to or a little past gill-opening; teeth in the jaws in villiform bands; dorsal fin with convex margin, its origin about midway between gill-opening and tip of caudal; caudal fin with a straight or slightly convex margin; anal fin small, its origin under or behind base of last ray of anal; ventral fins inserted considerably in advance of origin of dorsal, reaching vent; pectoral fins inserted under margin of opercle, without a definite spine, 1 to 1.33 in head.

Color light olive; a dark band from upper angle of gill-opening to base of caudal. In some individuals there is anteriorly a dark band above this one and one below it. These bands in most specimens are broken up into small round spots which are not much larger than eye. The back with small black spots; in large examples these are also sometimes present on lower part of sides.

Of this species 32 specimens were obtained, ranging in length from 40 to 90 mm. These are all from a small creek at Cana in the upper Rio Tuyra Basin. This creek was very rocky, and the bottom was covered with a reddish sediment.

The species of this genus are difficult to determine and the entire genus stands in need of revision. Our fish is closely related to *P. bogatense* Eigenmann and also to *P. chapmani* Eigenmann. From both it differs in color and in the slightly more anterior position of the dorsal fin.

Order II. Plectospondyli.

THE CARP-LIKE FISHES.

Body scaly; dorsal fin single; fins without true spines. Parietals broad, distinct; the four anterior vertebrae joined together; opercular bones all present.

Family VI. Characidae.

Body variously shaped, covered with scales which usually are cycloid; head naked; upper jaw mesially formed by the premaxillaries, laterally by the maxillaries; teeth various; dorsal fin small, without spines; adipose fin usually present. Adipose fin wanting in the genera, *Hoplias* and *Phanagoniates*, which come within the scope of the present work.

KEY TO THE GENERA.

- a. Caudal fin forked; adipose fin present (except in *Phanagoniates*).
- b. Scales cycloid.
- c. Teeth wanting. (*Curimatinae*) *Curimatus*, p. 269.
- cc. Teeth in lower jaw wanting. (*Parodontinae*) *Apareiodon*, p. 270.
- ccc. Teeth present in both jaws.
- d. Teeth in a single series in each jaw; lateral line incomplete. (*Cheirodontinae*)
- e. Adipose fin wanting; anal fin long, with more than 40 rays. *Phanagoniates*, p. 272.
- ee. Adipose fin present; anal fin short, with fewer than 30 rays.
- f. Lower half of base of caudal in the male with a peculiar lobe of enlarged scales. *Compsura*, p. 273.
- ff. No enlarged scales on base of caudal. *Pseudocheirodon* gen. nov., p. 275.
- dd. Teeth in upper jaw in 2 series, those in lower jaw in a single series. (*Tetragonopterinæ*)
- g. The thoracic region not greatly dilated or compressed.
- h. Lateral line complete
- i. Dorsal fin inserted far back, its origin nearer caudal than eye, notably behind origin of anal. *Gephyrocharax*, p. 277.
- ii. Dorsal fin inserted over or in advance of anal.
- j. Maxillary with few or no teeth; caudal spot if present not extended on middle caudal rays.
- k. Second suborbital narrow, leaving a naked triangular area below suture between the first and second suborbitals; first series of premaxillary teeth regularly placed. *Astyanax*, p. 279.
- kk. Second suborbital expanded, covering nearly the entire cheek, not leaving a naked triangle below suture between the first and second suborbitals; first series of premaxillary teeth more or less irregularly placed. *Bryconamericus*, p. 282.
- jj. Maxillary in adult with from 5 to 25 teeth; the inner caudal rays black. *Hemibrycon*, p. 285.
- hh. Lateral line incomplete; no caudal spot. *Hypheosobrycon*, p. 286.
- gg. The thoracic region greatly compressed, dialated, forming a semicircular disc. (*Gasteropelecinae*) *Thoracocharax*, p. 287.
- ddd. Premaxillary teeth in 3 series; teeth in mandible in 1 or 2 series, if with 2 series, the outer one composed of only 2 teeth on edge of jaw and directed forward.
- l. Anal fin short, with not more than 17 rays; body long, little compressed. (*Tetragonoptrinae*) *Creagrutus*, p. 289.

- ll. Anal fin long, with more than 40 rays; body strongly compressed anterior profile in adult deeply concave. (*Characinæ*)
Ræboides, p. 291.
- dddd. Premaxillary teeth anteriorly in 3 or 4 series, laterally in 2 or 3 series; mandible with 2 series, the inner series composed of only 2 conical teeth, placed a little behind the anterior teeth of outer series. (*Bryconinæ*) *Brycon*, p. 293.
- ddddd. Premaxillary teeth in a single series; mandibular teeth in 2 series; lateral line wanting. (*Piabuciniæ*) *Piabucina*, p. 299.
- bb. Scales strongly pectinate; form slender; jaws much produced, beak-like; palatines with a few teeth. (*Hydrocymnæ*)
Luciocharax, p. 302.
- aa. Caudal fin rounded; adipose fin wanting; palatines with teeth. (*Erythrininæ*)
Hoplías, p. 303.

16. Genus *Curimatus* Oken.

Curimatus Oken, Isis, 1817, 1183 (type *Salmo edentulus* Bloch).

Body elongate, robust, moderately compressed, abdomen behind ventrals trenchant or not; mouth small, without lips; tongue short, thick, adnate; teeth wanting; lateral line complete; adipose fin present; ventrals inserted below dorsal.

22. *Curimatus magdalenæ* Steindachner. Savaleta.

Curimatus magdalenæ Steindachner, Denkschr. K. Ak. Wiss. Wien, XXIX, 1878, 50 (Rio Magdalena); Steindachner, *l. c.*, XLI, 1879, 167 (Rio Mamoni, Panama); Steindachner, *l. c.*, XLI, 1880, 67 (Rio Cauca); Eigenmann & Eigenmann, Ann. N. Y. Acad. Sci., IV, 1889, 16 (name only); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., XIV, 1891, 47; Eigenmann, Science, N. S., XXII, July 7, 1905, 19; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1906, 332; Boulenger, Boll. Mus. Univ. Torino, No. 346, 1899, 2 (Laguna della Pita, Darien); Regan, Biol. Cent. Amer., Pisces, 1908, 174; Eigenmann, Repts. Princeton Univ. Exp. Patagonia, III, Pt. IV, 1910, 421.

Head 3 to 3.9; depth 2.6 to 3.2; D. 10 or 11; A. 9 or 10; scales in lateral line 37 to 40; 5½ or 6 rows between lateral line and base of anterior dorsal rays.

Body elongate, moderately compressed; dorsal region somewhat elevated; preventral area convex; postventral area usually very slightly keeled; caudal peduncle compressed, its depth 1.85 to 2.2 in head; head rather low, its upper surface with a low median ridge, ending at a short

groove at nape; snout broad, 3.5 to 4.3 in head; eye 3.4 to 4; mouth wide; jaws weak; gill-rakers very short; lateral line straight, slightly above the middle of side; scales large, regularly placed, with a serrate membranous border, 11 or 12 on median line in advance of dorsal; dorsal fin inserted midway between tip of snout and tip of adipose or slightly nearer the latter; caudal forked, the lobes with small scales at base; anal fin with concave margin, the anterior rays reaching far beyond tips of posterior rays when deflexed; ventral fins inserted under the base of dorsal; pectoral fins a little shorter than the ventrals, 1.4 to 1.8 in head.

Color plain brassy, darker above than below; no distinct markings on body or fins.

The Panama collection contains 263 specimens, ranging in length from 75 to 200 mm. These were taken at the following localities: a. Rio Chorrera Basin, at Chorrera and a small creek near Chorrera. b. Rio Marte Arnade. c. Rio Abaco. d. Rio Juan Diaz. e. Rio Bayano Basin, at El Capitan, Chepo, and Rio Calobre. f. Rio Tuyra Basin, at mouth of Rio Yape, Rio Capete, Rio Cupe at Boca de Cupe, Rio Aruza at Aruza, Rio Cituro at Cituro, Rio Setiganti at Cana, Rio Grande near Cana. The above includes all of the river basins visited on the Pacific slope of Panama, except the Rio Chame and the Rio Grande. The latter lies almost wholly within the Canal Zone and had at the time of our visit already been much disturbed by the construction of the Canal. There is little doubt but that this fish occurred there before the digging of the Canal, as it is abundant in streams on both sides of it.

This fish was not found by us where there was much current, but it occurred most commonly in quiet pools and often in stagnant ponds. It is common in streams at the head of tide water. The highest elevation at which it was taken was at Cana in the upper Rio Tuyra Basin.

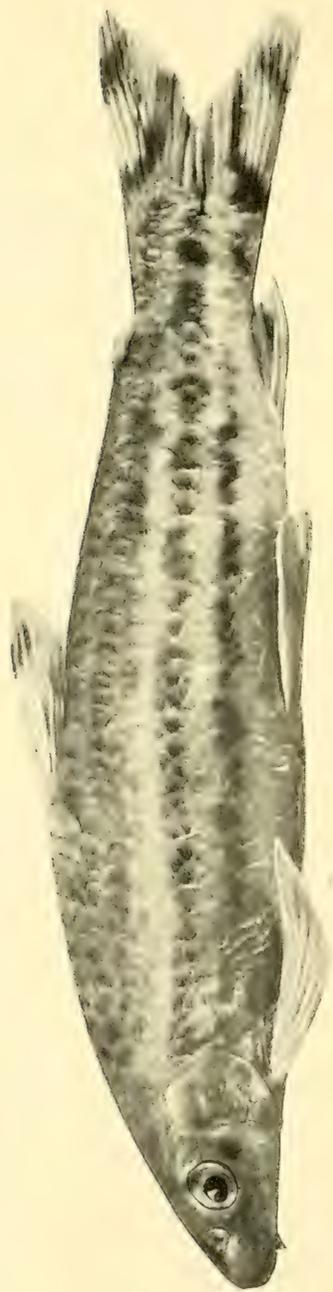
We have specimens for comparison from the Atlantic slope of Colombia. No differences are apparent, except that the Panama specimens appear to be somewhat darker in color.

Habitat: Pacific slope of Panama, Atrato and Magdalena basins and Lake Maracaibo.

17. Genus *Apareiodon* Eigenmann.

Apareiodon Eigenmann, Ann. Carnegie Mus., X, 1915 (1916), 71 (type *Parodon piraciabæ* Eigenmann).

Small fishes with elongate, little compressed body; ventral surface flattish; head small; snout pointed; mouth inferior, a transverse slit; lower jaw scoop-shaped, the lip with a straight transverse margin



APAREIODON DARIENSIS (Meek & Hildebrand).
From a specimen 115 mm. in length.

opposed to the premaxillary teeth; the latter narrow at bases, broad at tips, the cusps of about equal length, forming a straight transverse cutting edge; no teeth on sides of lower jaw; gill-membranes broadly united, free from the isthmus; gill-opening short; gill-rakers very short; lateral line complete; scales moderate, 35 to 45 in lateral series, a few large scales on caudal lobes; dorsal fin inserted in advance of middle of body, partly in front of ventrals; anal very short; pectorals and ventrals similar, short and broad; adipose fin minute, over posterior rays of anal.

23. *Apareiodon dariensis* (Meek & Hildebrand).

Parodon dariensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 83 (Rio Cupe, Cituro, Darien, Panama).

Apareiodon dariensis Eigenmann, Ann. Carnegie Mus., X, 1915 (1916), 71.

Head 4.6 to 4.7; depth 4 to 4.2; D. 11; A. 9; scales 35 to 37.

Body elongate, not much compressed; dorsal profile anteriorly evenly convex; lower outline anteriorly straight, parallel with longitudinal axis of body; head not deeper than wide; snout pointed, much in advance of mouth, 2.8 to 3 in head; eye 4.2 to 4.4; mouth very small, inferior; the lower lip with a straight transverse margin in the largest specimen, the type, in the next largest it is somewhat rounded, in the smallest it is distinctly triangular and feebly 5 lobed; lower jaw entirely without teeth in the 3 specimens at hand; teeth in upper jaw in the largest specimen very narrow at base expanded at tip, with a transverse, pectinate margin; teeth of middle size specimen narrow at base, then expanded and again narrower at tip, one of the cusps much enlarged, pointed; those of the smallest specimen narrow at base, much expanded at tip with an oblique, smooth margin; lateral line complete, straight, very feebly developed, especially in our smallest specimen; scales moderate, striate, regularly placed, 10 or 11 in median series in advance of dorsal; $2\frac{1}{2}$ rows between lateral line and base of anal; 5 or 6 across caudal peduncle from one lateral line to the other; dorsal fin inserted in advance of ventrals, its origin midway between tip of snout and tip of adipose or a little nearer the latter; adipose fin small, over posterior rays of anal; caudal fin forked, with a few large scales on base of fin; anal fin very small, shorter than dorsal, its origin nearer base of caudal than base of ventrals; ventral fins very broad, with 9 rays, reaching past vent which is situated midway between base of ventrals and origin of anal; pectoral fins broad, with 14 rays, inserted under margin of opercle, reaching about $\frac{2}{3}$ of the distance from their base to origin of ventrals.

Color very dark brownish green above, pale below; sides with 2 lateral bands, partly broken into confluent black spots; dorsal, anal and both lobes of caudal each with 2 oblique, black bars; pectorals and ventrals each with more or less black mesially.

Of this species only 3 specimens, respectively 105, 120 and 135 mm. in length, were taken. All are from the Rio Cupe at Cituro, where this stream is very rocky and seining is difficult.

The variation in dentition in the specimens at hand has been noted above. From this it is evident that only the largest specimen, the type, is a typical *Aparciodon*. However, as no other differences are evident, we have identified them all as one species and we tentatively place them under the above named genus.

18. Genus *Phanagoniates* Eigenmann & Wilson.

Phanagoniates Eigenmann & Wilson, Indiana Univ. Studies, No. 19, 1914, 2 (type *Phanagoniates wilsoni* Eigenmann = *Ræboides macrolepis* Meek & Hildebrand).

Body elongate, strongly compressed; chest not trenchant; teeth in a single series in each jaw, tricuspid except in posterior part of maxillary where they are conical; anal fin very long, its origin far in advance of dorsal; origin of dorsal a little behind middle of body; pectoral fins long, over-lapping the minute ventrals; no adipose fin; lateral line incomplete.

24. *Phanagoniates macrolepis* (Meek & Hildebrand).

Ræboides macrolepis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 84 (Rio Cupe, Boca de Cupe, Rio Tuyra Basin).

Phanagoniates wilsoni Eigenmann, Indiana Univ. Studies, No. 19, 1914, (Manigru, Rio Atrato Basin).

Phanagoniates wilsoni Eigenmann, Memoir. Carnegie Mus., VII, 1916, 43, Pl. 5, fig. 1.

Head 4.6 to 5.1; depth 3.3 to 3.9; D. 8 or 9; A. 49 to 53; scales in lateral series 40 to 44.

Body elongate, much compressed, the dorsal profile gently convex, highest at origin of dorsal; head small; snout conical, 3.65 to 4.35 in head; eye 2.6 to 3; interorbital 2.9 to 3.8; mouth small; the lower jaw a little in advance of the upper; maxillary reaching anterior margin of eye; premaxillary teeth tricuspid, 12 in number; maxillary with about 8 teeth, the 3 anterior ones similar to premaxillary, the others conical; lower jaw with about 18 tricuspid teeth, a little stronger than premaxillary teeth; gill-rakers short, far apart, about 6 on lower limb of

first arch; lateral line incomplete, present on 10 to 16 scales; scales thin, striate; dorsal fin small, its origin somewhat nearer base of caudal than tip of snout; caudal fin naked, its lower lobe the longer; anal fin very long, its base greater than half the length of body; ventral fins minute, scarcely longer than eye, reaching origin of anal; pectoral fins rather long, overlapping ventrals, but not quite reaching the tips of the latter.

Color translucent, silvery; sides with a dusky band, most distinct posteriorly. Scales with chromatophores, which are also present on the fins; chin and maxillary black; no caudal spot.

The present collection contains 12 specimens of this species, ranging in length from 35 to 57 mm. These were taken at various points in the Rio Tuyra Basin. A comparatively rare species.

We have for comparison a paratype of *P. wilsoni* Eigenmann, which we find to be identical with the present species. It is noted that in the original description of *P. wilsoni* the scales in the lateral series are given as 34 or 35. However, we are able to count 42 in the paratype that is at hand.

Habitat: Rio Tuyra and Rio Atrato basins.

19. Genus *Compsura* Eigenmann.

Compsura Eigenmann, Memoir. Carnegie Mus., VII, 1916, 60 (type *Compsura heterura* Eigenmann).

Minute fishes, with few teeth; multicuspid incisors, in a single series in each jaw, 2 or 3 teeth on maxillary; second suborbital in contact with the preopercle below and partly behind; lateral line incomplete;

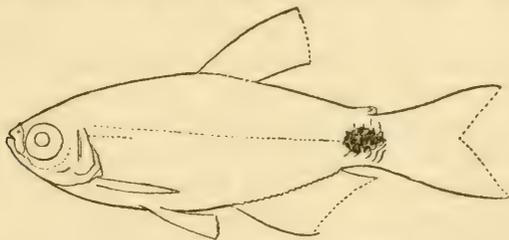


FIG. 1. DIAGRAM SHOWING THE PECULIAR SCALING AT BASE OF CAUDAL FIN OF THE MALE OF *Compsura gorgona* (Evermann & Goldsborough).

scales thin, with a few radiating striæ; the male with a peculiar lobe of enlarged scales on lower half of base of caudal; origin of dorsal about equidistant from snout and base of caudal; adipose fin well developed; interhæmal spines of caudal peduncle not projecting; a conspicuous caudal spot present.

This genus differs from *Cheirodon* in the peculiar scaling on the lower half of the base of the caudal fin of the male, and also in the non-projecting interhæmal spines of the caudal peduncle.

25. *Compsura gorgonæ* (Evermann & Goldsborough).

Cheirodon gorgonæ Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXII, 1909, 99, figs. 1 and 3 (Gorgona, Atlantic slope, Panama Canal Zone).

Cheirodon insignis Eigenmann, Memoir. Carnegie Mus., VII, 1916, 69 (in part).

Head 3.7 to 4.25; depth 2.55 to 3.3; D. 10 or 11; A. 16 to 20; scales 31 to 33.

Body rather short, compressed; profile gently convex from snout to dorsal; head small; snout short, 4.1 to 5.4 in head; eye 2.6 to 3.25; interorbital 3.1 to 3.6; mouth small; jaws subequal; maxillary reaching anterior margin of eye; premaxillary teeth usually 10 in number, each tooth with about 6 cusps, the median cusps considerably enlarged;

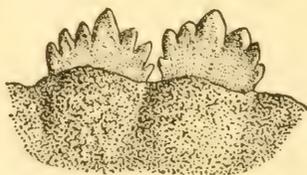


FIG. 2. FRONT TEETH OF *Compsura gorgonæ* (Evermann & Goldsborough).
(After Evermann & Goldsborough.)

maxillary usually with 2 teeth, similar to the premaxillary teeth; teeth in lower jaw usually 12 in number, close together, the expanded tips slightly overlapping, each with about 6 cusps, the median ones only slightly enlarged, making the margin evenly convex; lateral line incomplete, present on 5 to 13 scales; scales thin, striate, 10 to 12 in advance of dorsal; 8 to 10 rows between dorsal and adipose; dorsal fin pointed, the anterior rays the longest, its origin midway between tip of snout and base of caudal; adipose fin over last ray of anal, notably nearer base of caudal than dorsal fin; caudal fin naked, the lower lobe the longer; origin of anal under last rays of dorsal, its base considerably shorter than depth of body; ventral fins inserted a little in advance of dorsal, reaching nearly or quite to origin of anal; pectoral fins somewhat longer than ventrals, usually not quite reaching the base of the latter.

Color silvery, with a narrow plumbeous band; a very conspicuous black oval caudal spot, not extended on caudal rays. Head and body



PSEUDOCHEIRODON AFFINIS gen. et sp. nov.
From a male specimen 40 mm. in length.

with comparatively few dusky points, those above base of anal more or less regularly arranged in the form of several V's with the apex pointed backward. Fins with dusky points, those on the anal fin mostly arranged in a single series and on the anterior margin of the rays, few or none on the interradiial membranes.

Of this species there are over 200 specimens in the present collection, ranging in length from 25 to 40 mm. It is found along with *Pseudocheirodon affinis*, but is apparently less numerous.

Habitat: Both slopes of Panama.

20. *Pseudocheirodon* gen. nov.

Type *Pseudocheirodon affinis* sp. nov.

Minute fishes ranging in length from 25 to 60 mm. Body elongate, compressed; the back elevated; head small; second suborbital covering nearly the entire cheek; teeth in each jaw in a single series, expanded at tips, their cutting margins transverse or slightly rounded; 2 or 3 teeth on maxillary; lateral line incomplete, present on from 5 to 20 scales; scales thin, with radiating striæ; origin of dorsal about equidistant from tip of snout and base of caudal; adipose fin well developed; base of caudal with normal scales; origin of anal under posterior rays of dorsal, anteriorly with a single row of scales at base; interhæmal spines of the caudal peduncle not projecting; air bladder large, its walls thin; a conspicuous caudal spot usually present.

This genus is closely allied to *Cheirodon* on the one hand and to *Odontostilbe* on the other hand. From the former it differs in the absence of the protruding interhæmal spines on caudal peduncle and from the latter in the incomplete lateral line. From *Compsura* it differs in having the scaling on the base of the caudal in the male normal.

26. *Pseudocheirodon affinis* sp. nov.

Cheirodon insignis (non Steindachner) Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXII, 1909, 98, fig. 2 (Tabernilla, Atlantic slope, Panama Canal Zone).

Cheirodon insignis Eigenmann, Memoir. Carnegie Mus., VII, 1916, 69 (in part).

Type No. 8941, F. M. N. H.; length 38 mm.; Rio Gatun, Monte Liria, Canal Zone.

Head 3.8 to 4.5; depth 2.2 to 2.9; D. 10 or 11; A. 21 to 24 (rarely with only 20 rays); scales 31 to 33.

Body rather short, compressed; profile straight over eyes, elevated at nape; head small; snout blunt, 4 to 4.5 in head; eye 2.6 to 3; interorbital

2.3 to 2.9; mouth small; jaws subequal; maxillary reaching anterior margin of eye; premaxillary teeth usually 10 in number, each with about 6 cusps, the middle ones slightly larger than the outer ones, making the margins round; maxillary with 2 or 3 teeth similar to those of premaxillary; teeth in lower jaw usually 12 in number, close together, the expanded tips slightly overlapping, each with about 6 cusps of nearly equal size, their margins straight, transverse; lateral line incomplete, present on from 8 to 12 scales (present on 20 scales in one specimen); scales thin, striate, 10 to 12 in advance of dorsal, 9 or 10 rows between dorsal and adipose; dorsal

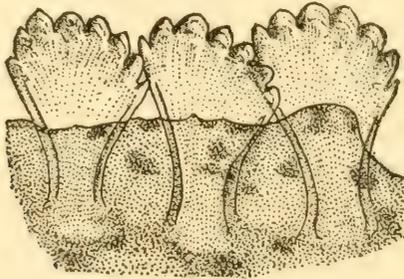


FIG. 3. FRONT TEETH OF *Pseudocheirodon affinis* gen. et sp. nov. (After *Cheirodon insignis* (non Steindachner) Evermann & Goldsborough.)

fin pointed, the anterior rays the longest, its origin midway between tip of snout and base of caudal; adipose fin over last rays of anal, notably nearer base of caudal than dorsal; caudal fin forked, the lower lobe the longer; origin of anal under last rays of dorsal, its base not quite equal to depth of body; ventral fins inserted slightly in advance of dorsal, reaching nearly or quite to origin of anal; pectoral fins somewhat longer than ventrals, usually not quite reaching base of the latter.

Color plain silvery, with a faint plumbeous lateral band; a very conspicuous, black, oval caudal spot, not extended on rays of caudal fin. Head and body, except chest and abdomen, with dusky punctulations. These largest above base of anal. Fins with dusky points, most numerous on the anal fin, occupying principally the interradi al membranes.

Numerous specimens were preserved. They range in length from 35 to 55 mm. Common but not abundant on both slopes of Panama. We have designated as the type a male specimen, 38 mm. in length, taken in the Rio Gatun, Monte Liria, Canal Zone.

Habitat: Both slopes of Panama.

21. Genus *Gephyrocharax* Eigenmann.

Gephyrocharax Eigenmann, Indiana Univ. Studies, No. 16, 1912, 23 (type *Gephyrocharax chocænsis* Eigenmann).

Body elongate, compressed; premaxillary teeth in 2 series, the inner with 8 to 10 teeth; second suborbital covering the entire cheek; lateral line complete; dorsal fin inserted posteriorly, its origin nearer caudal than eye, notably behind origin of anal; adipose fin present; the lower fulcra of caudal free, forming a peculiar spur in the male; pectorals long, overlapping the ventrals.

KEY TO THE SPECIES.

- a. The outer rays of caudal fin black; no distinct shoulder spot. *atricaudata*, p. 277.
- aa. The outer rays of caudal without black; a distinct shoulder spot present. *intermedius* sp. nov., p. 278.

27. *Gephyrocharax atricaudata* (Meek & Hildebrand).

Deuterodon atricaudata Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., 1912, 68 (Rio Frijoles, Panama Canal Zone).

Gephyrocharax atricaudata Eigenmann, Indiana Univ. Studies, No. 20, 1914, 41 (Panama Canal Zone).

Head 3.7 to 4.5; depth 2.8 to 3.8; D. 9 or 10; A. 26 to 33; scales 37 to 43.

Body elongate, rather strongly compressed; dorsal profile anteriorly straight or slightly concave; ventral outline strongly convex; abdomen round in advance of ventrals, keeled from ventrals to vent; head compressed; snout blunt, 3.4 to 4.75 in head; eye 2.6 to 3.44; interorbital 2.4 to 3.1; mouth small, very oblique; the lower jaw a little in advance of the upper; maxillary reaching slightly past anterior margin of eye; second suborbital broad, its lower posterior angle rounded; premaxillary teeth in 2 series, the outer series consisting of 8 teeth, each with 3 to 5 cusps; the inner series with 8 broad teeth, each with 5 cusps, the middle cusp much enlarged; maxillary with 2 small teeth; lower jaw with 8 large teeth and abruptly smaller ones at sides; gill-rakers short, about 8 on lower limb of first arch; lateral line complete, curved downward anteriorly; scales striate, 20 to 23 in median series in advance of dorsal; 6 complete rows between lateral line and base of dorsal; the rows below lateral line abruptly bent downward and backward toward anal; 5 scales in vertical series between lateral line and base of anterior rays of anal; the last scales on lower lobe of caudal much enlarged in males, with a hollow space or pocket underneath, its upper edge attached to

the seventh ray of the caudal; dorsal fin with convex margin, inserted posteriorly, its origin a little nearer the base of caudal than posterior margin of opercle; adipose fin about midway between base of last ray of dorsal and base of upper ray of caudal; caudal fin forked, the lower lobe the longer, the lower fulcra free, forming a short flat spur at margin of the enlarged scale of each side; anal fin rather long, its origin in advance of dorsal, midway between anterior margin of eye and base of caudal, or somewhat nearer the latter; ventral fins reaching to or past origin of anal; pectoral fins long, inserted notably nearer tip of snout than original of anal.

Color pale green above, with a dark vertebral band; sides silvery. A faint lateral band present in young, scarcely visible in adult; an indistinct shoulder spot present. Fins reddish yellow; a black spot or bar at base of caudal, extended to tips of outer rays of both caudal lobes.

Numerous specimens of this species, ranging in length from 30 to 60 mm., were preserved. It is abundant in all streams visited on both slopes of Panama, except in the Rio Chame where it is replaced by the closely related species, *G. intermedius*.

Habitat: Both slopes of Panama.

28. *Gephyrocharax intermedius* sp. nov.

Type No. 8945, F. M. N. H.; length 58 mm.; Rio Chame, Panama.

Head 4 to 4.5; depth 3.1 to 3.55; D. 9 or 10; A. 26 to 31; scales 39 to 43.

Body elongate, rather strongly compressed; dorsal profile anteriorly straight or slightly concave; ventral outline strongly convex; abdomen round in advance of ventrals, keeled from ventrals to vent; head compressed; snout blunt, 3.7 to 5 in head; eye 2.6 to 3.4; interorbital 2.5 to 3; mouth small, strongly oblique; the lower jaw a little in advance of the upper; maxillary reaching slightly past anterior margin of eye; second suborbital broad, with its lower posterior angle rather sharp, often forming almost a right angle; teeth as in preceding species; lateral line complete, curved downward anteriorly; scales striate, 18 to 20 in median series in advance of dorsal; 5 or 6 complete rows between lateral line and base of dorsal; the rows below lateral line abruptly bent downward and backward toward the base of anal, 5 scales in vertical series between lateral line and base of anterior rays of anal; the last scale on lower lobe of caudal much enlarged in males, with a hollow space or pocket underneath, its upper edge attached to the seventh ray of caudal; dorsal fin inserted posteriorly, its origin somewhat nearer base of caudal than margin of opercle; adipose fin about midway between base of last ray

of dorsal and base of upper ray of caudal; caudal fin forked, the lower lobe the longer, its lower fulcra free, forming a flat spur at margin of the enlarged scale of each side; anal fin long, its origin in advance of dorsal, about midway between anterior margin of eye and base of caudal; ventral fins reaching nearly or quite to origin of anal; pectoral fins long, overlapping the ventrals, inserted notably nearer tip of snout than origin of anal.

Color pale green above, with a dark vertebral band; sides silvery. A faint silvery lateral band usually present; a distinct shoulder spot or bar. Fins reddish yellow; a large oval caudal spot, which does not extend either on the middle or the outer rays of the caudal.

Of this species 64 specimens, ranging from 30 to 60 mm. in length, were preserved. All are from the Rio Chame, the only place where it was seen. The type is a male, 58 mm. in length.

This species is closely related to *G. atricaudata* and *G. chocænsis* Eigenmann, assuming an intermediate relationship, agreeing more nearly in color with the latter and in structure with the former. From *G. atricaudata* it is easily distinguished by the oval caudal spot which does not extend on the outer rays of the caudal, and the more prominent shoulder spot. No structural differences are evident, and it is possible that the two intergrade, but in the present large collection this is not the case. From *G. chocænsis* it differs in the more numerous scales between the lateral line and base of anal (4 in *G. chocænsis*, 6 in the present species), and the rows in the present species are more strongly decurrent above base of anal. The spur on lower lobe of caudal is notably shorter and broader in *G. intermedius* and the ray above the spur is flattened and expanded, while in the former it is normal.

22. Genus *Astyanax* Baird & Girard.

SARDINAS.

Astyanax Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854 26, and U. S. Mex. Bound. Survey, 1859, 74 (type *Astyanax argentatus* Baird & Girard).

Pæcilurichthys Gill, Ann. Lyc. Nat. Hist. N. Y., VI, 1858, 54 (type *Pæcilurichthys brevoortii* Gill).

Body more or less elongate, compressed, depth usually more than 2 in length; second suborbital narrow, leaving a naked triangular area below suture between first and second suborbitals; premaxillaries with 2 series of teeth, the first series with several teeth on each side, the second series equal or graduated, usually 10, sometimes 8 in number; lower jaw with strong teeth anteriorly, usually abruptly smaller, conical ones

on side; maxillary with a few or no teeth; gill-rakers setiform; lateral line complete; no predorsal spine; caudal naked.

KEY TO THE SPECIES.

- a. Sides with a dark, plumbeous, lateral band, darkest and most distinct posteriorly, sometimes indistinctly visible on caudal fin; no caudal spot. Reaching a length of 150 mm. *fasciatus*, p. 280.
 aa. Sides with a plumbeous, lateral band, ending in a large, well defined, oval caudal spot. Reaching a length of 110 mm.

ruberrimus, p. 281.

29. *Astyanax fasciatus* (Cuvier).

Chalceus fasciatus Cuvier, Mem. Mus. Paris, V, 1819, 352 (Brazil).

Tetragonopterus fasciatus Cuvier & Valenciennes, Hist. Nat. Poiss., XX, 1848, 149 (Rio San Francisco); Günther, Cat. Fish. Brit. Mus., V, 1864, 322 (Brazil; ? West Ecuador; ? Rio Chisay; ? Mexico; Guatemala); Vaillant, Bull. Mus. d'Hist. Nat. Paris, 1897, 221 (? Chagres).

Tetragonopterus fischeri Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1879, 166, Pl. I, figs. 1 & 2 (Rio Mamoni, Panama).

Tetragonopterus panamensis (non Günther) Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1879, 166, Pl. I, figs. 1 & 2 (Rio Mamoni, Panama).

Astyanax fasciatus Fowler, Proc. Ac. Nat. Sci. Phila., 1906, 346 (Para).

Astyanax rutilus Eigenmann & Ogle, Proc. U. S. Nat. Mus., XXXIII, 1907, 19 (Truando; West Coast of Central America).

Astyanax grandis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1912, 67 (Rio Juan Diaz, Panama).

Head 3.55 to 4.35; depth 2.35 to 2.6; D. 10 or 11; A. 25 to 27; scales 36 to 39.

Body deep, compressed; the back elevated; head small; snout conical, 3.7 to 4.4 in head; eye 2.6 to 3.6; interorbital 2.4 to 3; mouth small; jaws subequal; maxillary to or slightly past anterior margin of eye, slightly longer than snout; premaxillary teeth in 2 regular series, each with 8 teeth; maxillary with 2 small teeth near its juncture with the premaxillary; lower jaw with 8 strong teeth anteriorly and abruptly smaller ones at sides; gill-rakers short, about 12 on lower limb of first arch; lateral line complete, very slightly decurved; scales rather large, striate, 11 or 12 in advance of dorsal, 9 to 11 between dorsal and adipose, 7 or 8 longitudinal rows between anterior rays of dorsal and lateral line; dorsal fin inserted a little nearer tip of snout than base of caudal, the anterior rays longest, reaching past tips of posterior rays; adipose fin about one-third as far from base of upper caudal ray as from base of last dorsal ray; caudal fin forked, the lobes of about equal length; anal

fin rather long, its origin a little behind base of last dorsal ray, about midway between base of pectorals and base of caudal, its base much longer than head; ventral fins reaching to or slightly past vent, inserted midway between tip of snout and base of last anal ray; pectoral fins reaching nearly or quite to base of ventrals, inserted about midway between tip of lower jaw and base of ventrals.

Color silvery; back dark green, with bluish and silvery reflections; pale silvery below; no caudal spot. Sides with a plumbeous band, most distinct on caudal peduncle; a black shoulder spot present and sometimes a second indistinct spot an eye's diameter behind the first. Fins plain translucent in spirits. Dorsal and pectorals dark green in life; other fins bright red.

This species is represented in the Panama collection by 522 specimens, ranging in length from 60 to 150 mm. It occurs only in the Pacific slope streams in Panama. Apparently one of the later migrants from the Atlantic streams of Colombia.

Habitat: Western slope of Central America, Panama, Colombia, and Ecuador, and the eastern slope from Para to Napo.

30. *Astyanax ruberrimus* Eigenmann.

Tetragonopterus panamensis (non Günther) Gill, Proc. Ac. Nat. Sci. Phila., 1876, 336 (Rio Frijoles, Atlantic slope, Panama).

Astyanax fischeri (non Steindachner) Eigenmann & Ogle, Proc. U. S. Nat. Mus., 1907, 26 (Pacific slope of Panama; Rio Frijoles; Empire; Panama); Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXIII, 1910, 4 (Empire, Canal Zone).

Astyanax ruberrimus Eigenmann, Indiana Univ. Studies, No. 18, 1913, 25 (Istmina, Atlantic slope, Colombia).

Head 3.4 to 4.18; depth 2.2 to 3.15; D. 10 or 11; A. 22 to 27; scales 34 to 38.

Body short, compressed, the back elevated; head small; snout conical, 3.5 to 4.75 in head; eye 2.5 to 4.5; interorbital 2.45 to 3.15; mouth small; jaws subequal; maxillary reaching slightly past anterior margin of eye, scarcely as long as snout; premaxillary teeth in 2 regular series, each series with 8 teeth; maxillary with 2 small teeth near its juncture with the premaxillary; lower jaw with 8 large teeth anteriorly, and abruptly smaller ones at sides; gill-rakers short, about 12 on lower limb of first arch; lateral line complete, slightly decurved; scales rather large, striate, 11 or 12 in advance of dorsal, 9 to 11 between dorsal and adipose fin, 6 or 7 longitudinal rows between anterior rays of dorsal and lateral line; dorsal fin inserted midway between tip of snout and base of caudal, the anterior rays the longest, reaching past tips of posterior

rays; adipose fin about half as far from base of upper caudal ray as from base of last dorsal ray; caudal fin forked, the lower lobe the longer; anal fin rather long, its origin a little behind base of last dorsal ray, slightly nearer base of caudal than base of pectorals, its base notably longer than head; ventral fins reaching vent, inserted midway between tip of snout and base of last anal ray; pectoral fins usually reaching nearly or quite to base of ventrals, inserted midway between tip of lower jaw and base of ventrals.

Color silvery, sides with an ill-defined plumbeous band. A spot or short bar at shoulder, occasionally a second faint one an eye's diameter behind the first. Base of caudal with a well defined black oval spot, a little longer than deep, only slightly extended on base of caudal rays. Fins mostly bright red in life.

The most abundant species of all the fishes of Panama, occurring in large numbers from the lowland waters up to the highest mountain streams, on both slopes of Panama. Our collection contains numerous specimens, ranging in length from 35 to 110 mm.

The Pacific slope representatives average somewhat larger in size and their average depth is proportionately greater. The average depth in length for 38 specimens from various localities on the Pacific slope and of various sizes is 2.48. In a similar series from the Atlantic slope the average depth is 2.67.

Steindachner's name, *fischeri*, has long been used for this species, but his figures strongly indicate that he did not have this species, but *A. fasciatus*, as no caudal spot is indicated. The caudal spot is so conspicuous in the present species that it could scarcely have been overlooked. There is also nothing in Steindachner's description that indicates that it was not the latter species which he had. The only name that is then available is *A. ruberrimus* Eigenmann, of which we have that author's specimens from Colombia for comparison and find them to be identical with the Panama material.

Habitat: Both slopes of Panama and both slopes of Colombia.

23. Genus *Bryconamericus* Eigenmann.

Bryconamericus Eigenmann, Ann. Carnegie Mus., IV, 1907, 139 (type *Bryconamericus exodon* Eigenmann).

Very similar to *Astyanax*. Lateral line complete; caudal naked; second suborbital expanded, in contact with the lower limb of preopercle, and not leaving a naked triangle below suture between the first and second suborbitals. First series of premaxillary teeth more or less irregularly placed.

KEY TO THE SPECIES.

- a. Scales regularly placed, in 35 to 41 oblique series from upper angle of gill-opening to base of caudal; 11 to 13 scales in advance of dorsal; 10 or 11 between dorsal and adipose; 7 complete, longitudinal rows between lateral line and base of dorsal. Color silvery, with a plumbeous lateral band. Breeding males without tubercles on head and margin of scales; fins nearly smooth.
emperador, p. 283.
- aa. Scales more or less irregularly placed, in 40 to 48 oblique series from upper angle of gill-opening to base of caudal; 12 to 15 scales in advance of dorsal; 12 to 14 between dorsal and adipose; 8 complete longitudinal rows between lateral line and base of dorsal. Color dark silvery, lateral band very dark posteriorly. Breeding males with small tubercles on head and margin of scales; the fins with barbs, very rough to the touch.
cascajalensis sp. nov., p. 284.

31. *Bryconamericus emperador* (Eigenmann & Ogle).

Astyanax emperador Eigenmann & Ogle, Proc. U. S. Nat. Mus., XXXIII, 1907, 26 (Empire, Panama Canal Zone).

Bryconamericus emperador Eigenmann, Indiana Univ. Studies, No. 18, Pt. II, 1913, 11.

Head 3.05 to 4; depth 2.5 to 3; D. 10 or 11; A. 24 to 29; scales 35 to 41.

Body rather deep, compressed, the back elevated; head small; snout conical, 3.8 to 4.8 in head; eye 2.5 to 2.85; interorbital 2.75 to 3; mouth small; jaws subequal; maxillary reaching anterior margin of pupil, slightly longer than snout; premaxillary teeth in 2 series, the outer series irregular, with 10 teeth, the inner series regular with 8 to 10 teeth; maxillary with 2 small teeth near its juncture with the premaxillary; lower jaw with 8 large teeth anteriorly and abruptly smaller ones at sides; gill-rakers short, about 12 on lower limb of first arch; lateral line complete, moderately decurved; scales moderate, striate, 11 to 13 in advance of dorsal, 10 or 11 between dorsal and adipose, 7 or 8 longitudinal rows between anterior dorsal rays and lateral line; dorsal fin inserted midway between tip of snout and base of caudal; adipose fin about one-third as far from base of upper caudal ray as from base of last dorsal ray; caudal fin forked, the lower lobe the longer; anal fin rather long, its origin a little behind base of last dorsal ray, about midway between base of pectorals and base of caudal; ventral fins reaching to or slightly past vent, inserted midway between tip of snout and base of last anal ray; pectoral fins usually reaching to base of ventrals, inserted midway between tip of lower jaw and base of ventrals.

Color silvery; sides with a plumbeous lateral band, ending in a large, black, caudal spot, which is slightly longer than deep and extended only slightly on base of caudal. An ill-defined shoulder spot present.

This species is represented in the Panama collection by numerous specimens, ranging in length from 45 to 90 mm. It occurs on both slopes of Panama, and is always found in company with *Astyanax ruberrimus*, but much less abundant, except in the Rio Tuyra Basin where it outnumbers the latter.

Habitat: Both slopes of Panama.

32. *Bryconamericus cascajalensis* sp. nov.

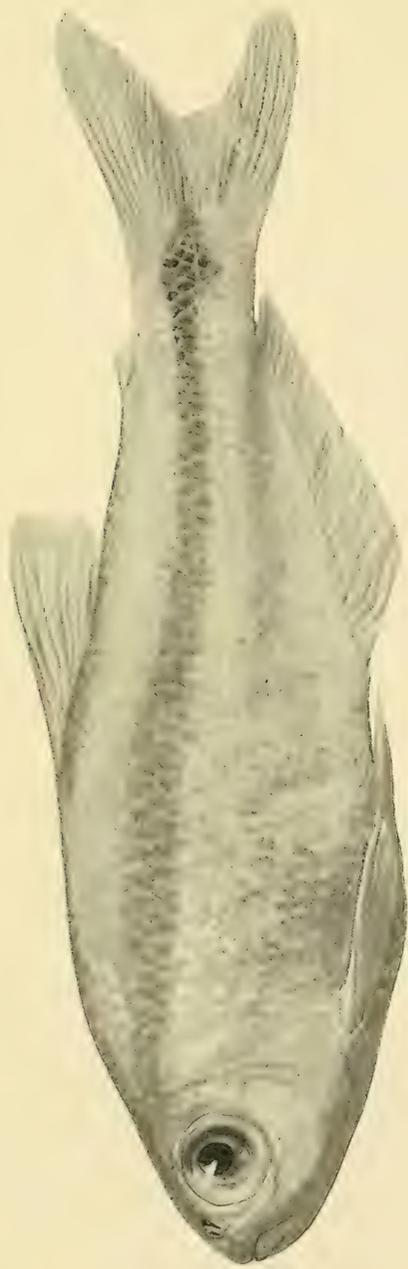
Type No. 8946, F. M. N. H.; length 92 mm.; Rio Cascajal, Porto Bello, Panama.

Head 3.8 to 4; depth 2.6 to 2.95; D. 10 or 11; A. 26 to 29; scales 40 to 48.

Body moderately elongate, compressed; the back elevated; head small; snout conical, 3.4 to 4.25 in head; eye 2.6 to 3; interorbital 2.6 to 3; mouth small; jaws subequal; maxillary reaching to or slightly past anterior margin of pupil, a little longer than snout; premaxillary teeth in 2 series, the outer series irregular, with 10 teeth, the inner series regular, with 8 teeth; maxillary with 2 small teeth near its juncture with the premaxillary; lower jaw with 8 strong teeth anteriorly and abruptly smaller ones at sides; gill-rakers short, about 12 on lower limb of first arch; lateral line complete, slightly decurved; scales rather small, feebly striate, 12 to 15 in advance of dorsal, 12 to 14 between dorsal and adipose, 8 longitudinal rows between lateral line and anterior dorsal rays; dorsal fin inserted about midway between tip of snout and base of caudal; adipose fin only a little more than half as far from base of upper caudal ray as base of last dorsal ray; caudal fin forked, the lower lobe the larger; anal fin rather long, its origin slightly behind base of last dorsal ray, a little nearer origin of pectorals than base of caudal; ventral fins reaching to or slightly past vent, inserted a little nearer tip of snout than base of last anal ray; pectoral fins reaching nearly or quite to base of ventrals, inserted a little nearer base of ventrals than tip of snout.

Color silvery; the back dark green; sides with a plumbeous band, which becomes almost black posteriorly, especially in the males. An elongate caudal spot present, somewhat extended on base of caudal rays. Breeding males with small bluish tubercles on head and margin of scales. An obscure humeral spot present. Fins in breeding males with barbs, making them rough to the touch.

Of this species the present collection contains 38 specimens, ranging in length from 60 to 95 mm. All were taken a little above tide water in



BRYCONAMERICUS CASCAJALENSIS sp. nov.
From a specimen 93 mm. in length.



HEMIBRYCON DARIENSIS sp. nov.
From a specimen 60 mm. in length.

the Rio Cascajal, a small coastal stream, at Porto Bello, on April 24; nearly all are gravid fish.

This species differs from the preceding in the smaller scales, in the somewhat darker coloration, principally in the darker lateral band and in that the breeding male has numerous small tubercles on head and margin of scales and very rough fins.

24. Genus *Hemibrycon* Günther.

Hemibrycon Günther, Cat. Fish. Brit. Mus., V, 1864, 318 (type *Hemibrycon polyodon* Günther).

Body elongate, compressed; head short; maxillary extending nearly or quite to middle of eye; cheeks nearly entirely covered by the first and second suborbitals, leaving only a narrow naked margin behind; premaxillary teeth in 2 series, the inner series with 4+4 or 5+5 teeth; maxillary in the adult with from 5 to 25 teeth, these in part at least tricuspid, teeth along half or more of its free margin; lower jaw with from 4+4 to 6+6 strong teeth anteriorly and with gradually or abruptly smaller teeth at sides; lateral line complete; scales cycloid; caudal naked; middle caudal rays black.

Closely related to *Bryconamericus*, but with more teeth on the maxillary, at least in the adult, and with the inner caudal rays black.

33. *Hemibrycon dariensis* sp. nov.

Type No. 8947, F. M. N. H.; length 65 mm.; Rio Yape, Rio Tuyra Basin, Panama.

Head 3.45 to 4.5; depth 2.4 to 3.55; D. 9 or 10; A. 27 to 29, rarely 30; scales 8-38 to 41-6.

Body elongate, compressed; profile straight or gently convex over eyes, elevated at nape; head short; snout blunt, 4 to 5 in head; eye 2.6 to 3.25; interorbital 2.8 to 3.15; mouth moderate; jaws subequal; maxillary reaching nearly to opposite middle of eye; premaxillary teeth in 2 series, the outer series irregular, the last tooth on each side and the 2 anterior teeth placed further outward, the second series with 8 larger teeth, each tooth with 4 to 5 cusps, one of them considerably enlarged; maxillary with from 6 to 10 teeth, similar to second premaxillary series, but larger, abruptly smaller ones at sides, these about 10 in number; gill-rakers short, 10 on lower limb of first arch; lateral line complete, decurrent, the pores on anterior 3 to 6 scales usually poorly developed; scales thin, striate, 14 to 16 rows in advance of dorsal, 9 to 11 rows between dorsal and adipose, the longitudinal rows above and in advance

of anal decurrent, with several interpolated rows; origin of dorsal fin about midway between tip of snout and base of caudal; adipose fin well developed, over posterior fifth of anal, a little nearer base of caudal than base of last dorsal ray; caudal fin forked, the lobes of about equal length; anal fin rather long, its base 2.8 to 3.25 in length of body, its origin under posterior rays of dorsal, midway between posterior margin of eye and base of caudal; ventral fins scarcely reaching origin of anal, inserted an eye's diameter nearer tip of snout than base of last anal ray; pectoral fins reaching to or slightly past base of ventrals, only slightly shorter than head.

Color silvery; sides with a plumbeous lateral band, darkest posteriorly; faint humeral and opercular spots present; a black band extending from base of caudal to tips of middle caudal rays.

Of this species there are 66 specimens, ranging from 40 to 80 mm. in length, in the present collection. All were taken in the Rio Tuyra Basin. We have designated as the type a specimen, 65 mm. in length, from the mouth of the Rio Yape.

Considerable variation in the depth of the body and the number of teeth on the maxillary is apparent among our specimens, but these appear to be only individual variations.

This species differs from *H. decurrens* (Eigenmann), of which we have examined a paratype, in the fewer scales in the lateral line, in the slightly shorter and more posteriorly placed anal. In *H. decurrens* there are 44 scales in the lateral line, 31 to 33 anal rays and the origin of the anal is in front of the middle of base of dorsal. This species is also closely related to *H. guppii* (Regan) from which it apparently differs in having one more row of scales between the lateral line and base of dorsal, also one more row between base of anal and lateral line; the rows of scales in *H. guppii* above and in advance of anal are less strongly decurrent and the interpolated rows are fewer.

Habitat: Rio Tuyra Basin, Panama.

25. Genus *Hyphessobrycon* Durbin.

Hyphessobrycon Durbin, in Eigenmann, Bull. Mus. Comp. Zool., LII, 1908, 100 (type *Hemigrammus compressus* Meek).

Dermatocheir Durbin, Ann. Carnegie Mus., 1909, 55 (type *Dermatocheir catablepta* Durbin).

Body short, compressed, the back elevated; head short; premaxillary teeth in 2 series; maxillary teeth, if present, crowded on the upper anterior angle; lateral line incomplete; caudal fin naked; the lobes equal or subequal.

34. *Hyphessobrycon panamensis* Durbin.

Hyphessobrycon panamensis Durbin, in Eigenmann, Bull. Mus. Comp. Zool., LII, 1908, 101 (Rio Boqueron, Atlantic slope, Panama).

Hemigrammus minutus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1912, 67 (Agua Clara, Panama).

Head 3.43 to 3.8; depth 2.4 to 2.85; D. 11; A. 22 to 25; scales 7-32 to 36-6.

Body short, compressed; profile straight over eyes, elevated from nape to dorsal; head short; snout blunt, 3.15 to 4.8 in head; eye 2 to 2.65; interorbital 3 to 4.4; mouth rather small; jaws subequal; maxillary reaching anterior margin of pupil; premaxillary teeth in 2 series, the first series with 6 tricuspid teeth; the inner series with 10 teeth, each with 3 or 4 cusps, one of the cusps considerably enlarged; maxillary with 3 small teeth on the upper anterior angle; teeth in lower jaw in a single series, 8 large ones anteriorly, similar to the second series of premaxillary teeth but larger, and abruptly smaller ones at sides; gill-rakers short, about 10 on lower limb of first arch; lateral line present on 8 to 13 scales; scales thin, striate, 10 to 12 in advance of dorsal, 7 to 9 between dorsal and adipose, 12 longitudinal rows between base of dorsal and base of ventral; origin of dorsal midway between tip of snout and base of caudal; adipose fin well developed, over last rays of anal; caudal fin naked, the lobes of about equal length; anal fin slightly emarginate, its origin under last ray of dorsal; ventral fins reaching past origin of anal, inserted midway between tip of snout and base of last anal ray; pectoral fins reaching past base of ventrals, a little shorter than head.

Color silvery; sides with a dark line at least posteriorly; no caudal spot; one and sometimes two faint shoulder spots present. Scales and fins with dusky points; tip of anal and anterior dorsal ray sometimes black.

This species is represented by 140 specimens in the present collection, ranging in length from 30 to 50 mm. These were taken only in the lower part of the Rio Chagres Basin. Although the type is listed from the Rio Boqueron, one of the upper tributaries of the Rio Chagres, we did not get it there during several days fishing.

Habitat: Rio Chagres Basin, Panama.

26. Genus *Thoracocharax* Fowler.

Thoracocharax Fowler, Proc. Ac. Nat. Sci. Phila., 1906, 452 (type *Gasteropelecus stellatus* Kner).

Body strongly compressed, the thoracic region dilated into a semicircular disc; abdomen compressed into a sharp keel; dorsal profile anteriorly slightly convex; teeth tricuspid or conical, in 2 series on premaxillary;

maxillary with a few small teeth on its edge; mandible with a single series; lateral line incomplete, directed downward and backward; dorsal inserted far back; pectorals large; ventrals very small; adipose present.

35. *Thoracocharax maculatus* (Steindachner). Paribiba.

Gasteropelecus maculatus Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1879, 168 (Rio Mamoni, Chepo, Panama); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 338; Regan, Biol. Cent. Amer., Pisces, 1908, 173.

Head 3.35 to 4; depth 1.7 to 1.9; D. 10 or 11; A. 33 to 36; scales 30 to 35.

Body deep, strongly compressed; the dorsal profile straight over eyes, but slightly convex from nape to dorsal; the thoracic region much dilated, the abdomen with a sharp keel; head small, flat above; snout blunt, 3.4 to 4 in head; eye 3.1 to 4; interorbital 2.1 to 2.45; mouth small, nearly vertical; lower jaw projecting; maxillary reaching anterior margin of eye; premaxillary teeth in 2 series, the outer series consisting of only 2 conical teeth, near tip of jaw, the second series with 10 tricuspid teeth; maxillary with 4 or 5 pointed teeth on its edge; lower jaw with a single series, anteriorly with 8 tricuspid teeth and abruptly smaller ones at sides; gill-rakers poorly developed; lateral line incomplete, directed downward and backward toward about the third ray of anal, failing to reach base of anal by from 3 to 6 scales; scales large along side, reduced on abdomen and above base of anal, the rows directed downward and backward on lower part of side; dorsal fin small, its origin notably behind origin of anal, about midway between margin of preopercle and tip of caudal; adipose fin small, just behind vertical from base of last anal ray; caudal fin forked, the lobes subequal; anal fin rather long, its base equal to depth of body at origin of dorsal; ventral fins not much longer than pupil, inserted just in front of vent; pectoral fins large, reaching beyond origin of anal, 2 to 2.25 in length of body.

Color silvery, darker above; sides sometimes with a faint plumbeous band; no caudal spot. Chromatophores on scales so arranged as to form dotted vertical lines on sides; abdominal keel dusky. Fins unmarked.

Of this species there are at hand nearly 300 specimens, ranging in length from 42 to 92 mm. These were taken near Chorrera, Panama, and in the Rio Bayano and Rio Tuyra basins.

We have for comparison specimens of *T. brevis* Eigenmann, from Raspadura, Atrato Basin, Colombia. This is certainly a very closely related species, if in fact distinct. The two seem to intergrade, but *T. brevis* averages fewer scales in the lateral series and the average depth is slightly greater.

Habitat: Pacific slope of Panama.



Cragrutus notropoides Meek & Hildebrand
From a specimen 60 mm. in length.

27. Genus *Creagrutus* Günther.

Creagrutus Günther, Cat. Fish. Brit. Mus., V, 1864, 339 (type *Leporinus mülleri* Günther).

Body elongate, not strongly compressed; abdomen rounded; head rather low; second suborbital large, covering nearly the entire cheek; premaxillary teeth in 3 series; maxillary with from 1 to 4 teeth; mandible with a single series of teeth, the anterior ones enlarged; gill-membranes free from the isthmus; lateral line complete; anal fin short, of not more than 17 rays. Species small.

KEY TO THE SPECIES.

- a. Depth of body 3.6 to 4.3; upper jaw little projecting; none of the premaxillary teeth exposed when mouth is closed; 11 or 12 gill-rakers on lower limb of first arch. *notropoides*, p. 289.
- aa. Depth of body 3.1 to 3.7; upper jaw strongly projecting; most of the first series of premaxillary teeth exposed when mouth is closed; 7 to 9 gill-rakers on lower limb of first arch. *simus*, p. 290.

36. *Creagrutus notropoides* Meek & Hildebrand.

Astyanax mexicanus (non Filippi) Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXIII, 1910, 4 (Canal Zone, Panama).

Creagrutus notropoides Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1912, 68 (Rio Indio, upper tributary of Rio Chagres).

Creagrutus affinis (in part) Eigenmann, Indiana Univ. Studies, No. 18, 1913, 7 (Rio Chagres; Puerto Negria; Istmina; Boca de Raspadura).
Head 3.6 to 3.95; depth 3.6 to 4.3; D. 10; A. 14 to 16; scales 5-34 to 38-4.

Body elongate, not strongly compressed anteriorly; caudal peduncle rather strongly compressed, its depth 2.1 to 2.5 in head; dorsal region little elevated; head low, rather wide; snout blunt 3.65 to 4.6 in head; eye 2.6 to 3; interorbital 2.8 to 3.25; mouth small; upper jaw but little in advance of the lower; maxillary-premaxillary border rather strongly curved; maxillary reaching anterior margin of pupil; premaxillary teeth all covered by the lower lip when mouth is closed, the series irregular; maxillary with 3 or 4 small teeth; lower jaw with 8 large teeth anteriorly and about 4 smaller ones at each side; teeth in the young pointed or tricuspid, very blunt or even pavid in adult; gill-rakers moderate, 11 or 12 on lower limb of first arch; scales striate, 8 or 9 before dorsal, 9 or 10 between dorsal and adipose; 9 or 10 longitudinal rows between base of dorsal and base of anal; origin of dorsal over base of ventrals, midway between tip of snout and tip of adipose, or slightly nearer the latter; adipose fin well developed, just behind vertical from

base of last ray of anal; caudal fin naked, the lobes subequal; anal fin rather small, its origin a little behind last ray of dorsal, about midway between preopercular margin and base of caudal; ventral fins reaching to or slightly past origin of anal; pectoral fins reaching base of ventrals, about as long as head without snout.

Color silvery; sides with a plumbeous lateral band; a distinct shoulder spot present; caudal spot wanting; fins unmarked.

There are 148 specimens, ranging in length from 35 to 80 mm., in the present collection. All are from the Rio Chagres and its tributaries. Inhabiting upland streams where the current is swift.

We have compared our specimens with specimens of *C. affinis* Steindachner, identified by Dr. Eigenmann, from Colombia and Ecuador. We have also examined a number of the paratypes of *C. magdalena* Eigenmann, and find that our specimens differ from both in having 1 or 2 more rows of scales between the base of dorsal and base of anal. Our specimens are also more slender and the upper jaw projects less strongly.

Habitat: Rio Chagres Basin, Panama.

37. *Creagrutus simus* Meek & Hildebrand.

Creagrutus simus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 85 (Rio Cupe, tributary of Rio Tuyra, Cituro, Panama).

Head 3.5 to 4; depth 3.1 to 3.7; D. 10; A. 14 to 16; scales 5-34 to 36-4.

Body elongate, moderately compressed; caudal peduncle strongly compressed, its depth 2 to 2.4 in head; dorsal region little elevated; snout blunt, 3.5 to 4 in head; eye 2.45 to 3.13; interorbital 2.9 to 3; upper jaw notably projecting; maxillary-premaxillary border strongly curved; maxillary reaching slightly past anterior margin of pupil; outer series of premaxillary teeth anteriorly in advance of the lower lip, exposed when the mouth is closed; maxillary with 2 or 3 small teeth; lower jaw with 8 large teeth anteriorly and 3 to 5 smaller ones at sides; teeth in the young tricuspid or pointed, blunt in the adult; gill-rakers short, 7 to 9 on lower limb of first arch; scales striate, 9 or 10 before dorsal, 7 to 9 between dorsal and adipose, 9 or 10 longitudinal series between base of dorsal and base of anal; origin of dorsal over base of ventrals, a little nearer tip of adipose than tip of snout, adipose fin well developed, over base of last anal ray; caudal fin naked, the lobes subequal; anal fin rather small, its origin just behind last ray of dorsal, about midway between margin of opercle and base of caudal; ventral fins usually reaching origin of anal; pectoral fins usually not quite reaching base of ventrals, slightly longer than head without snout.

Color silvery; sides with a plumbeous lateral band; a distinct shoulder spot present; no caudal spot; fins unmarked.

The present collection contains over 400 specimens of this species, ranging in length from 30 to 70 mm. All are from the Rio Tuyra Basin. Inhabiting upland streams where the current is swift.

This species is evidently very closely related to *C. affinis* Steindachner, from which it, however, differs in having 1 or 2 more longitudinal rows of scales between the base of dorsal and base of anal.

Habitat: Rio Tuyra Basin, Panama.

28. Genus *Rœboides* Günther.

ANCHOVATA OR ANCHOBETA.

Rœboides Günther, Cat. Fish. Brit. Mus., V, 1864, 347 (type *Anacyrtus microlepis* Reinhardt).

Body elongate, ventral region rounded; teeth mostly pointed, in 2 or $\frac{3}{2}$ more series, present on maxillary, premaxillaries and mandible; gill-openings wide, the membranes separate, free from the isthmus; gill-rakers slender; shoulder girdle with a large spine; lateral line straight, complete; anal fin very long; adipose fin well developed.

KEY TO THE SPECIES.

a. Scales in lateral line 82 to 89, rarely with 80 or 81; gill-rakers short, 8 or 9 on lower limb of first arch; origin of dorsal notably nearer tip of snout than base of caudal; origin of anal nearer tip of snout than base of last ray of anal; no black blotch behind the obscure spot at upper angle of gill-opening; a black longitudinal bar in lateral band under base of dorsal usually present.

guatemalensis, p. 291.

aa. Scales in lateral line 72 to 80; gill-rakers longer, 10 to 11 on lower limb of first arch; origin of dorsal about midway between tip of snout and base of caudal; origin of anal midway between tip of snout and base of last anal ray; a large black blotch an eye's diameter behind the obscure spot at upper angle of gill-opening.

occidentalis sp. nov., p. 293.

38. *Rœboides guatemalensis* (Günther).

Anacyrtus (Rœboides) guatemalensis Günther, Cat. Fish. Brit. Mus., V, 1864, 347 (Rio Chagres; Huamuchal; Lake Nicaragua); Vaillant, Bull. Mus. d'Hist. Nat., 1897, 221 (Rio Chagres).

Cynopotamus guatemalensis Garman, Bull. Essex Inst., XII, 1890, 13 (Rio Chagres).

Ræstes guatemalensis Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., XIV, 1891, 56.

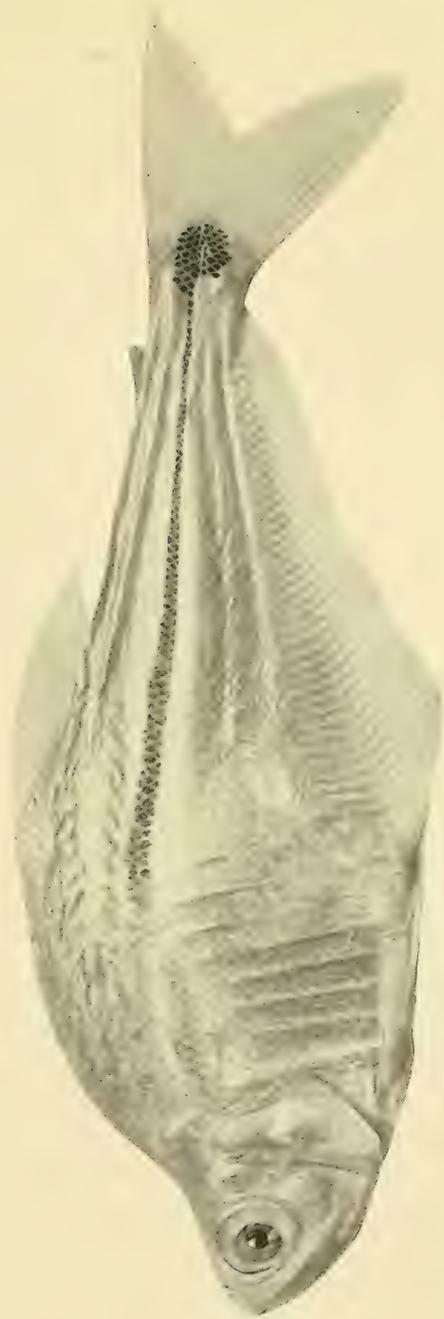
Ræboides guatemalensis Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., XIV, 1891, 57; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 338; Regan, Biol. Cent. Amer., Pisces, 1908, 174 (Rio Chagres); Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXII, 1909, 101 (Rio Boqueron; Tabernilla, Atlantic slope, Panama Canal Zone).

Head 3.75 to 4.2; depth 2.65 to 2.95; D. 11; A. 47 to 52; scales 82 to 89, rarely 80 or 81.

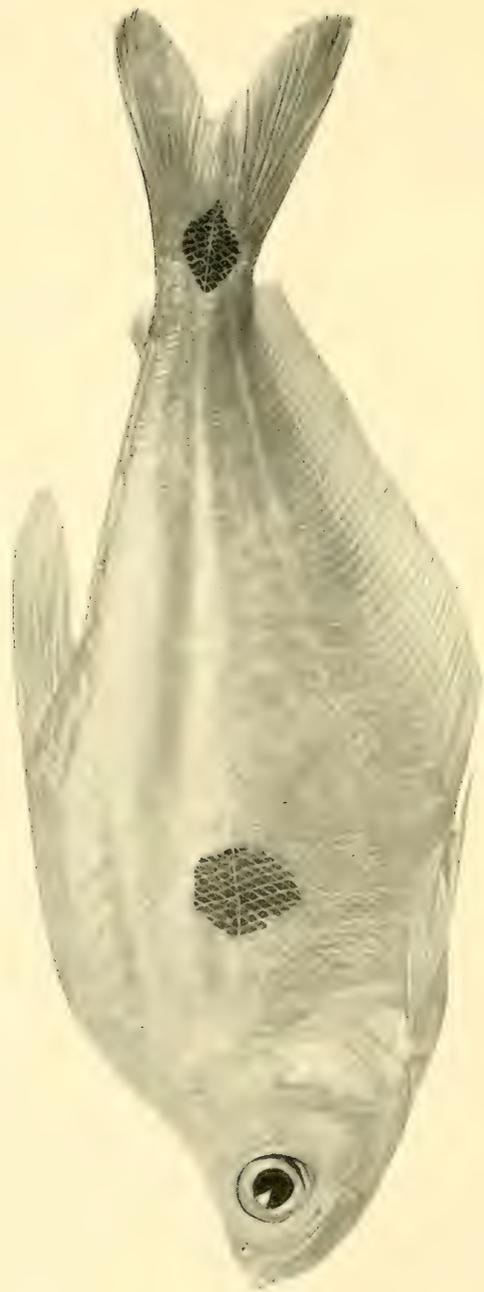
Body deep, strongly compressed; the dorsal region elevated; profile deeply concave over eyes in adult, less so in young; head small; snout blunt, 3.34 to 4.5 in head; eye 3.1 to 3.8; interorbital 3.4 to 4.1; mouth large; upper jaw projecting; maxillary reaching posterior margin of pupil, 1.85 to 2.25 in head; premaxillary teeth in 3 more or less irregular series; the first series composed of 4 conical teeth on outer edge pointed directly outward, horn-like; the second series with pointed teeth, the anterior ones in advance of lower lip; the third series composed of tricuspid teeth; maxillary with about 6 small teeth on its inner anterior angle and with from 5 to 8 blunt teeth on its outer margin; lower jaw with 2 series, the first series with 2 conical teeth on outer margin pointed directly forward, the second series anteriorly with 4 tricuspid teeth, then with 2 or 3 smaller conical teeth at each side, then a larger tricuspid tooth, this one followed by several minute, conical teeth; gill-rakers rather short, 8 or 9 on lower limb of first arch; shoulder girdle with a sharp spine, reaching base of pectorals; lateral line complete, straight; scales small and thin; dorsal fin elevated anteriorly, its origin a little nearer tip of adipose than tip of snout; adipose fin well developed, over the base of about the eighth anal ray counting from the last ray forward; caudal fin naked, the lower lobe the larger; anal fin very long, its origin nearer tip of snout than the base of its last ray; ventral fins reaching past origin of anal; pectoral fins overlapping the ventrals, not much longer than the latter.

Color greenish brown above, silvery below; a bright silvery lateral band in which there is often a short longitudinal black bar under base of dorsal. An obscure shoulder spot near upper angle of gill-opening usually present; a large black caudal spot; pectorals greenish yellow; other fins greenish at base, becoming red at tips.

Of this species there are numerous specimens in the present collection, ranging in length from 40 to 150 mm. It is one of the most common fishes in the streams of the Atlantic slope of Panama, occurring everywhere from brackish water upward to the mountain streams.



RCEBOIDES GUATEMALENSIS (Günther).
From a specimen 130 mm. in length.



PERCOIDES OCCIDENTALIS sp. nov.
From a specimen 137 mm. in length.

It is eaten by the natives who fry it crisp in oil. Prepared in this way the bones and flesh are eaten together, making a very palatable dish.

Habitat: Atlantic slope of Panama northward to Guatemala.

39. *Rœboides occidentalis* sp. nov.

Type No. 8948, F. M. N. H.; length 115 mm.; Rio Cardenas, Corozal, Panama.

Head 3.35 to 4.1; depth 2.35 to 2.9; D. 11; A. 44 to 50; scales 72 to 80.

Body deep, strongly compressed; the dorsal region elevated; profile deeply concave over eyes in adult, less so in young; head small; snout blunt, 3.5 to 4 in head; eye 3 to 3.9; interorbital 3.45 to 3.9; mouth large; upper jaw projecting; maxillary reaching posterior margin of pupil, 1.7 to 2.2 in head; teeth as in preceding species; gill-rakers moderate, 10 or 11 on lower limb of first arch; shoulder girdle with a long, sharp spine reaching base of pectoral; lateral line straight, complete; scales small and thin; dorsal fin elevated anteriorly, its origin about midway between tip of snout and base of caudal or slightly nearer the former; adipose fin well developed, over about the seventh ray of anal counting from the last ray forward; caudal fin naked, the lower lobe the larger; anal fin very long, its origin about midway between tip of snout and base of its last ray; ventral fins reaching past origin of anal; pectoral fins overlapping the ventrals, a little longer than the latter.

Color greenish above, silvery below; with bright silvery lateral band; an obscure shoulder spot at upper angle of opercle; a larger and more distinct black spot about an eye's diameter behind the first; a black caudal spot present. Pectorals greenish; other fins greenish at base, reddish at tips.

We have numerous specimens, ranging in length from 30 to 170 mm. It is common in all the Pacific slope streams of Panama, from the head of tide water up to the mountain streams.

This species like the preceding is used as food.

Habitat: Pacific slope of Panama and probably southward to Colombia and Ecuador.

29. Genus *Brycon* Müller & Troschel.

PIPON; SARDINA.

Brycon Müller & Troschel, Horæ Ichthyologiæ, I, 1845, 15 (type *Brycon falcatus* Müller & Troschel).

Chalcinopsis Kner, Sitzungsbr. K. Bayer. Ak. Wiss. München., 1863, 226 (type *Chalcinopsis striatus* Kner).

Body elongate, robust anteriorly, compressed posteriorly, covered with cycloid scales; dorsal fin over or slightly behind ventrals; mouth

large, premaxillary with 3 or 4 series of teeth, each tooth with from 3 to 5 cusps; teeth in lower jaw in 2 series, the first composed of large tricuspid teeth, the second series with 2 canine teeth situated behind anterior teeth in first series; maxillary with small tricuspid teeth; nostrils close together; gill-openings wide, the membranes slightly united, free from the isthmus; gill-rakers slender; fontanel present.

The species of this genus range from Guatemala, south. Four species are found in the region of the Canal Zone.

KEY TO THE SPECIES.

- a. Scales small, 64 to 80 in lateral series; anal fin long, its base much longer than head, with 32 to 37 rays.
- b. Teeth in lower jaw very large and strong, usually 8, rarely only 7 and occasionally 9, in outer series; teeth on outer edge of maxillary very small, 9 to 10 in number; 18 to 21 vertical rows of scales crossing back between dorsal and adipose.
 - striatulus*, p. 294.
- bb. Teeth in lower jaw notably smaller, 13 to 14 in outer series; teeth on outer edge of maxillary moderately developed, 12 to 13 in number; 21 to 25 vertical rows of scales crossing back between dorsal and adipose.
 - chagreensis*, p. 295.
- aa. Scales larger, 43 to 58 in lateral series; anal fin short, its base about equal to length of head, with 24 to 30 rays.
- c. Scales moderate, 53 to 58 in lateral series, 16 to 18 vertical rows crossing back between dorsal and adipose; upper jaw strongly projecting, exposing two series of premaxillary teeth anteriorly.
 - petrosus*, p. 297.
- cc. Scales large, 43 to 48 in lateral series, 12 to 14 vertical rows crossing back between dorsal and adipose; upper jaw only slightly in advance of the lower, the second series of premaxillary teeth well covered by lower lip.
 - argenteus*, p. 298.

40. *Brycon striatulus* (Kner).

Chalcinopsis striatulus Kner, Sitzungs. K. Bayer. Ak. Wiss. München, 1863, 226 (Panama); Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München, 1866, 38, Pl. V, fig. 2 (New Granada and Panama on the Pacific slope); Günther, Cat. Fish. Brit. Mus., V, 1864, 337.

Brycon striatulus (in part) Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 337.

Head 3.6 to 4.45; depth 3.05 to 3.6; D. 11; A. 32 to 35; scales in lateral series 64 to 73.

Body elongate, compressed; profile slightly concave over eyes, slightly rounded in region of dorsal; head rather small; snout pointed, 3.5 to 4.3 in head; eye 3 to 4.6; interorbital 2.35 to 3.5; mouth moderate; upper jaw strongly projecting; maxillary scarcely reaching middle of eye, 2.05 to 2.3 in head; premaxillary teeth laterally in only 2 series, anteriorly in 4 series, the third series consisting of only 2 teeth; the fourth or transverse series situated just in front of the teeth in lower jaw, composed of 3 or 4 teeth; the series on outer edge of maxillary very small, only 9 or 10 in number; those in lower jaw very large and strong, usually 8, rarely 7 and occasionally 9 in first series; gill-rakers rather small, about 15 on lower limb of first arch; lateral line complete, curved downward; scales moderate, regularly placed, 18 to 21 vertical rows crossing back between dorsal and adipose, 4 or 5 longitudinal rows between lateral line and base of pectoral; dorsal fin inserted slightly nearer base of caudal than tip of snout; caudal fin forked, the lower lobe the longer; anal fin long, its base much longer than head, inserted slightly behind base of last ray of dorsal; ventral fins inserted midway between base of pectoral and origin of anal or slightly nearer the latter; pectoral fins inserted under margin of opercle, usually reaching nearly to base of ventrals.

Color steel blue above, silvery below; a black bar on shoulder behind margin of opercle; sides otherwise perfectly plain in our largest specimens. The smaller ones with indistinct blackish vertical bars and a large caudal spot. Young of 100 mm. and less in length with a dark lateral band. Fins unmarked at all ages.

This species is represented by 62 specimens, ranging from 45 to 365 mm. in length. It was taken in the Rio Chorrera at Chorrera, Rio Juan Diaz, a small stream near Panama, and in the Rio Bayano and Rio Tuyra basins.

Habitat: Pacific slope of Panama.

41. *Brycon chagrensis* (Kner).

Chalcinopsis chagrensis Kner, Sitzungsber. K. Bayer. Ak. Wiss. München., 1863, 223; Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München., 1864, 42, Pl. V, fig. 3 (Rio Chagres); Günther, Cat. Fish. Brit. Mus., V, 1864, 338; Vaillant, Bull. Mus. d'Hist. Nat., 1897, 22 (Rio Chagres).

Brycon striatulus (in part) Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 337; Eigenmann & Ogle, Proc. U. S. Nat. Mus., XXXIII, 1907, 30 (Aspinwal, now Colon); Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXIII, 1910, 4 (Panama Canal Zone).

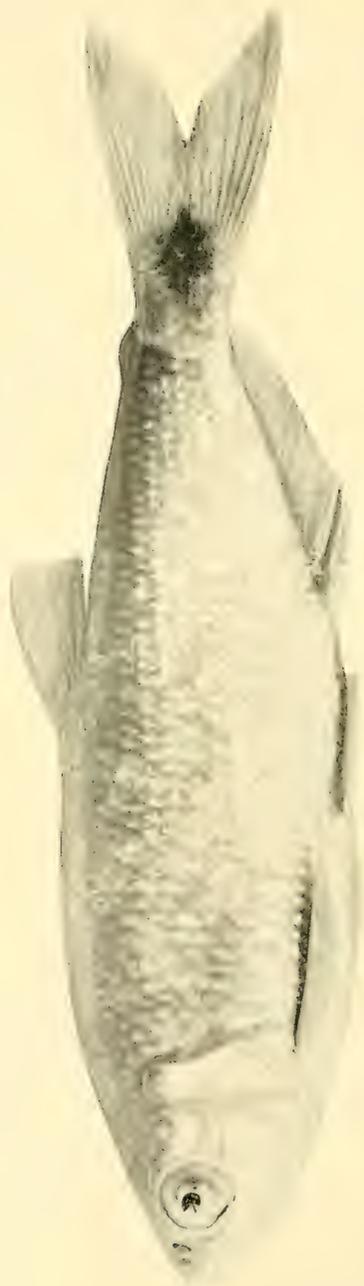
Head 3.6 to 4.9; depth 3 to 3.65; D. 11; A. 32 to 37; scales in lateral series 70 to 80.

Body elongate, compressed; profile straight or slightly concave over eyes, slightly rounded in region of dorsal; head rather small; snout pointed, 3.2 to 4 in head; eye 2.6 to 4.6; interorbital 2.18 to 3.6; mouth moderate; upper jaw strongly projecting; maxillary usually not quite reaching middle of eye, 2 to 2.35 in head; premaxillary teeth laterally in only 2 series, anteriorly in 4 series, the fourth or transverse series situated just in front of teeth in lower jaw, composed of 3 or 4 teeth; the series on outer edge of maxillary moderately developed, 12 or 13 in number; teeth in lower jaw moderate, notably smaller than in *B. striatulus*, 13 or 14, rarely only 12, in first series; gill-rakers rather small, about 15 on lower limb of first arch; lateral line complete, curved downward; scales rather small, more or less irregularly placed, 21 to 25 vertical rows between dorsal and adipose, 4 or 5 longitudinal rows between lateral line and base of pectoral; dorsal fin inserted midway between tip of snout and base of caudal, or slightly nearer the latter; caudal fin forked, the lower lobe the larger; anal fin inserted behind base of last ray of dorsal, its base notably longer than head; ventral fins inserted a little nearer origin of anal than base of pectorals; pectoral fins inserted under margin of operclei failing to reach base of ventrals by 3 or 4 rows of scales in large examples, sometimes reaching ventrals in the smaller ones.

Color steel blue above, silvery below; a black bar on shoulder behind margin of opercle; sides with ill defined blackish bars, these not evident in specimens less than 110 mm. in length. The young with a dark lateral band. A caudal spot present, or rarely wanting in large specimens. Fins unmarked.

This species is represented by many specimens, ranging from 25 to 500 mm. in length. It is very common in all streams in the Rio Chagres Basin, ranging from the lowland waters to the highest mountain streams. It is the most important fresh water food fish of Panama. Its flesh is penetrated by numerous small bones, but it is of good flavor and much prized by the natives. It is much more abundant than its Pacific slope relative, *B. striatulus*.

This species differs from *B. striatulus* principally in the dentition. The scales are also a little smaller. The average in a lateral series for the present species in 9 specimens is 74+, while in the preceding species for the same number of specimens the average is 68+. In the present species from 12 to 15 vertical rows of scales cross the back, between the dorsal and adipose, while in the foregoing there are 18 to 21 rows. The color in the present species



BRYCON PETROSUS Meek & Hildebrand.
From a specimen 140 mm. in length.

is somewhat darker and the blackish bars on sides are usually more distinct.

An examination of specimens from Guatemala shows these to represent a distinct species and should be known as *Brycon guatemalensis* Regan. The teeth are like those of *B. striatulus*, but the scales are larger (53 or 54 in a lateral series).

Habitat: Atlantic slope of Panama.

42. *Brycon petrosus* Meek & Hildebrand.

Brycon petrosus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 184 (Upper Chagres, Panama).

Head 3.3 to 4.1; depth 3.15 to 3.9; D. 11, rarely 10; A. 24 to 30; scales in lateral series 53 to 58.

Body elongate, compressed, profile straight over eyes, somewhat elevated at nape; head moderate; snout pointed, 3.44 to 4 in head; eye 2.83 to 4.23; interorbital 2.15 to 4; mouth moderate; upper jaw strongly projecting; maxillary reaching slightly past anterior margin of pupil, 2.1 to 2.66 in head; premaxillary teeth laterally in only 2 series, the second series exposed at least anteriorly, not covered by lower lip; the last or transverse series rather close in front of teeth in lower jaw; the outer series of premaxillary teeth usually 14, rarely 16, in number; outer series in lower jaw with 8 strong teeth of about equal size and 2 or 3 smaller ones behind laterally; gill-rakers about 12 to 14 on lower limb of first arch; lateral line decurved, notably below median line of side; scales moderate, regularly placed, 16 to 18 vertical rows crossing back between dorsal and adipose; 3 complete rows between lateral line and base of pectoral; dorsal fin inserted a little nearer base of caudal than tip of snout; adipose fin half as far from base of upper caudal ray as from base of last dorsal ray; caudal fin forked, the lower lobe the longer; anal fin rather short, its base slightly longer than head, its origin a little behind base of last dorsal ray, slightly nearer base of caudal than base of pectoral; ventral fins usually reaching vent, inserted nearer origin of anal than base of pectoral; pectoral fins inserted under margin of opercle, usually failing to reach base of ventrals by 2 to 4 rows of scales.

Color silvery, bluish above, lighter below; sides plain silvery; an obscure shoulder spot present in the smaller specimens, wanting in all of our larger individuals; very young with a dark lateral band. A large black caudal spot present at all ages.

This species is represented by numerous specimens, ranging from 50 to 285 mm. in length. It is less abundant than *B. chagrensis* and does not grow as large. It was not found in the lowland waters but it is

common in the upper courses of rocky streams in the Rio Chagres Basin. From *B. argenteus* of the Pacific slope, its nearest relative, it differs mainly in the smaller scales.

Habitat: Atlantic slope of Panama.

43. *Brycon argenteus* Meek & Hildebrand.

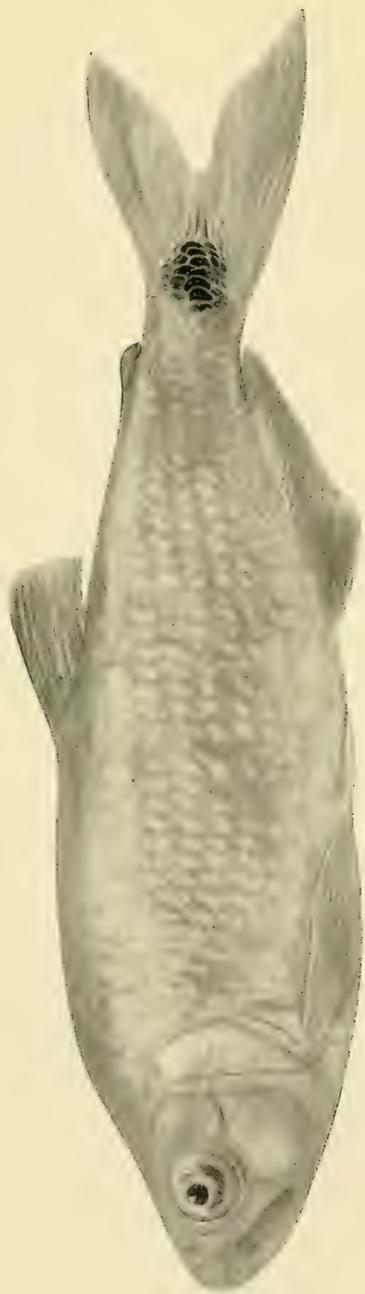
Brycon argenteus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 84 (Rio Aruza, Darien).

Head 3.5 to 4.45; depth 2.96 to 3.84; D. 11, rarely 10; A. 24 to 28; scales in lateral series 43 to 48.

Body elongate, compressed, profile straight over eyes, somewhat elevated at nape; head small; snout pointed, 3.46 to 4.2 in head; eye 2.86 to 4.25; interorbital 2.4 to 3.5; mouth moderate; upper jaw a little in advance of the lower; maxillary reaching to or slightly past anterior margin of pupil, 2.1 to 2.44 in head; premaxillary teeth laterally in only 2 series, the second series well covered by the lower lip; the last or transverse series situated close in front of the teeth in lower jaw, touching them when mouth is closed; the outer series of premaxillary teeth 14 in number; first series in lower jaw with 8 strong teeth of about equal size and 2 or 3 smaller ones behind laterally; gill-rakers rather small, 12 to 14 on lower limb of first arch; lateral line decurved, below median line of side; scales large, regularly placed, 12 to 14 vertical series crossing back between dorsal and adipose; 2 longitudinal rows between lateral line and base of pectoral; dorsal fin inserted a little nearer base of caudal than tip of snout; adipose fin only half as far from base of upper caudal ray as base of last dorsal ray; caudal fin forked, the lower lobe the larger; anal fin short, its base about as long as head, its origin below or slightly behind base of last dorsal ray, a little nearer base of caudal than base of pectorals; ventral fins usually not quite reaching vent, inserted a little nearer origin of anal than base of pectorals; pectoral fins inserted under margin of opercle, sometimes reaching base of ventrals, but often failing to reach them by 2 or 3 rows of scales.

Color silvery, bluish above, pale silvery below; sides plain in large specimens, the smaller ones often with indistinct dark reticulations; very young with a dark lateral band. A large black caudal spot present; no opercular spot; a blackish spot or bar at shoulder, this indistinct in some of the larger specimens.

The present collection contains 340 specimens, ranging in length from 30 to 230 mm. This species was taken in the Rio Chorrera and in the Rio Bayano and Rio Tuyra basins. It is common in the upper courses of rocky streams, reaching a smaller size than *B. striatulus* and of less value as food.



BRYCON ARGENTEUS Meek & Hildebrand.
From a specimen 142 mm. in length.

Closely related to *B. oligolepis* Regan (Ann. & Mag. Nat. Hist., Ser. 8, IX, 1913, 462). We have not seen the type of the latter, but have for comparison specimens from the type locality (Rio Condoto), identified by Dr. Eigenmann. The differences noted are: a. The more strongly projecting upper jaw of the latter, exposing 2 series of premaxillary teeth, while in the former the upper jaw projects but little and the second series of teeth is well covered by the lower lip. b. The last series of premaxillary teeth is situated well in front of the teeth in lower jaw, leaving a space between them when the mouth is closed. In *B. argenteus* the last series of premaxillary teeth are close in front of the teeth in lower jaw, touching the latter when the mouth is closed.

Habitat: Pacific slope of Panama.

30. Genus *Piabucina* Cuvier & Valenciennes.

Piabucina Cuvier & Valenciennes, Hist. Nat. Poiss., XXII, 1849, 161
(type *Piabucina erythrinoides* Cuvier & Valenciennes).

Body oblong, covered with large scales; ventral region rounded; mouth moderate; teeth in upper jaw in one series, tricuspid, those of lower jaw in two series; maxillary with few teeth; nostrils close together; gill-openings wide, the membranes not attached to the isthmus; lateral line wanting; dorsal and anal fins short; dorsal fin inserted behind ventrals.

Neither of the two species listed below grows large. Our largest specimens are only a little over 200 mm. in length.

KEY TO THE SPECIES.

- a. A dark lateral band extending from above posterior angle of opercle to base of caudal and situated on median line of side, this band broad at shoulder, becoming narrower, posteriorly often broken up into blotches, ending in a large caudal spot; body slender, the depth 4 to 4.6 in length; depth of caudal peduncle 2.16 to 2.7 in head; maxillary reaching middle of eye; origin of dorsal midway between margin of preopercle and tip of adipose. *panamensis*, p. 300.
- aa. A dark lateral band extending from posterior angle of opercle to base of caudal, situated notably below median line of side, anteriorly very obscure and not connected with the shoulder spot, becoming more distinct above ventrals, not broken up into spots posteriorly; no caudal spot; body rather robust, the depth 3.6 to 3.95 in length; depth of caudal peduncle 1.75 to 2 in head; maxillary reaching slightly past anterior margin of eye; origin of dorsal midway between tip of adipose and margin of opercle. *festæ*, p. 301.

44. *Piabucina panamensis* Gill.

Piabucina panamensis Gill, Proc. Ac. Nat. Sci. Phila., 1876, 336 (Rio Frijoles, Panama); Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., XIV, 1891, 52; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 332; Regan, Biol. Cent. Amer., Pisces, 1907, 167 (Rio Tripoli, misprint for Rio Frijoles); Eigenmann, Repts. Princeton Univ. Exp. Patagonia, III, Pt. IV, 1910, 439; Evermann & Goldsborough, Proc. Biol. Soc. Wash., XXIII, 1910, 3 (Gatun, Panama Canal Zone).

Head 3.5 to 4.2; depth 4 to 4.6; D. 8 or 9; A. 10 or 11; scales 28 or 30.

Body elongate, little compressed, dorsal and ventral outlines about evenly convex, the dorsal region not elevated; caudal peduncle compressed, its depth 2.16 to 2.7 in head; head low, not much deeper than wide at margin of preopercle; snout conical, 3.7 to 4.5 in head; eye 3.4 to 5.8; mouth moderate, lower jaw projecting; maxillary reaching about middle of eye; teeth tricuspid, in a single series in upper jaw, 2 series in lower jaw, the outer the larger and about 30 in number; gill-rakers short; scales large, regularly placed, 12 in median line in advance of dorsal; dorsal fin inserted about midway between margin of preopercle and tip of adipose; adipose fin well developed in all specimens at hand; caudal fin covered with small scales at base, its margin convex; anal fin with a sheath of scales at base, its margin convex; ventral fins inserted in advance of dorsal; pectoral fins a little longer than ventrals, failing to reach base of ventrals by 4 or 5 rows of scales, 1.45 to 1.6 in head.

Color brownish above, lighter below; a dark lateral band extending from above posterior angle of opercle to base of caudal, situated on median line of side. This band is broad at shoulder, gradually becoming narrower along side; posteriorly it is often broken up into spots. Dorsal fin with an obscure dark spot at base, fins otherwise unmarked. When swimming in the water, a large golden spot appears on the back, involving the base of the dorsal fin. This area becomes slightly darker than remainder of back in preserved specimens.

This species is represented in the present collection by 148 specimens, ranging from 60 to 205 mm. in length. It was taken at the following localities: a. On the Atlantic slope at Toro Point, Agua Clara, Rio Indio on Upper Chagres, Gorgona, Empire, Culebra and Porto Bello. b. Pacific slope at Corozal, Araján, Culebra, Rio Calobre, tributary of the Bayano, and Cerro Azul.

This fish is usually found in the upper courses of streams on rocky bottom where it is difficult to catch with a seine. However, it takes the hook readily when baited with fresh meat. Its distribution appears

to be limited to the vicinity of the Canal Zone. In the Rio Tuyra Basin it is replaced by *P. festæ*.

Habitat: Both slopes of Panama, except in the Rio Tuyra Basin.

45. *Piabucina festæ* Boulenger.

Piabucina festæ Boulenger, Boll. Mus. Torino, No. 346, XIV, 1899, 1 (Laguna della Pita, Darien, Panama); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1900, 3145; Regan, Biol. Cent. Amer., Pisces, 1907, 168; Eigenmann, Repts. Princeton Univ. Exp. Patagonia, III, Pt. IV, 1910, 439.

Head 3.7 to 4.25; depth 3.6 to 3.95; D. 8 or 9; A. 10 or 11; scales 27 or 28.

Body elongate, rather robust, the ventral outline a little more strongly convex than the dorsal, the dorsal region not elevated; caudal peduncle rather deep, compressed, its depth 1.75 to 2 in head; head low, a little deeper than wide at margin of preopercle; snout conical, 4 to 4.5 in head; eye 3.5 to 5; mouth rather small; lower jaw projecting; maxillary reaching a little past anterior margin of eye; teeth in upper jaw mostly tricuspid, in a single series, two series in lower jaw, the outer teeth the larger and about 20 in number, some of them with 3 cusps and some with 5; gill-rakers short and slender; scales large, regularly placed, 11 or 12 on median line in advance of dorsal; dorsal fin inserted about midway between margin of opercle and tip of adipose; adipose fin present in all Panama specimens, often poorly developed; caudal fin covered with small scales at base, its margin rather deeply concave, the lobes round and of equal length; anal fin with a sheath of scales at base, its margin convex; ventral fins inserted in advance of dorsal; pectoral fins somewhat longer than ventrals, failing to reach the base of the latter by 4 or 5 rows of scales, 1.25 to 1.4 in head.

Color brownish above, lighter below; sides with a dark lateral band, extending from posterior angle of opercle to base of caudal, situated below median line of side. Anteriorly it is very obscure, becoming broader and more distinct on middle of side, not broken up into spots and not ending in a caudal spot; a shoulder spot present but not connected with lateral band; fins unmarked. When swimming in the water there appears a bright golden streak in front of the dorsal. This area is unmarked in preserved specimens.

Of this species 54 specimens, ranging in length from 60 to 160 mm., were preserved and form the basis for the above description. It was found only in the Rio Tuyra Basin where it was secured in both ponds and streams. It does not confine itself as closely to rocky streams as the preceding species.

Habitat: Rio Tuyra Basin and southward to Colombia.

31. Genus *Luciocharax* Steindachner.

Ctenolucius Gill, Proc. Ac. Nat. Sci. Phila., 1861, 8 (no type designated).
Luciocharax Steindachner, Denkschr. K. Ak. Wiss. Wien, XXXIX,
 1878, 67 (type *Luciocharax insculptus* Steindachner).

Belonocharax Fowler, Proc. Ac. Nat. Sci. Phila., 1906, 464 (type *Belonocharax beani* Fowler).

Body long, not much compressed; ventral surface rounded; jaws much produced; teeth present on both jaws and maxillary, in a single series, directed backward, a small patch present on roof of mouth near tip of upper jaw; lateral line incomplete; scales large, pectinate; dorsal and anal inserted far backward.

46. *Luciocharax beani* (Fowler).

Belonocharax beani Fowler, Proc. Ac. Nat. Sci. Phila., 1906, 464 (Rio Truando, tributary of the Rio Atrato).

Ctenolucius hujeta (non Valenciennes) Bean, Proc. U. S. Nat. Mus., XXXIII, 1908, 701 (Rio Truando).

Luciocharax striatus Boulenger, Ann. & Mag. Nat. Hist., Ser. 8, VII, 1911, 212 (Boca de Calima, Choco).

Head 2.5 to 3.25; depth 5.9 to 9.1; D. 10; A. 10 or 11; scales 47 to 50.

Body long, not much compressed; the back not elevated; head long, flat above; snout long, slender, beak-like, 2 to 2.5 in head; eye 7.7 to 10; interorbital 4.85 to 7.7; mouth large, slightly oblique; upper jaw projecting, ending in a fleshy point; lower lip developed into a flap on each side; maxillary slipping under suborbital, reaching opposite posterior margin of eye; teeth in the jaws sharply pointed, more or less lance-shaped, in a single series, all directed backward; the anterior ones in upper jaw somewhat enlarged and in advance of lower jaw; teeth in sides of jaws and maxillary small and very numerous; roof of mouth near tip of upper jaw with a small patch of conic teeth; gill-rakers poorly developed, 7 more or less developed on lower limb of first arch; lateral line present on 22 to 32 scales (in one specimen on only 16 scales); scales strongly striate and ctenoid, with pores; dorsal fin small, its origin half as far from base of caudal as from margin of preopercle; adipose fin well developed, a little nearer base of upper caudal rays than base of last dorsal ray; caudal fin forked, the lower lobe the larger; anal fin small, its origin under posterior rays of dorsal; ventral fins short, inserted midway between base of pectorals and origin of anal; pectoral fins equal to or slightly shorter than postorbital part of head, inserted midway between tip of lower jaw and base of ventrals.

Color steel blue above, silvery-white below; sides with alternating dark and pale stripes. The pale stripes occupy the middle of each row of scales and the black ones are between the rows, occupying a portion of 2 rows of scales. Base of caudal with a jet black spot, preceded by a pale area. Fins unmarked, the dorsal caudal and anal a little darker than the others.

There are over 100 specimens of this species in the present collection, ranging in length from 70 to 325 mm. It was taken in the Rio Tuyra, and Rio Mamoni basins and in the Rio Marte Arnade and Rio Juan Diaz.

We have for comparison specimens from the Rio Atrato Basin with which our specimens seem to agree perfectly.

Habitat: Pacific slope of Panama and both slopes of Colombia.

32. Genus *Hoplias* Gill.

Hoplias Gill, Proc. U. S. Nat. Mus., XXVI, 1903, 1015 (type *Esox malabaricus* Bloch).

Macrodon Müller & Troschel, Horæ Ichth., 1842, 6 (type *Esox malabaricus* Bloch). (Preoccupied.)

Body elongate, terete, slightly compressed; mouth large, with conical teeth, some canine-like; palatines with teeth; maxillary for most part slipping under suborbital; no occipital process; no fontanel; air bladder present; no adipose fin; dorsal and anal fins short.

KEY TO THE SPECIES.

- a. Scales in lateral line 42 to 44; 11 rows across caudal peduncle from one lateral line to the other; 5 complete rows between lateral line and base of anal. *microlepis*, p. 303.
- aa. Scales in lateral line 39 to 41; 9 rows across caudal peduncle from one lateral line to the other; 4 complete rows between lateral line and base of anal. *malabaricus*, p. 305.

47. *Hoplias microlepis* (Günther). Perro Pesca or Pejeperro.

Macrodon microlepis Günther, Cat. Fish. Brit. Mus., V. 1864, 282 (Rio Chagres; Western Ecuador); Eigenmann & Eigenmann, Proc. Cal. Ac. Sci., 2nd Ser., 2, 1889, 102 (Obispo; Rio Chagres); Eigenmann, Ann. N. Y. Acad. Sci., 1889, 102; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 330; Boulenger, Boll. Mus. Torino, No. 329, XIII, 1898, 1 (Rio Daule and Rio Vinces, Ecuador).

Macrodon trahira var. *microlepis* Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1880, 101 (Guayaquil).

Hoplias microlepis Starks, Proc. U. S. Nat. Mus., XXX, 1906, 772 (Guayaquil); Regan, Biol. Cent. Amer., Pisces, 1907, 167 (Rio Chagres; western Ecuador); Eigenmann, Repts. Princeton Univ. Exp. Patagonia, III, Pt. IV, 1910, 447.

Head 2.85 to 3.4; depth 4 to 5; D. 14, rarely 13; A. 10, rarely 11; scales in lateral line 42 to 44.

Body elongate, not much compressed, dorsal region not elevated; head long and low, slightly convex above; interorbital 3.2 to 5 in head; snout 3.45 to 4.6; eye 4.75 to 8.25; mouth large, lower jaw projecting; maxillary reaching beyond posterior margin of eye, mostly slipping under suborbital; teeth present on both jaws, and on palatines, the latter all small; some of the anterior teeth in jaws much enlarged, somewhat flattened, with very sharp cutting edges; gill-rakers poorly developed, 5 below angle on anterior arch; lateral line complete, straight, situated on median line of side; scales moderate, regularly placed, cycloid, 15 to 18 on median line in advance of dorsal; 11, rarely 10, rows of scales across caudal peduncle from one lateral line to the other; 5 complete rows between the lateral line and anal fin; dorsal fin inserted midway between tip of upper jaw and base of caudal, or slightly nearer the former; adipose wanting; caudal fin convex; anal fin inserted posteriorly, the longest ray reaching nearly to base of lower caudal ray; ventral fins inserted under base of pectorals, slightly nearer base of caudal than tip of lower jaw; pectoral fins inserted slightly behind margin of preopercle, failing to reach base of ventrals by 4 or 5 rows of scales.

Color of large specimens very dark brown above, lighter below, uniform, without band or blotches; young much paler, mottled with brown and with a more or less distinct dark lateral band. The dark mottlings of the young later appear to become concentrated into dark blotches along the side. The dark lateral band is much more persistent in some specimens than in others. Fins all with dark spots forming more or less distinct wavy bars.

There are 175 specimens, ranging from 27 to 460 mm. in length, in the present collection. It was found in all streams visited on both slopes of Panama, except in the Rio Tuyra Basin where it is replaced by *H. malabaricus*. A very abundant fish in lowland streams, usually preferring shallow water where there is an abundance of vegetation. It is called, "Perro Pesca" = dog fish, by the natives because of its large sharp teeth and its habit of snapping at objects coming near it. Care must be exercised in picking specimens from the net, as it is able to inflict painful wounds with its sharp teeth and powerful jaws. This fish, although used to some extent as food, is not regarded as of good flavor and is of minor importance.

We have for comparison specimens from western Ecuador, which seem to be identical with the Panama specimens.

Habitat: Both slopes of Panama, except in the Rio Tuyra Basin, and the western slope of Ecuador.

48. *Hoplias malabaricus* (Bloch).

Esox malabaricus Bloch, Naturgesch. der Ausland. Fische, Pt. 8, 1794, 149, Pl. 392 (Tranquebar, locality wrongly given).

Synodus malabaricus Bloch & Schneider, Syst. Ichth., 1801, 397.

Synodus tareira Bloch & Schneider, Syst. Ichth., 1801, 398, Pl. 79.

Macrodon tareira Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 1846, 508 (Bahia; San Francisco; Amazon; Maracaibo).

Erythrinus trahira Agassiz, Spix, Piscium Brasil., 1829, Pl. 18 (Bahia).

Macrodon trahira Müller & Troschel, in Schomburgk, Reisen in Britisch-Guiana, Fische, III, 1848, 632.

Erythrinus macrodon Agassiz, Spix, Piscium Brasil., 1829, 43, Pl. 18 (Alma, Prov. Bahia; San Francisco).

Erythrinus microcephalus Agassiz, Spix, Piscium Brasil., 1829, 44 (San Francisco).

Erythrinus brasiliensis Agassiz, Spix, Piscium Brasil., 1829, 45, Pl. 20 (Peruaguacu).

Macrodon guavina Valenciennes, Humboldt Observ. Zool., II, 1833, 179, Pl. 48, fig. 1.

Macrodon auritus Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 1846, 519 (Montevideo).

Macrodon teres Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 1846, 521 (Lake Maracaibo).

Macrodon patana Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 1846, 522 (Cayenne).

Macrodon aimara Cuvier & Valenciennes, Hist. Nat. Poiss., XIX, 1846, 523, pl. 586 (Cayenne).

Macrodon ferox Gill, Ann. Lyc. Nat. Hist. N. Y., VI, 1858, 51 (Trinidad, W. I.).

Macrodon intermedius Günther, Cat. Fish. Brit. Mus., V, 1864, 282 (Cipo River).

Macrodon malabaricus Eigenmann & Eigenmann, Cal. Ac. Sci., 2nd Ser., 2, 1889, 102.

Hoplias malabaricus Gill, Proc. U. S. Nat. Mus., XXVI, 1903, 1015.

Head 2.15 to 3.3; depth 4.3 to 5; D. 13 or 14; A. 10 or 11; scales in lateral line 39 to 41.

Body elongate, not much compressed, dorsal region not elevated; head long and low, slightly convex above; interorbital space 3.65 to

4.25 in head; snout 3.7 to 4.37; eye 4.65 to 6.8; mouth large; lower jaw projecting; maxillary reaching past posterior margin of eye, mostly slipping under suborbital; teeth as in preceding species; gill-rakers poorly developed, 5 below angle on anterior arch; lateral line complete, straight, occupying median line of side; scales large, regularly placed, cycloid, 15 to 17 on median line in advance of dorsal; 9 scales across caudal peduncle from one lateral line to the other; 4 complete rows of scales between lateral line and anal fin; dorsal fin inserted midway between tip of upper jaw and base of caudal or slightly nearer the former; adipose fin wanting; caudal fin convex; anal fin inserted posteriorly, the longest rays not quite reaching base of lower caudal rays; ventral fins inserted under base of dorsal, a little nearer base of caudal than tip of lower jaw; pectoral fins inserted behind margin of preopercle, failing to reach base of ventrals by 4 or 5 rows of scales.

Color as in preceding species.

Of this species 8 specimens were preserved. They range in length from 85 to 295 mm. All are from the Rio Tuyra Basin.

This species is closely related to the preceding, differing mainly in the slightly larger scales. Our specimens were compared with specimens from the Rio Atrato Basin, with which they appear to agree perfectly.

Habitat: Rio Tuyra Basin; both slopes of Colombia; Ecuador, and south to Brazil.

Family VII. *Gymnotidæ*.

Body elongate, more or less eel-shaped; with or without scales; vertebræ many; skull with or without a frontal fontanel; parietal fontanel always present; mouth with or without teeth; margin of upper jaw formed by maxillaries and premaxillaries; air-bladder in 2 parts, connected by a small tube; vent well forward, never behind tips of pectorals, usually under head; dorsal fin wanting, or represented by a filament; caudal fin present or more usually absent, the tail terminating in a pointed appendage when fin is wanting; anal fin very long; ventral fins wanting; pectoral fins present, small.

KEY TO THE GENERA.

- a. Frontal fontanel wanting. *Gymnotus*, p. 307.
- aa. Frontal and parietal fontanels present.
- b. Caudal fin and dorsal filament wanting.
- c. Orbital margin free; teeth present in both jaws, in 2 more or less distinct patches in upper jaw and in a single patch in lower jaw.

Sternopygus, p. 308.

- cc Orbital margin not free; eye covered by a transparent membrane.
- d. Teeth wanting; origin of anal about the length of pectoral fin behind gill-opening. *Hypopomus*, p. 309.
- dd. Teeth present in both jaws; origin of anal under or slightly behind base of pectorals. *Eigenmannia*, p. 311.
- bb. Caudal fin and dorsal filament present; mouth large, its angle little, if any, in front of eyes. *Sternarchus*, p. 312.

33. Genus *Gymnotus* Linnæus.

Gymnotus Linnæus, Syst. Nat., Ed. X, 1758, 246 (type *Gymnotus carapo* Linnæus).

Size moderate, not exceeding 600 mm. in length. No frontal fontanel; no caudal fin; a dorsal filament; no electrical organs; cylindrical anteriorly, somewhat compressed posteriorly; head large and depressed, the top quite flat; gape not reaching the eyes; lower jaw protruding; teeth small, conical, in one row (which is sometimes irregular) in each jaw; eyes small and covered by membrane, without free orbital margin; scales cycloid and very small; lateral line complete and paralleling the main axis of the body; pectorals small; anal long, its origin back of vertical from the tip of the pectoral. (Ellis.)

Of this genus only a single widely distributed species is known.

49. *Gymnotus carapo* Linnæus.

Gymnotus carapo Linnæus, Syst. Nat., Ed. X, 1758, 246, and Ed. XII, 1766, 427; Meek, Field Mus. Nat. Hist. Pub., Zool. Ser., VII, 1907, 135 (Los Amates and Lake Amatitlan, Guatemala); Ellis, Memoir. Carnegie Mus., VI, 1913, 117 (Guatemala, south to the Rio de la Plata and the West Indies).

Gymnotus fasciatus Pallas, Spicil. Zool., VII, 1769, 35; Schomburgk, Fishes of Guiana, 1843, 184, Pl. 19 (Rio Branco).

Gymnotus albus Pallas, Spicil. Zool., VII, 1769, 36 (Surinam).

Gymnotus brachyurus Bloch, Syst. Ichthyol. 1787, Taf. 157, fig. 1.

Gymnotus putaol Lacépède, Hist. Nat. Poiss., II, 1800, 176.

Carapus fasciatus Cuvier, Règne Animal, Ed. I, II, 1817, 237.

Carapus brachiurus Cuvier, Règne Animal, Ed. I, II, 1817, 237.

Carapus inæquilabiatus Valenciennes, in d'Orbigny, Voy. Amér. Mérid., V, Pt. 2, 1847, 11, Pl. 14 (La Plata).

Giton fasciatus Kaup, in Dumeril, Analyt. Ichthyol., 1856, 201; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 340 (Guatemala to Rio de la Plata).

"Head 7.25 (old individuals) to 11 (young individuals); depth 8.5 to 14 in length to end of the anal; anal rays 200 to 260.

"Snout 2.5 to 3; interorbital 2.25 to 3 in head; eye 4 (young) to 7 in the snout, 4.25 to 6 in the interorbital, 10 to 6 in the head.

"Body cylindrical; head depressed; width of head 1.25 to 1.6, depth of head at base of the occipital process 1.3 to 1.8 in the greatest depth; anus near the vertical from a point the length of the snout behind the eye; dorsal profile almost straight; ventral profile slightly convex.

"Snout very slightly pointed in young specimens, blunt in adults; mouth rather large; gape straight, reaching about two-thirds of the distance to almost below the eye; upper jaw included; caudal peduncle one-half the length of the snout or less; pectorals 2.25 to 3 in the head; origin of the anal behind pectorals, on the vertical from a point about 1.5 times the snout behind the head.

"Ground-color of alcoholic specimens varies from a light slate-gray in young specimens to a light orange in adults; a series of transverse white stripes crossing the body in young individuals, which widen and become yellow with age so that the adults are yellow, barred with black; dorsal parts washed with a dark chocolate-brown containing numerous black spots; fins translucent, mottled with black or brown.

"In life the body is translucent, flesh color or pale yellow, varying to a distinct pink in the parts rich in blood. The stripes and markings are blue or green, giving the fish a purplish or olive-green cast. This color may be deepened or lightened slightly by the expansion and contraction of chromatophores.

"The general marking of the species varies considerably, specimens from clear water being darker and more striped than those from muddy water. Some specimens from Guatemala and from the Upper Paraguay are almost without markings." (Ellis)

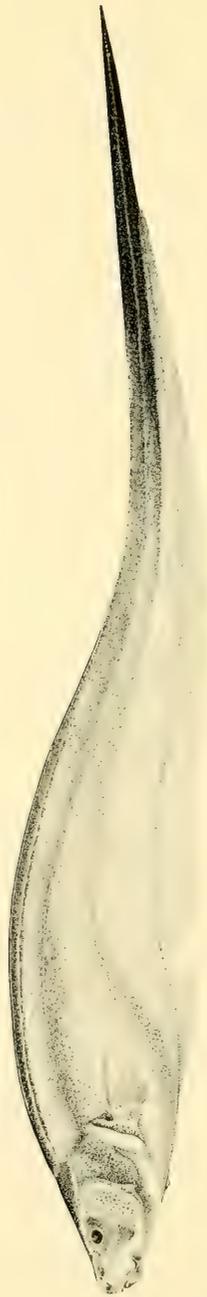
This species was not taken in Panama, but it is here included because it has been recorded from Central and South America, thus coming within the range of the present work.

Habitat: Guatemala south to the Rio de la Plata, and the West Indies.

34. Genus *Sternopygus* Müller & Troschel.

Sternopygus Müller & Troschel, *Horæ Ichthyol.*, III, 1849, 13 (type *Gymnotus macrurus* Block & Schneider).

Differing from all other Gymnotids in the free orbital margin. Body elongate, compressed; head moderate; snout short; jaws equal, or the upper a little in advance of the lower, the latter included at sides; teeth minute, in 2 more or less distinct patches in upper jaw, in a single patch



STERNOPTYGUS DARIENSIS sp. nov.
From a specimen 240 mm. in length.

in lower jaw; frontal and parietal fontanelles present; caudal peduncle round or compressed, without caudal fin; scales small, cycloid; lateral line complete; origin of anal in pectoral region; posterior air bladder conic. Size moderate or rather large.

59. *Sternopygus dariensis* sp. nov.

Type No. 8949, F. M. N. H.; length 300 mm.; Marrigante, Rio Tuyra, Panama.

Head 5.95 to 7.7 in length to end of anal; depth 6.65 to 7.8; A. 256 to 292.

Body elongate, more or less eel-shaped, compressed; head small, its upper profile usually slightly concave; snout rather slender, not much deeper than wide, its length 2.2 to 3 in head; eye small, with a free orbital margin, 3.1 to 7.25 in snout; interorbital 4.85 to 6.66 in head; mouth moderate, the gape reaching about half way to eye; upper jaw a little in advance of the lower, the latter included at sides; teeth in the jaws villiform, those of the upper jaw separated into two patches by a median line; gill-slit scarcely as long as snout; vent 3 or 4 times diameter of eye behind vertical from posterior margin of orbit; caudal peduncle varying in length, from notably shorter than head to a little longer than head, rather robust, compressed; lateral line complete, following the outline of the back; scales very small, cycloid; origin of anal below or a little behind base of pectorals, the longest rays a little shorter than snout; pectoral fins small, 2.1 to 2.75 in head.

Color grayish brown, the back slightly darker than the rest of body; sides with numerous dusky punctulations. Fins unmarked.

This species is represented by 25 specimens, ranging from 124 to 810 mm. in length. All were taken below the head of tide water at Marrigante on the Rio Tuyra. We have designated as the type a specimen 300 mm. in length.

This species differs from *S. macrurus*, its nearest relative, in the slightly concave profile of head, more slender snout, smaller eye, narrower interorbital, in the shorter and much heavier tail, and in the slightly more posterior position of the vent.

35. Genus *Hypopomus* Gill.

Hypopomus Gill, Proc. Ac. Nat. Sci. Phila., 1864, 152 (type *Rhamphichthys mülleri* Kaup).

Brachyrhamphichthys Günther, Cat. Fish. Brit. Mus., VIII, 1870, 6 (type *Rhamphichthys artedi* Kaup).

Body elongate, compressed; size small; head short; snout blunt; frontal and parietal fontanels well developed; mouth small; teeth wanting; eyes covered by a transparent membrane; scales small, cycloid; lateral line complete; no caudal fin; origin of anal about the length of pectoral fin behind vertical from gill-opening.

51. *Hypopomus brevirostris* (Steindachner).

Rhamphichthys brevirostris Steindachner, Sitzb. K. Ak. Wiss. Wien, LVIII, 1868, 254, Pl. II, fig. 2 (Guaporé); Günther, Cat. Fish. Brit. Mus., VIII, 1870, 6; Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1880, 89 (Rio Guaporé, Amazon stream near Santarem, and Rio Cauca).

Brachyrhamphichthys brevirostris Eigenmann & Eigenmann, Proc. U. S. Nat. Mus., XIV, 1891, 62.

Hypopomus brevirostris Eigenmann & Kennedy, Proc. Ac. Nat. Sci. Phila., 1903, 530 (Campo Grande, Arroyo Chagalalina); Ellis, Memoir. Carnegie Mus., VI, 1913, 134, fig. 7; Eigenmann & Fisher, Indiana Univ. Studies, No. 25, 1914, 236 (Rivers of Colombia).

Hypopomus occidentalis Regan, Ann. & Mag. Nat. Hist., Ser. 8, XIV, 1914, 32.

Head in length to end of anal fin 6.8 to 9.3; depth 6.8 to 9; A. 213 to 238.

Body elongate, rather strongly compressed; caudal filament ribbon-shaped, pointed; upper profile of head and body gently convex; head short; snout blunt, 3 to 3.55 in head; eye small, covered with a transparent membrane, 9 to 12 in head; interorbital 4 to 4.35; mouth small; jaws subequal, the lower slightly included; maxillary about twice the length of eye; teeth wanting; no mental filaments; lateral line becoming obscure posteriorly; scales small, cycloid; caudal filament 1.12 to 1.2 in length to end of anal; vent under preopercular margin, from 2 to 3.5 times diameter of eye behind vertical from posterior margin of orbit; origin of anal fin a little in advance of tips of pectorals, or about the snout's length behind base of these fins; pectoral fins short, 1.65 to 2 in head.

Color brownish or buff, with darker markings of varying sizes, sometimes forming more or less distinct cross-bars on anterior portion of body.

This fish is represented by 4 specimens ranging from 68 to 162 mm. in length. Two of our specimens are from the Rio Chagres Basin and the other two from the Rio Bayano Basin.

Habitat: Both slopes of Panama and Colombia and south to the Rio de la Plata.

36. Genus **Eigenmannia** Jordan & Evermann.

Cryptops Eigenmann, Ann. N. Y. Ac. Sci., VII, 1894, 626 (type *Sternopygus humboldtii* Steindachner = *Sternarchus virescens* Valenciennes). (Name preoccupied.)

Eigenmannia Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 341. (Substituted for *Cryptops*.)

This genus is distinguished from *Sternopygus* by the absence of a free orbital margin. Body elongate, compressed; head rather small; snout blunt; mouth small; jaws equal, or the lower included; a large frontal and parietal fontanel present; eyes medium, covered by a transparent membrane; teeth in upper jaw in 2 almost confluent patches, those of lower jaw in 2 lateral patches; scales small, cycloid; lateral line complete; origin of anal back of vertical from origin of pectorals; caudal filament moderate or long. Size moderate, not exceeding 400 mm.

52. **Eigenmannia virescens** (Valenciennes).

Sternarchus virescens Valenciennes, in d'Orbigny, Voy. Amér. Mérid., V, Pt. 2, 1847, 11, Pl. 13, fig. 2.

Sternarchus virescens Müller & Troschel, in Schomburgk, Reisen in Britisch-Guiana, Fische, III, 1848, 640 (Guiana); Günther, Cat. Fish. Brit. Mus., VIII, 1870, 7 (Surinam).

Sternopygus lineatus Müller & Troschel, in Schomburgk, Reisen in Britisch-Guiana, Fische, III, 1848, 640 (Guiana).

Sternopygus tumifrons Müller & Troschel, Horæ Ichthyol., III, 1849, 14.

Sternopygus humboldtii Steindachner, Denkschr. K. Ak. Wiss. Wien, XXXIX, 1878, 71, Pl. XIV (Rio Magdalena).

Cryptops virescens Eigenmann, Ann. N. Y. Ac. Sci., VII, 1894, 626.

Cryptops lineatus Eigenmann, Ann. N. Y. Ac. Sci., VII, 1894, 635.

Cryptops humboldtii Eigenmann, Ann. N. Y. Ac. Sci., VII, 1894, 625.

Eigenmannia humboldtii Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 341.

Head 6.05 to 7.15 in length to end of anal fin; depth 5.7 to 7; A. 165.

Body elongate, compressed; dorsal profile of head and body convex; head short; snout blunt, its length 2.85 to 3.3 in head; eye moderate, 4.9 to 5.7; interorbital 3 to 3.2; mouth small; jaws subequal, the lower included, at least on sides; maxillary about equal to length of eye; teeth in the upper jaw in 2 nearly confluent patches, those in lower jaw in 2 lateral patches; vent about one-half diameter of eye behind vertical from posterior margin of orbit; caudal filament in our small specimen flat, ribbon-shaped and more than half the length of anal, lost in the

larger specimen; origin of anal slightly behind origin of pectorals, the longest rays but little shorter than eye and snout; pectorals of moderate length, 1.17 to 1.2 in head.

Color grayish buff; sides with dark points, forming an indistinct dark area at beginning of lateral line and an indefinite dark streak on lateral line, and short bars below base of anal rays; fins unmarked.

Of this species we have only 2 specimens and the largest one is without a tail. The smallest one measures 150 mm. in total length. Both are from Marrigante, below the head of tide water on the Rio Tuyra.

We have at hand for comparison many specimens from more southern localities. Our uninjured specimen appears to differ somewhat from all the others that have been examined in the apparently deeper body, shorter anal fin and the compressed caudal filament, which is considerably longer than half the anal. It is, therefore, probable that our specimens represent a new variety or species, but our material is too meagre to establish this fact.

Habitat: Rio Tuyra south to the Rio de la Plata.

37. Genus *Sternarchus* Bloch & Schneider.

Sternarchus Bloch & Schneider, Syst. Ichthyol., 1801, 497, Pl. 94 (type *Gymnotus albifrons* Linnæus).

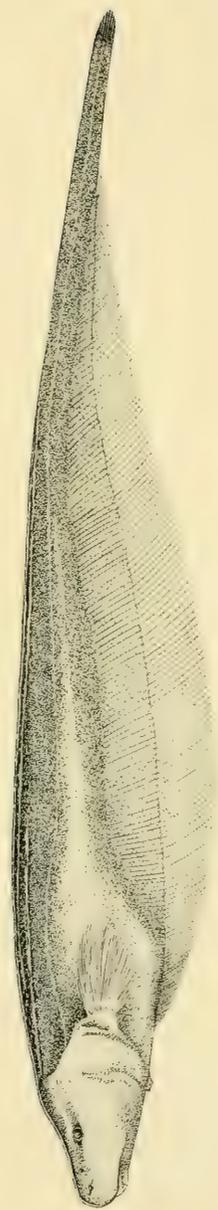
Body elongate, compressed; head large, naked; snout short, not tubular; fontanels present; eyes without free orbital margin; mouth large, its angle little if any in advance of eyes; teeth in patches on both jaws; scales cycloid; lateral line complete; caudal fin present, distinct; anal fin long, but not reaching caudal fin, its origin at or a little in advance of vertical from gill-opening.

53. *Sternarchus rostratus* Meek & Hildebrand.

Sternarchus rostratus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 85 (Rio Grande near Cana).

Head 6.7 in length to base of caudal; depth 8.25.

Body compressed throughout; head rather low, its greatest depth 1.8 in its length, its upper profile slightly concave; snout not greatly produced, blunt, very slightly compressed, its length somewhat greater than distance from anterior margin of eye to upper angle of gill-opening, 2.3 in head; eye 18.5; interorbital 5.6; mouth rather large, its angle under about middle of eye; upper jaw a little in advance of the lower; gill-opening a small slit in advance of pectorals; lateral line complete; mucus pores numerous and distinct on back and sides; vent under margin of preopercle; dorsal filament present; caudal fin distinct,



STERNARCHUS ROSTRATUS Meek & Hildebrand.
From a specimen 126 mm. in length.

rounded, not much longer than interorbital width; origin of anal slightly in advance of gill-opening, its longest rays equal to or a little shorter than snout; pectoral fins equal to half length of head.

Color uniform brownish, without dark punctulations; a very distinct yellowish stripe on median line of snout and back, disappearing at origin of dorsal filament. Fins unmarked.

Of this species only a single specimen was secured, measuring 126 mm. in length. It was taken in the Rio Grande, tributary of the Rio Tuyra, several miles above Cana. Several others were seen, floating down stream after a discharge of dynamite, but before they could be reached they had apparently recovered from the shock and quickly disappeared.

We compared our specimen with several from the Rio Cauca, at Cali, Colombia, and found them to be identical.

Order III. Haplomi.

THE PIKE-LIKE FISHES.

Body elongate; scales cycloid, extending on head; lateral line wanting; fin rays soft; dorsal fin single, placed posteriorly; ventral fins abdominal. Opercles well developed; mesocoracoid absent; hypercoracoid and hypocoracoid separate; pharyngeal bones distinct.

Family VIII. Pœciliidæ.

THE KILLIFISHES.

Body oblong to more or less elongate; depressed anteriorly, compressed posteriorly, covered with rather large cycloid scales; head usually flat above; mouth protractile, bordered above by the premaxillaries; jaws with teeth, incisor-like to villiform; gill-membranes more or less connected, free from the isthmus; gill-rakers short and thick; dorsal fin single, of soft rays only; ventral fins abdominal; caudal fin usually rounded or truncate.

The species of this family are very numerous; some of them are viviparous. Those which occur in the area under consideration in this work are all viviparous, except the ones belonging to the genus *Rivulus*.

Mr. Regan of the British Museum has lately revised the subfamily *Pœciliinæ*, basing his classification of the genera on the modified anal

fin of the males. Since, with two exceptions, all the species treated of here belong to this subfamily, we have followed for the most part Mr. Regan's classification. However, in as much as the modified anal fin of the males vary so essentially in different species, its use as a generic character seems to us to lead to too many divisions, resulting in nearly as many genera as species. It is, therefore, our opinion that this character should be regarded of specific, rather than of generic importance.

KEY TO THE GENERA.

- a. Males with the anal fin advanced and modified into an intromittent organ. Species viviparous.
- b. Ventral fins similar in both sexes.
- c. Mouth not wholly transverse, the cleft partly lateral; teeth conical, immovable.
- d. Distal portion of produced rays of anal fin in male directed backward, usually with one or more retrorse spines or hooks.
 - Gambusia*, p. 314.
- dd. Distal portion of produced rays of anal in male directed forward, with or without antrorse hooks.
 - Priapichthys*, p. 319.
- cc. Mouth transverse; teeth slightly compressed, movable; the intromittent organ long and slender, without hooks or serrations at apex.
 - Pæciliopsis*, p. 324.
- bb. Ventral fins in the male enlarged, the second ray notably produced; teeth in the jaws movable; the first prolonged ray of anal fin in male bearing a small antrorse hook at apex.
 - Mollienisia*, p. 326.
- aa. Anal fin in the males not modified into an intromittent organ. Species oviparous.
 - Rivulus*, p. 330.

38. Genus *Gambusia* Poey.

Gambusia Poey, *Memorias*, I, 1855, 382 (type *Gambusia punctata* Poey).
Gambusia Regan, *Proc. Zool. Soc. Lond.*, 1913, 981.

Body elongate, moderately compressed in the female; mouth small, the branches of the lower jaw firmly united; teeth fixed, conical, in bands, the outer ones slightly the larger; branchiostegals 6; anal fin of female more or less in advance of the dorsal; anal of male much advanced, its anterior rays modified into an intromittent organ; alimentary canal short; vertebræ about 32; viviparous.

This genus, as restricted by Regan, includes species in which the modified anal of the male is about $\frac{1}{3}$ the length of the body of the fish and is formed of three rays.

"The distal segments of the first prolonged ray are produced into processes directed more or less towards its apex; the anterior branch of the second prolonged ray is slender distally and at some distance from the end has an antrorse projection which may be termed the 'elbow'; the posterior branch of this ray ends in a retrorse pointed hook or barb, and the segments immediately proximal to the elbow of the anterior branch are produced backwards into serræ; the third prolonged ray ends in a hook more or less similar to that of the second." (Regan)

The males of this genus and related genera are smaller than the females, and more elongate; they are apparently fewer in number. All *Gambusia* are small, and as a net sufficiently small to capture females will permit the males to pass through it, the few males taken by the collector may not indicate their true ratio. Many of the species of this genus live in swamps and lowland streams, but a few species throughout Mexico and Central America are found in clear mountain streams at as high an altitude as any fishes are found. *Gambusia* feed chiefly on insects and small crustacea. To some of the species are credited the eating of mosquito larvæ.

We here tentatively refer to this genus 2 species, *G. episcopi* and *G. cascajalensis*, that do not have any definite retrorse hooks on the distal portion of the intromittent organ, but they agree in other respects with this genus.

KEY TO THE SPECIES.

- a. Intromittent organ of male with 2 strong retrorse hooks at apex, and anteriorly with strong serrations; each scale with a dark dot, forming lines along the rows of scales; dorsal and caudal with black spots, forming bars. *nicaraguensis*, p. 316.
- aa. Intromittent organ of male without retrorse hooks or strong serrations at apex; no dark lines along the rows of scales; anal fin with a black spot at base, which may or may not be extended to tip of rays.
- b. Body rather robust, the depth 3.2 to 4.1 in length; caudal peduncle 1.15 to 1.6 in head; origin of dorsal in female over or slightly anterior to vertical from middle of anal; anal fin not falcate; skin underneath the scales strongly pigmented, marking the margins of the scales; sides with more or less distinct dark spots or bars. Largest females 52 mm. in length.
episcopi, p. 317.
- bb. Body slender, the depth 3.7 to 4.5 in length; caudal peduncle 1.7 to 2 in head; origin of dorsal in female over posterior rays of anal; anal more or less falcate; the rows of scales very indistinctly marked; sides without spots or bars. Largest female 62 mm. in length.
cascajalensis, p. 318.

54. *Gambusia nicaraguensis* Günther.

Gambusia nicaraguensis Günther, Cat. Fish. Brit. Mus., VI, 1866, 336, and Trans. Zool. Soc. London, 1868, 483, Pl. 82, fig. 3 (Lake Nicaragua); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 682; Regan, Biol. Cent. Amer., Pisces, 1907, 96 (Lake Nicaragua; El Hule, Mexico), and Proc. Zool. Soc. London, 1913, 985, fig. 168 A (Lake Nicaragua; El Hule and Coaxacoalcos, Mexico).

Paragambusia nicaraguensis Meek, Field Col. Mus. Pub., Zool. Ser., V, 1904, 133 (Otopa; Boca del Rio; El Hule; Obispo; Perez).

Head 3.3 to 3.8; depth 3.3 to 3.8; D. 7 or 8; A. 10 or 11; scales 29 to 31.

Body elongate, compressed; upper profile from snout to dorsal straight or slightly convex; head rather low, flat above; snout short, 2.7 to 3.8 in head; eye 2.8 to 3.5; interorbital 2 to 2.9; mouth very small, the gape extending only about half way to eye; teeth in jaws in villiform bands; gill-rakers short, about 14 on lower limb of first arch; scales moderate, cycloid, extending forward to eyes; caudal peduncle strongly compressed, its least depth 1.5 to 1.8 in head; origin of dorsal in female over or slightly behind base of last ray of anal, or about midway between posterior margin of eye and tip of caudal, in male notably behind base of last ray of anal and about midway between tip of snout and tip of caudal; caudal fin rounded; anal fin in female inserted somewhat nearer tip of snout than tip of caudal, its outer margin concave, in adult male it is inserted about midway between tip of snout and base of caudal, the longest modified ray 2.6 to 2.8 in body, the first produced ray with strong serrations on distal portion and the posterior branch of second and third produced rays each with a strong retrorse hook at apex; ventral fins small, reaching origin of anal in female, and past origin of anal in male; pectoral fins moderate, 1.5 to 1.85 in head.

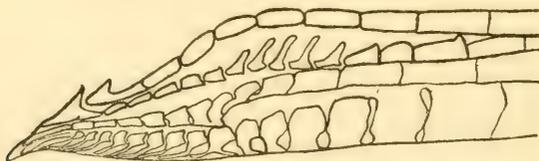


FIG. 4. DISTAL PART OF INTROMITTENT ORGAN OF *Gambusia nicaraguensis* Günther.
(Greatly magnified.)

Color greenish; each scale on upper part of sides with a dark dot, forming lines along the rows of scales. Dorsal and caudal with black spots forming bars; other fins unmarked.

Of this species we have over 100 specimens. The largest female is 45 and the largest male 27 mm. in length. Nearly all of our specimens

are from brackish water on the Atlantic coast. We have a single female specimen from brackish water from the Pacific coast, which we doubtfully refer to this species.

Habitat: Southern Mexico south to Panama.

55. *Gambusia episcopi* Steindachner.

Gambusia episcopi Steindachner, Sitzb. K. Ak. Wiss. Wien, LXXVII, 1878, 387, Pl. II, figs. 3 & 4 (Obispo, Panama); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 683 (Ditches on the Isthmus of Panama, Obispo Station); Garman, Mem. Mus. Comp. Zool., XIX, 1895, 88 (Panama Railroad between Gorgona and Matachin); Regan, Biol. Cent. Amer., Pisces, 1907, 96.

Gambusia latipunctata Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 87 (Araijan, Panama).

Head 3.1 to 3.5; depth 3.2 to 4.1; D. 8 or 9; A. 9 or 10; scales 26 to 28.

Body rather robust; profile from snout to nape straight, from nape to dorsal slightly convex; head flat above; snout rather short 3.2 to 4 in head; eye 3 to 3.7; interorbital 2 to 2.6; mouth moderate, the cleft reaching about half the distance to eye; teeth in the jaws pointed, in bands, the outer ones scarcely enlarged; scales large, cycloid, extending forward to eyes, 6 longitudinal rows between anterior part of base of dorsal and base of anal; caudal peduncle strongly compressed, its least depth, 1.15 to 1.6 in head; origin of dorsal in female over middle of base of anal, or slightly anterior to this point, and somewhat nearer anterior margin of eye than tip of caudal; in the adult male the origin of the dorsal is a little nearer end of snout than tip of caudal; caudal fin rounded; anal fin in female usually inserted a little nearer end of snout than tip of caudal, the anterior rays scarcely produced; in the adult male the origin of the anal is slightly nearer base of caudal than end of snout, the modified portion of anal failing to reach base of caudal by about the length of postorbital part of head, equal to or a little longer than head, 3.4 to 3.85 in length of body, the apex scarcely bent backward, no hooks, the two branches of the second ray and the third ray of about equal length and the anterior ray only slightly shorter than the second and third; ventral fins rather small, reaching vent in female, reaching to or past origin of anal in male; pectoral fins reaching slightly past base of ventral, 1.3 to 1.55 in head.

Color rather variable, apparently depending largely upon the clearness of the water in which they live. The sexes similarly colored, olivaceous, with dusky punctulations, which are mostly on the skin underneath the scales, making it appear as if the scales were margined with dark; this dark coloration is much more prominent on some in-

dividuals than others; sides with more or less distinct dark spots. In the specimens in which they are most distinct they form short, vertical bars, and in others they appear as quadrate spots. Dorsal fin with black chromatophores preceding each ray, forming a dark bar near the base; interradiial membranes between the posterior rays of anal with black chromatophores, forming a dark spot at base of fin, these chromatophores may or may not be extended on the rays and up the fin. All intergradations from an obscure spot at base of the rays to a prominent spot, with the black extending nearly to the tips of the rays, occur.

A fairly common species on both slopes of Panama, occurring mainly in the upper courses of creeks. Numerous specimens are at hand. The

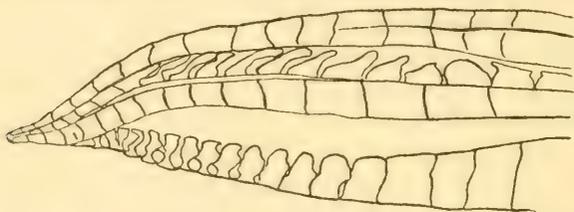


FIG. 5. DISTAL PART OF INTROMITTENT ORGAN OF *Gambusia episcoopi* Steindachner.
(Greatly magnified.)

largest female is 52 and the largest male 23 mm. in length. It was not taken in the Rio Tuyra or Rio Bayano basins.

Further study of our material convinces us that the form we described as *Gambusia latipunctata* in 1913 intergrades with the present species and is therefore not valid.

Habitat: Both slopes of Panama, north of the Rio Bayano.

56. *Gambusia cascajalensis* Meek & Hildebrand.

Gambusia cascajalensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 86 (Rio Cascajal, Porto Bello, Panama).

Head 3.2 to 3.9; depth 3.7 to 4.5; D. 7 or 8; A. 10; scales 28 to 30.

Body rather slender; the profile straight over the head, slightly convex from nape to dorsal; head rather flat above; snout moderate, 3.1 to 3.35 in head; eye 2.8 to 3.25; interorbital 2.1 to 2.4; mouth rather small, the cleft extending about one-third the distance to eye; teeth in the jaws pointed, in bands, the outer ones slightly enlarged; scales moderate, cycloid, extending forward on snout and on base of caudal fin, 7 longitudinal rows between anterior part of base of dorsal and base of anal; caudal peduncle strongly compressed, its least depth 1.7 to 2 in head; origin of dorsal in female over posterior rays of anal, and about midway between middle of eye and tip of caudal, in the male its origin

is slightly nearer tip of caudal than tip of snout; caudal fin rounded; anal fin in female inserted a little nearer tip of snout than tip of caudal, the anterior rays somewhat produced; in the adult male the origin of the anal is about equidistant from middle of eye and base of caudal, the modified portion rather short, not nearly reaching base of caudal, its structure as in *G. episcopi*; ventral fins reaching to or slightly past vent in the female and well past the origin of the anal in the male; pectoral fins reaching a little past base of ventrals, 1.2 to 1.5 in head.

Color plain olivaceous; the dark pigment underneath the scales marking the rows of scales, which are so prominent in *G. episcopi*, is very indistinct in the present species; sides without spots or bars. The tip of dorsal black; anal fin with a black spot at base, which is usually extended on 2 to 5 rays of the fin.

Of this species there are numerous specimens in the present collection. The largest female at hand is 62 and the largest male 43 mm. in length. Only a few of our specimens are from the Pacific slope of Panama, and it appears to be comparatively rare in the Rio Chagres Basin, but it is abundant in some small coastal streams at Porto Bello. It was not taken in the Rio Tuyra or Rio Bayano basins.

Habitat: Both slopes of Panama, north of the Rio Bayano.

39. Genus *Priapichthys* Regan.

Priapichthys Regan, Proc. Zool. Soc. London, 1913, 991 (type *Gambusia annectens* Regan).

This genus differs from *Gambusia* in that the modified anal fin of the male is longer, its tip nearly reaching the caudal fin, and it is differently formed; the terminal part is hooked forward and the prolonged rays taper distally and have no specially modified segments, except the usual serræ of the posterior branch of the second; the first prolonged ray does not extend to the apex, and the hook is supported by the anterior branch of the second and third rays. (Regan) Origin of the dorsal fin above the anal. We have tentatively referred one species (*P. panamensis*), which does not possess definite antrorse hooks on the intromittent organ, to this genus.

KEY TO THE SPECIES.

- a. First produced ray of intromittent organ with a recurved spur below its apex, directed upward and forward; the apex of this organ curved forward; male with a jet black spot about the size of pupil on sides slightly in advance of vertical from origin of dorsal; dorsal with a dusky spot at base on posterior one-fourth of fin.

- b. Body posteriorly with 6 to 8 dark cross-bars, present in both sexes. *tridentiger*, p. 320.
- bb. Body in females plain, no cross-bars, male with very indistinct cross-bars. *tridentiger cana*, p. 321.
- aa. First produced ray of intromittent organ without a recurved spur below its apex.
- c. First produced ray of anal anteriorly serrate below apex, and bearing a hook at apex directed downward and forward, the anterior branch of the second produced ray curved forward at apex; a dark area at base of anterior rays of anal. *dariensis*, p. 321.
- cc. Intromittent organ without hooks or serrations, the apex curved forward; a dark area about vent. *panamensis* sp. nov., p. 322.

57. *Priapichthys tridentiger* (Garman).

Gambusia tridentiger Garman, Mem. Mus. Comp. Zool., XIX, 1895, 89, Pl. IV, fig. 10, teeth (Isthmus of Panama); Regan, Biol. Cent. Amer., Pisces, 1907, 95.

Priapichthys tridentiger Regan, Proc. Zool. Soc. London, 1913, 992.

Head 3.55 to 4; depth 3.1 to 5.35; D. 7 or 8; A. 9 or 10; scales 28 to 30.

Body compressed; profile straight from snout to nape, then convex to dorsal; head flat above; snout short, 3.75 to 4.3 in head; eye 2.85 to 3.34; interorbital 1.9 to 3; mouth small, cleft reaching about one-third the distance to eye; teeth in jaws pointed, in bands, the outer series somewhat enlarged; scales moderate, cycloid, extending forward to eyes; caudal peduncle strongly compressed, its least depth 1.45 to 2 in head; origin of dorsal in female over the posterior rays of the anal and about equidistant from posterior margin of eye and tip of caudal, or slightly nearer the former, in the male its origin is about midway between posterior margin of eye and base of caudal; caudal fin rounded; anal fin in female inserted somewhat nearer base of caudal than posterior margin of eye, its posterior margin concave at least in large examples; in the adult male the anal fin is inserted notably nearer tip of snout than base of caudal, the longest produced ray failing to reach base of caudal by about an eye's diameter, 2 to 2.3 in length of body; the apex of the intromittent organ curved forward, the first produced ray with a spur a short distance below its apex which is directed downward and forward; ventral fins rather small, reaching vent in female, and past origin of anal in the male; pectoral fins reaching slightly past base of ventrals, 1.2 to 1.9 in head.

Color of female olivaceous; scales with pale margins, next to the margins is a dark area formed by dusky points; sides of caudal portion

of body, *i.e.*, from anal fin backward, with from 6 to 8 dark cross-bars; a dark line from last anal ray to base of caudal; a dark area at base of anterior rays of anal, not extending on fin; posterior rays of anal with a dusky spot near middle and another at tips; dorsal with a dusky spot on posterior one-fourth near base of rays. Color of male very similar, but the cross-bars less distinct, and a jet black spot about the size of the pupil present on side slightly in advance of vertical from origin of dorsal;

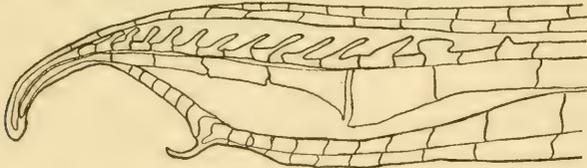


FIG. 6. DISTAL PART OF INTROMITTENT ORGAN OF *Priapichthys tridentiger* (Garman).
(Greatly magnified.)

no dark spot at base of anterior rays of anal. Specimens from Taboga Island paler with the cross-bars less distinct in both sexes.

Of this species we have numerous specimens from both slopes of Panama, but none from the Rio Tuyra Basin. The largest female is 45 and the largest male 20 mm. in length.

Habitat: Both slopes of Panama, and Taboga Island.

58. *Priapichthys tridentiger cana* (Meek & Hildebrand).

Gambusia cana Meek & Hildebrand, Field. Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 87 (Rio Satiganti, Cana, Panama).

Head 3.8 to 4.25; depth 3.2 to 4.35; D. 7 or 8; A. 10; scales 29 to 31.

This variety agrees with *P. tridentiger* in all respects, except in color. In the female there are no dark cross-bars on posterior part of body. In the male the characteristic dark spot of *P. tridentiger* on side above the base of anal is present, but the cross-bars are less distinct.

This form is represented by 68 specimens from the Rio Satiganti, one of the upper tributaries of the Rio Tuyra. The largest female is 40 and the largest male 23 mm. in length.

59. *Priapichthys dariensis* (Meek & Hildebrand).

Gambusia dariensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 88 (Rio Capeti).

Head 3.4 to 4.15; depth 3.4 to 4.5; D. 7 or 8; A. 9 or 10; scales 28 to 31.

Body moderately compressed; dorsal profile straight over head, slightly convex from nape to dorsal; head flat above; snout short, 3.3 to 4.15 in head; eye 3 to 4.35; interorbital 2.2 to 2.4; mouth small, the gape

reaching about one-third the distance to eye; teeth in the jaws pointed, in narrow bands, the outer ones somewhat enlarged; scales moderate, cycloid, extending forward to the eyes; caudal peduncle strongly compressed, its least depth 1.4 to 1.7 in head; origin of dorsal in female just behind base of last ray of anal and about equidistant from posterior margin of eye and tip of caudal or slightly nearer the latter; in the male this fin is somewhat nearer posterior margin of eye than tip of caudal; caudal fin rounded; anal fin in the female inserted about equidistant from posterior margin of eye and base of caudal, its posterior margin nearly straight; in the adult male this fin is inserted a little nearer tip of snout than base of caudal, the longest modified ray 2.6 to 2.7 in body; the first ray strongly serrate, with a hook at apex directed downward and forward, the anterior branch of second produced ray curved forward, the second branch shorter; ventral fins rather small, reaching origin of anal in female and past this point in male; pectoral fins 1.1 to 1.4 in head.

Color of female plain olivaceous; scales on back and upper part of sides with dark punctulations; no black spot on sides or on fins; a dark area at base of anterior ray of anal, and a dark line from anal fin to base

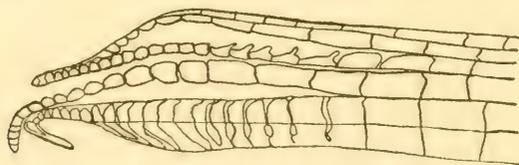


FIG. 7. DISTAL PART OF INTROMITTENT ORGAN OF *Priapichthys dariensis* (Meek & Hildebrand). (Greatly magnified.)

of caudal. The male with a variable number (often as many as 20) of narrow, dark cross-bars on sides; otherwise essentially as in females.

There are over 100 specimens of this species in the present collection. The largest female is 36 and the largest male 27 mm. in length. This species was taken in the Rio Juan Diaz, Rio Bayano, and Rio Tuyra basins.

60. *Priapichthys panamensis* sp. nov.

Type No. 8950, F. M. N. H.; length 24 mm.; Chame Point, Panama.

Head 3.55 to 4; depth 3.65 to 4.3; D. 8; A. 10; scales 29 to 31.

Body moderately compressed; profile very gently convex from snout to origin of dorsal; head broad, flat above; snout short, 3.75 to 4.5 in head; eye 2.65 to 3.3; interorbital 1.75 to 2.4; mouth small, the cleft

reaching about one-third the distance to eye; teeth pointed, in bands in the jaws, the outer ones slightly enlarged; scales moderate, cycloid, extending to tip of snout and on base of caudal; caudal peduncle strongly compressed, its least depth 1.5 to 1.8 in head; origin of dorsal in female over base of last ray of anal, and about midway between posterior margin of eye and base of caudal; in the male the origin of the dorsal is about midway between tip of snout and base of caudal; caudal rather pointed; anal fin in female inserted considerably nearer end of snout than tip of caudal, its posterior margin convex; origin of anal in adult male is about half as far from end of snout as from tip of caudal, the produced portion failing to reach base of caudal by about the length of post-orbital part of head, its length 2 to 2.25 in body, the anterior branch of the second produced ray the longest, directed forward at apex, the first produced ray a little longer than the third, no spur; ventral fins reaching to or slightly past vent in female, and notably past origin of anal in male; pectoral fins reaching at least to middle of ventrals, 1 to 1.4 in head.

Color of the sexes similar, grayish green; posterior part of body with 4 or 5 indistinct, dark cross-bars; a dark line from anal to base of

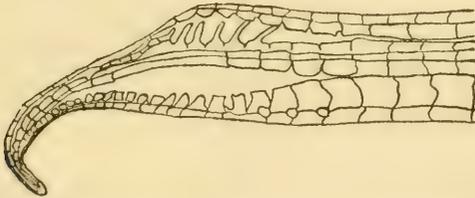


FIG. 8. DISTAL PART OF INTROMITTENT ORGAN OF *Priapichthys panamensis* sp. nov.
(Greatly magnified.)

caudal; dorsal fin with dark chromatophores at base of the posterior rays and again at the tips of these rays; usually with a more or less distinct dark area about vent.

Of this species we have 37 specimens. The largest female is 37 and the largest male 24 mm. in length. One specimen is from the Rio Chame and all the others from a brackish pool at Chame Point on the Pacific coast.

In general appearance this fish resembles *Priapichthys tridentiger*, but the intromittent organ of the male is quite different, the caudal fin is more pointed and bears more scales on its base, the color is paler, and the cross-bars are fewer.

Type a male 24 mm. in length, from Chame Point.

40. Genus *Pæciliopsis* Regan.

Pæciliopsis Regan, Proc. Zool. Soc. London, 1913, 996 (type *Pæcilia presidionis* Jordan & Culver).

Body elongate, compressed; head more or less depressed; mouth small, the cleft transverse; teeth in the jaws in 2 series or bands, depressable, the outer ones largest, slightly compressed; the intromittent organ long and slender, without hooks or serrations at apex; ventral fins not modified in the male.

KEY TO THE SPECIES.

- a. The three produced rays of anal, as well as both branches of the second, all of about equal length and reaching to apex of intromittent organ, failing quite notably to reach base of caudal when deflexed; no dark area over vent; young of 60 mm. and less in length with dark cross-bars on posterior part of body; fins unmarked. *elongatus*, p. 324.
- aa. The first and the anterior branch of the second produced ray of anal fin in male of about equal length and extending to apex of intromittent organ, the posterior branch of the second and the third produced ray notably shorter; intromittent organ when deflexed nearly or quite to base of caudal; a dark area over vent; indistinct cross-bars on body; fins dusky, the dorsal with blackish basal band and dark edge.

isthmensis, p. 325.

61. *Pæciliopsis elongatus* (Günther).

Pæcilia elongata Günther, Cat. Fish. Brit. Mus., VI, 1866, 342 (Panama), and Trans. Zool. Soc. London, VI, 1869, 484, Pl. LXXXV, fig. 2 (Panama); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 697; Gilbert & Starks, Mem. Cal. Ac. Sci., 1904, 50 (Brackish sloughs about Panama); Regan, Biol. Cent. Amer., Pisces, 1907, 102.

Mollienisia elongata Regan, Proc. Zool. Soc. London, 1913, 1013 (Panama).

?*Heterandria colombianus* Eigenmann & Henn, Indiana Univ. Studies, No. 16, 1912, 27 (Rio Dagua, Colombia); Regan, Proc. Zool. Soc. London, 1913, 996.

?*Pæciliopsis colombianus* Henn, Ann. Carnegie Mus., X, 1916, 120 (Rio Dagua, Colombia).

Head 3.4 to 4.4; depth 3.4 to 4; D. 8 to 10, usually 9; A. 8 or 9; scales 28 to 33.

Body elongate, robust, posteriorly compressed; head depressed, flat above; snout broad, 3.8 to 4.55 in head; eye 3.33 to 4.6; interorbital 2 to 2.2; mouth transverse; teeth in outer series close-set, slightly com-

pressed or pointed, curved inward, this series is followed by a narrow band of minute teeth; scales large, cycloid, 8 or 9 rows between base of dorsal and anal; origin of dorsal in female variable, usually about midway between end of snout and tip of caudal, and posterior to vertical from origin of anal; its origin in the male is at about the same point as in female, but the fin is higher; caudal fin scaly at base, its margin rounded; anal fin in female usually inserted about midway between tip of snout and base of caudal; anal fin in adult male inserted nearer end of snout than base of caudal, the modified portion very long, slender, more or less needle-shaped, 2.35 to 2.7 in length; ventral fins similar in both sexes, usually failing to reach vent in large females, reaching opposite base of anal in males; pectoral fins moderate, 1 to 1.25 in head.

Color of sexes similar, olivaceous. Large specimens without cross-bars; young of 60 mm. and less in length with narrow, dark cross-bars on posterior portion of sides. Fins unmarked.

Of this species we have 80 specimens. The largest female is 150 and the largest male 60 mm. in length. It was taken by us only in brackish water about the city of Panama where it is fairly common.

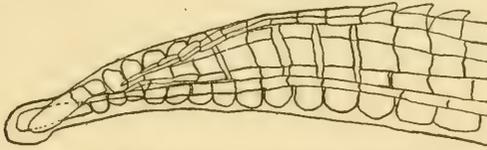


FIG. 9. DISTAL PART OF INTROMITTENT ORGAN OF *Paeciliopsis elongatus* (Günther).
(Greatly magnified.)

We have examined 2 female specimens, paratypes, of *P. colombianus* (Eigenmann & Henn). We do not find that they differ essentially from the present species. However, in the absence of male specimens of the former their identity with *P. elongatus* remains doubtful.

Habitat: Pacific coast of Panama and probably of Colombia.

62. *Paeciliopsis isthmensis* Regan.

Paeciliopsis isthmensis Regan, Proc. Zool. Soc. London, 1913, 997
(Colon, Panama).

Head 3.5 to 3.7; depth 2.5 to 3; D. 9 or 10; A. 10; scales 26 to 28.

Body robust; mouth small; teeth in narrow bands; interorbital width 1.8 to 2 in head; eye 3 to 3.2; origin of dorsal fin midway between anterior margin of the eye and base of caudal, its longest ray 1.5 in head; origin of anal below fourth or fifth ray of dorsal, its first branched ray 1.3 in head; pectoral a little shorter than the head; least depth of caudal peduncle 1.3 to 1.5 in head; in the male the origin of the dorsal is

midway between the tip of the snout and base of caudal, or nearer the former; the modified anal reaching quite to caudal fin.

Color olivaceous, scales dark edged; a blackish spot above the vent; fins dusky, the dorsal with a blackish basal band and a dark edge. The male with indistinct cross-bars on the body. Females 35 to 60 mm. in length; males 35 to 42.

This species was not taken by us at Colon. It is probably identical with the species described by Meek* as *Pacilia pittieri* from Costa Rica.

41. Genus *Mollienisia* LeSueur.

Mollienisia LeSueur, Jour. Acad. Nat. Sci. Phila., 1821, 3, Pl. III (type *Mollienisia latipinna* LeSueur).

Body oblong to rather robust; mouth small, transverse, with weak jaws; teeth small, in bands, the outer series in each jaw movable; branchiostegals 5; anal fin of female slightly in advance to slightly behind dorsal; dorsal fin of males often very high; dorsal fin of 7 to 16 rays; anal fin of male modified into an intromittent organ, the first prolonged ray bearing a small antrorse spine at or near its end, the last ray bearing a process directed outward and towards the base of the fin; intestinal canal long and with numerous convolutions; vertebræ about 17+18.

KEY TO THE SPECIES.

- a. Dorsal fin with 7 to 11 rays.
- b. Origin of dorsal slightly in advance of anal.
- c. Dorsal fin with 10 or 11 rays; anal with 10 rays; dorsal and caudal fins spotted with black. *sphenops*, p. 326.
- cc. Dorsal fin with 7 or 8 rays; anal fin with 8 or 9 rays; dorsal fin with a dark spot on its base, the rest of dorsal and caudal fin unspotted. *caucana*, p. 329.
- bb. Origin of dorsal slightly behind that of anal; dorsal and caudal with a series of transverse spots. *cuneata*, p. 329.
- aa. Dorsal rays 11 to 13; origin of dorsal a little nearer base of caudal than end of snout. *formosa*, p. 330.

63. *Mollienisia sphenops* (Cuvier & Valenciennes). Paribiba.

Pacilia sphenops Cuvier & Valenciennes, Hist. Nat. Poiss., XVIII, 1846, 130, Pl. 526 (Vera Cruz, Mexico); Günther, Cat. Fish. Brit. Mus., VI, 1866, 343 (Vera Cruz, Mexico); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 694; Regan, Biol. Cent. Amer., Pisces, 1907, 102 (Streams near Panama).

*Meek, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1912, 71.

Xiphophorus gillii Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München, X, 1864, 28, Pl. IV, fig. 1 (Rio Chagres, Panama).

Platypæcilus mentalis Gill, Proc. Ac. Nat. Sci. Phila., 1876, 335 (Panama); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 686.

Pæcilia boucardi Steindachner, Sitzb. K. Ak. Wiss. Wien, LXXXVI, 1878, 386, Pl. III, figs. 2 & 3 (Colon, Panama); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 695; Gilbert & Starks, Mem. Cal. Acad. Sci., 1904, 51 (Streams near Panama).

Pæcilia gillii Garman, Mem. Mus. Comp. Zool., XIX, 1895, 63 (Panama).

Mollienisia sphenops Regan, Proc. Zool. Soc. London, 1913, 1012, fig. 173, F (in part); Henn, Ann. Carnegie Mus., X, 1916, 136 (Cartagena, Colombia).

Head 3.15 to 4; depth 2.65 to 3.75; D. 10 or 11; A. 10; scales 27 to 30.

Body compressed; head depressed, flat above; snout broad, its length 3.2 to 4 in head; eye 3.1 to 3.9; interorbital 1.85 to 2.4; mouth small, the cleft transverse; teeth in the outer series slender, movable, somewhat broadened and hooked at apex; inner teeth in a band, small, tricuspid; scales moderate, cycloid, 8 longitudinal rows between base of dorsal and anal; origin of dorsal in female a little in advance of anal, and somewhat nearer end of snout than tip of caudal, its base about equal to length of longest rays; in the male this fin is much higher and the base is equal to about two-thirds the length of the longest rays; caudal fin scaly at base, its margin rounded; anal fin in female inserted about equidistant from end of snout and tip of caudal, the anterior rays not produced; in the male this fin is inserted equidistant from end of snout and base of caudal, the produced portion 1.2 to 1.45 in head, the first and the two branches of the second produced ray of about equal length, the anterior ray bearing a small antrorse hook at apex, the third with a process directed downward and backward at its apex; in advance of the intromittent organ lies a sort of hood which is not attached to the distal portion of this organ; ventral fins normal in the female, reaching vent; in the male the first articulated ray is produced, reaching notably beyond base of anal; pectoral fins rather long, 1.05 to 1.7 in head.

Color olivaceous, dorsal and caudal fins with dark dots. The color of specimens from salt and brackish water is more variable than those taken in fresh water. The markings on Atlantic slope specimens are more distinct than on those from the Pacific side. The color markings of specimens from Colon agree with those from Vera Cruz, Mexico; most of the specimens have a black spot on each scale forming lines along the rows. These spots are seldom present on the Pacific side specimens and when present are not very distinct. The males often have

the basal half of the dorsal and caudal fins black, the distal half of the latter often yellow, a condition not conspicuous on west coast specimens.

The fresh water individuals are much more uniform in color, and usually smaller than those from salt and brackish water. Those taken from fresh water might be regarded as a variety under the name *Mollienisia sphenops gillii* (Kner & Steindachner).

This species is represented by numerous specimens in the present collection. The largest females are 100 and the largest males 78 mm. in length. It occurs abundantly in quiet ponds and arms of the rivers and creeks of both slopes of Panama, but not in the Rio Tuyra Basin.

The males of this species are so large that they are pretty certainly caught along with the females and do not escape through the meshes of the net, as has been stated of other viviparous species of this family, in explanation of the small number of male specimens occurring in collections. For this reason we have counted 2,142 specimens collected at various points and on various dates during two periods of the two years during which these collections were made. Among this number there are 579 males or nearly 3.7 females to every male. The disparity of males to females is, however, believed, in reality, to be greater than these figures indicate, for this species was many times taken in such abundance that only a small number of them was preserved. In such

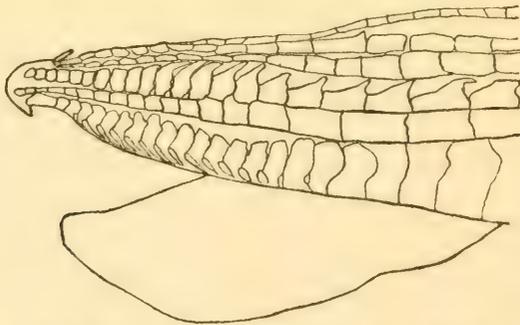


FIG. 10. DISTAL PART OF INTROMITTENT ORGAN OF *Mollienisia sphenops* (Cuvier & Valenciennes). (Greatly magnified.)

cases, due to the fact that the males are more brightly colored and thus more conspicuous, it is quite probable that more than their proportionate number was selected, although we do not remember that any particular attention was given to this matter at the time.

Habitat: Coasts and rivers from Sinaloa, Mexico, both slopes of Panama, south to eastern Colombia, Venezuela and the Leeward Islands.

64. *Mollienisia caucana* (Steindachner).

Girardinus caucanus Steindachner, Denkschr. K. Ak. Wiss. Wien, XLII, 1880, 87, Pl. VI, figs. 4 & 5 (Caceres, Colombia), and Denkschr. K. Ak. Wiss. Wien, LXXII, 1902, 146 (Baranquilla, Colombia).

Pæcilia caucana Regan, Biol. Cent. Amer., Pisces, 1908, 190.

Mollienisia sphenops Regan, Proc. Zool. Soc. London, 1913, 1012 (in part).

Head 3.35 to 3.7; depth 3.6 to 4; D. 7 or 8; A. 8 or 9; scales 28 to 30.

Body compressed; head slightly depressed, flat above; snout rather broad, 3.2 to 4.4 in head; eye 3 to 3.75; interorbital 2.3 to 2.7; mouth small, the cleft transverse; teeth and scales as in preceding species; origin of dorsal in female over origin of anal, a little nearer end of snout than tip of caudal; slightly more anteriorly situated in male; caudal fin scaly at base, the margin rounded; anal fin in female inserted a little nearer end of snout than tip of caudal; in the male this fin is inserted somewhat nearer end of snout than base of caudal, the modified portion usually about equal to length of head, its structure apparently identical with that of the preceding species; ventral fins in females reaching vent, the outer ray produced in males, reaching beyond base of anal; pectoral fins moderate, 1.2 to 1.66 in head.

Color of the sexes similar, olivaceous; dorsal fin with a dark blotch at base of the middle rays; fins otherwise unmarked.

This species is represented by 22 specimens in the present collection. The largest female is 35 and the largest male 30 mm. in length. It was taken by us at only two places, Aruza and Cituro, in the Rio Tuyra Basin. This is the only species of *Mollienisia* collected in that river basin.

This species is apparently closely related to *M. sphenops*, but differs in color, and in the number of dorsal and anal rays.

Habitat: Pacific slope of southeastern Panama and the eastern slope of Colombia.

65. *Mollienisia cuneata* (Garman).

Pæcilia cuneata Garman, Mem. Mus. Comp. Zool., XIX, 1895, 62, Pl. V, fig. 3 (Turbo, Gulf of Darien).

Head 4; D. 8 to 10; A. 9 or 10; scales 28 or 29.

Body short and deep; caudal peduncle deep; head depressed, broad and flat; snout as long as eye; mouth wide, the jaws weak and loosely joined; outer series of teeth slender, oar-shaped, movable; inner bands small, pointed; eye half interorbital space, its length $3\frac{1}{2}$ in head; origin of dorsal over third ray of anal, midway from base of caudal to head:

anal of female small, its third ray the longest; modified anal of male shorter than the head; ventrals small, not reaching anal; caudal deep, its posterior margin rounded.

Color brownish, bases of scales dark; dorsal region dark, the ventral region silvery; dorsal with one to several transverse series of small spots of black, the fin sometimes black tipped; caudal with small spots of black on basal half, or with a couple of clouded transverse bands; the fins uniform or punctulate. (Garman.)

This species was not seen by us.

66. *Mollienisia formosa* (Girard).

Limia formosa Girard, Proc. Ac. Nat. Sci. Phila., 1859, 115 (Palo Alto, Mexico).

Mollienisia formosa Günther, Cat. Fish. Brit. Mus., VI, 1866, 349; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 699; Regan, Proc. Zool. Soc. Lond., 1913, 1012 (Tampico, Mexico; Colon, Panama).

Head 3.3 to 4; depth 2.5 to 3; D. 11 to 14; A. 9 or 10; scales 26 to 28.

Body rather robust; eye 3 to 3.5 in head; interorbital 1.7 to 2; origin of dorsal a little nearer the base of caudal than the end of the snout; origin of anal below fourth ray of dorsal; pectoral shorter than the head; caudal fin rounded; least depth of caudal peduncle, 1.3 to 1.6 in head; modified anal of male 1.3 in head.

Color olivaceous; scales with brown spots; dorsal fin with transverse series of blackish spots, other fins plain.

This species is recorded from Colon by Regan. It does not occur in our collections.

Habitat: Atlantic slope of Mexico and Central America.

42. Genus *Rivulus* Poey.

Rivulus Poey, Memorias, II, 1858, 307 & 383 (type *Rivulus cylindraceus* Poey).

Cynodonichthys Meek, Field Col. Mus. Pub., Zool Ser., V, 1904, 101 (type *Cynodonichthys tenuis* Meek).

Slender fishes with subterete body; mouth small, the branches of the lower jaw firmly united; teeth conical, in bands, the outer ones enlarged and curved; one or two teeth on each side usually enlarged and canine-like; margin of eyes not free; pectorals obtuse, low; caudal rounded or subtruncate; dorsal small, over posterior part of the much longer anal; oviparous; air bladder large; alimentary canal short, about $\frac{2}{3}$ to $\frac{3}{4}$ length of body.

KEY TO THE SPECIES.

- a. Dorsal fin with 7 rays; anal with 11 or 12 rays; depth 5 to 6 in length. *elegans*, p. 331.
- aa. Dorsal fin with 9 or 10 rays; anal with 13 or 14 rays; depth 4.35 to 4.9 in length. *brunneus*, p. 331.

67. Rivulus elegans Steindachner.

Rivulus elegans Steindachner, Denkschr. K. Ak. Wiss. Wien, XLII, 1880, 85, Pl. VI, fig. 6 (Rio Cauca); Regan, Ann. & Mag. Nat. Hist., Ser. 8, X, 1912, 498 (Rio Condoto, Colombia), and Ann. & Mag. Nat. Hist., Ser. 8, X, 1913, 471; Henn, Ann. Carnegie Mus., X, 1916, 108 (Rio Condoto and Rio Truando, Colombia).

Head 3.33 to 3.85; depth 5 to 6; D. 7; A. 11 or 12; scales 33 to 35.

Body long, slender, posteriorly compressed; head depressed, wider than deep; snout broad, 3.5 to 4.3 in head; eye 3 to 3.75; interorbital broad, 2.15 to 2.6; mouth rather small, oblique; lower jaw projecting; teeth in the jaws in bands, the outer ones enlarged, curved inward; scales cycloid, with prominent circulae, 7 or 8 longitudinal rows of scales between base of dorsal and anal; origin of dorsal over posterior one-fourth of anal, and about midway between gill-opening and tip of caudal or slightly nearer the former, the base of the last ray a little behind vertical from base of last anal ray; caudal fin strongly rounded; anal fin inserted notably nearer tip of caudal than tip of snout, the length of its base scarcely equal to the greatest width of head; ventral fins small, about as long as diameter of eye, reaching origin of anal; pectoral fins moderate, not reaching base of ventrals, 1.3 to 1.8 in head.

Color brownish, sides more or less speckled with dark spots. Most of our specimens with a dark ocellus at base of upper rays of caudal; lower lobe of caudal with or without a black stripe extending from under side of caudal peduncle to end of caudal rays, forming an intramarginal bar. Dorsal and anal more or less dusky.

There are 22 specimens in the present collection, ranging in length from 26 to 38 mm. All were taken in small brooks near the water shed on the Atlantic slope at Culebra.

R. elegans is very probably identical with *R. godmani* Regan.

Habitat: Panama, south to Colombia.

68. Rivulus brunneus Meek & Hildebrand.

Rivulus brunneus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 86 (Toro Point, Canal Zone, Panama).

Head 3.3 to 3.7; depth 4.35 to 4.9; D. 10, rarely 9; A. 13 or 14, rarely 12; scales 34 to 38.

Body rather robust, posteriorly compressed; head depressed, wider than deep; snout short, 3.65 to 4.25 in head; eye 3.2 to 3.8; interorbital 2.2 to 2.65; mouth small, the cleft scarcely lateral; teeth pointed, in bands in the jaws, the outer ones somewhat enlarged, curved inward; scales rather small, cycloid, the circulae strongly developed; 8 longitudinal rows of scales between base of dorsal and base of anal; origin of dorsal over middle of base of anal or slightly posterior to this point, and somewhat nearer tip of caudal than posterior margin of eye, the base of its last ray slightly behind vertical from base of last ray of anal; caudal fin rounded; anal fin inserted midway between the tip of snout and tip of caudal or slightly nearer the former, its margin convex, the length of the base equal to the greatest width of head; ventral fins small, about as long as diameter of eye, reaching vent; pectoral fins moderate, failing quite notably to reach base of ventrals, 1.6 to 1.8 in head.

Color brownish, sides more or less speckled with darker; dorsal and caudal with or without faint, dark spots; a black stripe from under side of caudal peduncle to end of caudal rays usually present, forming an intramarginal bar; on some specimens there is a similar bar on the upper lobe of the caudal fin, although less distinct. In life the upper parts of the body are grayish with shades of pink, and the belly is pale and also has a shade of pink. The fins are all reddish, and the base of caudal and anal are deep red.

Of this species we have 17 specimens, ranging in length from 35 to 50 mm. All are from the upper course of a small creek at Toro Point.

Order IV. *Acanthopterygii*.

THE SPINY-RAYED FISHES.

Spines normally present in the anterior part of the dorsal and anal fins; border of the mouth formed by the premaxillary; ventral fins usually thoracic; anterior vertebrae unmodified; opercular bones all present.

Family IX. *Mugilidæ*.

Body elongate, more or less compressed; mouth small, terminal or inferior; teeth, if present, small, various in form; premaxillaries protractile; gill-openings wide, the membranes free from the isthmus; gill-rakers usually long and slender; gills 4, a slit behind the fourth;

lateral line usually absent, never complete; scales large, extending forward on head; dorsal fins 2, well separated, the first composed of 4 rather strong spines; second dorsal with one spine and from 7 to 10 soft rays; caudal fin forked; anal fin with 2 or 3 spines and 7 to 11 soft rays; ventral fins abdominal, each with one spine and 5 branched rays; pectoral fins placed high.

The genera *Agonostomus* and *Joturus* comprise fresh water species and are dealt with in the present paper. The marine species of this family will be discussed in another work.

KEY TO THE GENERA.

- a. Snout scarcely in advance of upper lip; teeth in lower jaw in a continuous band; dorsal spines rounded, not prominently compressed. *Agonostomus*, p. 333.
- aa. Snout projecting beyond upper lip; teeth in lower jaw in two lateral patches, not confluent anteriorly; dorsal spines notably compressed. *Joturus*, p. 336.

43. Genus *Agonostomus* Bennett.

Agonostomus Bennett, Proc. Comm. Zool. Soc., I, 1831, 166 (type *Agonostomus telfairii* Bennett).

Neomugil Valliant, Bull. Soc. Philom. Paris, IV, 1894, 73 (type *Neomugil digueti* Valliant.)

Body elongate, compressed; mouth terminal in young, subinferior in adult, the cleft extending laterally to or past front of eye, the lower lip not greatly thickened; teeth in bands on jaws, vomer and palatines, those on jaws with lance-shaped apices or serrated margins; first dorsal with 4 rounded spines; anal spines 2, the first one minute, often hidden in the skin; stomach not gizzard-shaped. Inhabiting tropical rivers, some of them living in mountain torrents.

The American species of this genus have been described in current works as having pointed teeth in the jaws. This is certainly not true of the specimens at hand, either from Panama or Cuba. The outer series in each jaw is mostly composed of lance-shaped teeth and the inner ones nearly all have a serrated margin.

KEY TO THE SPECIES.

- a. Body comparatively slender, the depth 3.7 to 3.85 in its length in specimens about 150 mm. long; mouth rather small, the maxillary reaching to or slightly past vertical from anterior margin of eye. *monticola*, p. 334.

- aa. Body somewhat deeper, the depth 3.1 to 3.3 in length in specimens about 150 mm. long; mouth large, the maxillary reaching nearly to vertical from middle of eye. *macracanthus*, p. 335.

69. *Agonostomus monticola* (Bancroft).

Mugil monticola Bancroft, in Griffith's Edition Cuvier's Animal Kingdom, Fishes, 1836, 367, Pl. 36 (West Indies).

Agonostoma monticola Günther, Cat. Fish. Brit. Mus., III, 1861, 464 (West Indies).

Agonostoma nasutum Günther, Cat. Fish. Brit. Mus., III, 1861, 463 (Rio San Geronimo, Guatemala), and Trans. Zool. Soc. London, 1868, 444, Pl. 70, fig. 1.

Neomugil digueti Valliant, Bull. Soc. Philom., IV, 1894, 73 (Lower California).

Agonostomus monticola Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 819, fig. 347; Regan, Biol. Cent. Amer., Pisces, 1907, 66; Meek, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1914, 118 (both slopes of Costa Rica).

Agonostomus nasutus Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 819; Regan, Biol. Cent. Amer., Pisces, 1907, 68, Pl. X, fig. 4.

Head 3.4 to 4.1; depth 3.1 to 4.1; D. IV-I, 8; A. II, 10; scales 39 to 43.

Body compressed; upper profile gently convex; head rather small; snout conical, 3.2 to 4.1 in head; eye 3 to 4.9; interorbital 2.85 to 3.4; mouth moderate, nearly horizontal; upper jaw somewhat in advance of the lower; upper lip various, thin, moderately thick, or very thick, its upper margin elevated or not at tip of snout; maxillary reaching to or a little past vertical from anterior margin of eye, 2.6 to 3.2 in head; teeth in bands on jaws, vomer and palatines, the jaw teeth mostly with serrate margins, some with lance-shaped apices; gill-rakers rather short, 17 to 20 on lower limb of first arch; scales rather large, ctenoid, extending forward to interorbital area, about 12 rows between anterior rays of second dorsal and anal; origin of first dorsal notably nearer tip of snout than base of second dorsal, the anterior 2 spines of equal length posteriorly when deflexed, the first one somewhat longer than eye and snout; origin of second dorsal nearer origin of the first dorsal than base of caudal, the outer margin of the fin concave; caudal fin with small scales on basal half, moderately forked; anal fin similar to second dorsal, but a little longer, its origin slightly in advance of second dorsal, with 2 spines, the first one minute and hidden in the skin in adult; ventral fins inserted under middle of pectorals, a little nearer origin of anal than tip of snout; pectoral fins placed high, of about the same length as ventrals, 1.32 to 1.5 in head.

Color bluish black above; sides mostly silvery, the margin of scales brown; pale below. Very young often with a dark lateral band, which later becomes only faintly visible. A dark caudal spot present at all ages, but most distinct in young. The spines of first dorsal black, the membranes yellowish green; second dorsal and caudal yellowish green at base; ventrals yellow; pectorals plain translucent. Very young sometimes with reddish fins.

There are 118 specimens, ranging from 40 to 255 mm. in length, in the present collection which we have identified as this species. These were collected at various points on both slopes of Panama, mostly in the lowland streams, some even were taken in brackish water, and a few are from upland streams. On the Atlantic slope it was taken at several points in the Chagres Basin and in small coastal streams at Porto Bello and Toro Point. On the Pacific slope it was found everywhere, except in the Rio Tuyra Basin.

After careful study of our material, together with specimens from Cuba and Guatemala, we find it impossible to retain the two nominal species, *A. monticola* and *A. nasutus*. The only reason for keeping the two separate heretofore apparently was the alleged difference in the thickness of the upper lip. We, however, find that in our large series this is a variable character upon which no reliance can be placed. We have specimens with a thin upper lip, some with a thick lip, and nearly all stages between. These occur indiscriminately on both slopes, and in the same rivers and pools. However, the thick-lipped form occurs more frequently among our Pacific slope specimens than among those from the Atlantic.

Habitat: Mexico; Central America; both slopes of Panama and the West Indies.

70. *Agonostomus macracanthus* Regan.

Agonostomus macracanthus Regan, Ann. & Mag. Nat. Hist., Ser. 7, XIX, 1907, 65, and Biol. Cent. Amer., Pisces, 1907, 69, Pl. XI, fig. 1 (Rio Guacalate, Guatemala).

Head 3.4 to 3.55; depth 3.1 to 3.3; D. IV-I, 8; A. II, 12; scales 41 to 42.

Body compressed, rather deep; head low; snout conical; 3.25 to 3.55 in head; eye 4.34 to 4.9; interorbital 3.05 to 3.25; mouth rather large, slightly oblique; the upper jaw projecting; the upper lip quite thick; maxillary reaching nearly to vertical from middle of eye, 2.44 to 2.6 in head; teeth as in preceding species; gill-rakers short, about 20 on lower limb of first arch; scales large, ctenoid, extending forward to interorbital region, about 12 rows between anterior rays of second dorsal and

anal; origin of first dorsal about midway between tip of snout and base of caudal, the first spine equal to or shorter than the second, not longer than eye and snout; origin of second dorsal notably nearer origin of first dorsal than base of caudal, margin of fin concave; caudal fin with small scales on basal half, moderately forked; anal fin similar to second dorsal but a little longer, with 2 spines, the first one minute and often hidden in the skin, its origin under or slightly in advance of second dorsal, midway between base of ventrals and base of caudal; ventral fins inserted under middle of pectoral, somewhat nearer origin of anal than tip of snout; pectoral fins placed high, of about the same length as the ventrals, 1.4 to 1.65 in head.

Color bluish black above; sides silvery, with margin of scales brown; pale below. An indefinite dark lateral streak, with a silvery one above it, most evident on posterior part of body; a dark caudal spot present. Spines of first dorsal black, the membranes greenish; second dorsal, caudal and distal half of anal dusky; ventrals and pectorals plain in spirits, except that the upper ray of pectoral is black.

There are only 2 specimens of this species in the present collection, respectively 173 and 205 mm. in length. Both specimens were taken at the base of a waterfall near the mouth of the Rio Indio, a tributary of the Upper Chagres.

This species differs from the preceding principally in the somewhat deeper body and in the notably larger mouth.

Habitat: Rio Guacalate, Guatemala; Rio Chagres, Panama.

44. Genus *Joturus* Poey.

Joturus Poey, Memorias, II, 1861, 263 (type *Joturus pichardi* Poey).

Xcnorhynchichthys Regan, Ann. & Mag. Nat. Hist., Ser. 8, II, 1908, 461 (type *Joturus stipes* Jordan & Gilbert).

Snout protruding beyond upper lip; teeth in lower jaw in two lateral patches which do not meet anteriorly; dorsal spines compressed. In other respects essentially as in *Agonostomus*. One species known, living at the foot of waterfalls and rapids.

71. *Joturus pichardi* Poey.

Joturus pichardi Poey, Memorias II, 1861, 263 (Cascades throughout Cuba); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 821; Regan, Biol. Cent. Amer., Pisces, 1907, 70; Meek, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1914, 117 (both slopes of Costa Rica). *Agonostoma globiceps* Günther, Ann. & Mag. Nat. Hist., Ser. 4, XIV, 1874, 370 (Myzantla, Vera Cruz).

Joturus stipes Jordan & Gilbert, Proc. U. S. Nat. Mus., V, 1882, 373 (Rio Bayano, Panama).

Xenorhynchichthys stipes Regan, Ann. & Mag. Nat. Hist., Ser. 8, II, 1908, 461 (Rio Iroquois, Costa Rica).

Head 4 to 4.27; depth 3.2 to 3.9; D. IV-I, 9; A. II, 11; scales 43 to 45.

Body elongate, compressed; the dorsal region somewhat elevated; profile from snout to first dorsal evenly convex; head rather low and broad; snout conical, projecting beyond upper lip, 2.75 to 3.4 in head; eye small, 4 to 6.5; interorbital broad, 1.93 to 2.7; mouth moderate, horizontal, inferior; lower jaw included; maxillary reaching about to vertical from middle of eye, 2.3 to 3.1 in head; teeth in the jaws compressed, with serrate margins, those of the upper jaw in a narrow, continuous band, those of the lower jaw in 2 lateral patches, not meeting anteriorly; vomerine teeth in a transverse patch; palatine teeth minute, in a very narrow band; pterygoid teeth, if present, very minute; gill-rakers short, about 30 below angle on first arch; scales large, ctenoid, extending forward to nostrils, 12 to 14 longitudinal rows between base of second dorsal and anal; origin of first dorsal a little nearer base of last ray of second dorsal than tip of snout, the spines notably compressed, the first one reaching slightly past tip of the second when deflexed, equal to about two-thirds length of head; second dorsal, caudal and anal mostly covered with small scales; origin of second dorsal somewhat nearer origin of first than base of caudal, its outer margin concave; caudal fin forked, the lobes of about equal length; anal fin similar to second dorsal, its origin under or slightly in advance of origin of second dorsal, and about midway between base of ventrals and base of caudal; ventral fins inserted under middle of pectorals, about midway between tip of snout and origin of anal; pectoral fins somewhat longer than ventrals, 1.1 to 1.3 in head.

Color in life, of a specimen about 200 mm. in length, very dark green above, with the base of scales green and the margin black; sides lighter green with the margin of the scales brown; pale below. Dorsal fins black at base with broad yellowish green margins; caudal and anal black at base, otherwise irregularly blotched with black and yellow; ventrals and pectorals dark at base and yellowish at tips. The young have two oblique bars on each lobe of the caudal and two similar ones on second dorsal and anal. In large examples these markings completely disappear.

We have 26 specimens of this species, ranging from 150 to 460 mm. in length. Most of our specimens were taken by a discharge of dynamite below a waterfall near the mouth of the Rio Indio, a tributary of the Upper Chagres. The others were taken by natives with hook and

line at Gatun, at the "Spill-way," which creates an artificial waterfall. We did not obtain it on the Pacific slope, although it is recorded from the Rio Mamoni.

This fish is said to reach a length of one meter and is much valued as food.

Habitat: Southern Mexico to Panama and Cuba.

Family X. Cichlidæ.

THE MOJARRAS.

Body elongate, compressed, covered with ordinary scales, which are usually ctenoid; lateral line interrupted under soft portion of dorsal, reappearing lower down on caudal peduncle; mouth large or small, terminal to subinferior; teeth conical, incisor-like, or lobate; vomer and palatines without teeth; premaxillaries freely protractile; the maxillary usually slipping under the broad preorbital; nostril single on each side; dorsal fin single, the spinous portion usually longer than the soft portion; gill-membranes usually connected and free from the isthmus; air bladder present; ventral fins I, 5, thoracic; anal fin with 3 or more spines, the soft portion smaller, though similar to that of dorsal; branchiostegals 5 or 6; no pseudobranchiæ.

A large family of fresh water fishes inhabiting the lowland streams of Mexico and the waters of Central and South America and Africa. Only a few species occur in Panama.

KEY TO THE GENERA.

- a. Anal fin with 3 spines.
- b. First gill-arch normal, without a lamelliform lobe above angle; snout usually shorter than postorbital part of head. *Æquidens*, p. 338.
- bb. First gill-arch with a lamelliform lobe above angle; snout much longer than postorbital part of head. *Geophagus*, p. 340.
- aa. Anal fin with more than 3 spines.
- c. Teeth all conical. *Cichlasoma*, p. 342.
- cc. The outer series of teeth in both jaws compressed, incisor-like. *Neetroplus*, p. 348.

45. Genus *Æquidens* Eigenmann & Bray.

Æquidens Eigenmann & Bray, Ann. N. Y. Ac. Sci., VII, 1894, 616 (type *Acara tetramerus* Heckel).

Body robust, compressed; mouth small, the premaxillary not greatly protractile; gill-rakers minute; margin of lower lip free at sides; teeth conical, none of them canine-like; anal spines 3; upper portion of anterior gill-arch without a lamelliform lobe.

This genus contains a large number of species which inhabit the waters of South America, one species only occurring as far north as Panama.

72. *Æquidens cœruleopunctatus* (Kner & Steindachner).

Acara cœruleopunctata Kner & Steindachner, Sitzungsber. K. Bayer. Ak. Wiss. München, 1863, 222, and Abhandl. K. Bayer. Ak. Wiss. München, X, 1864, 16, Pl. II, fig. 3 (Rio Chagres, Isthmus of Panama); Günther, Trans. Zool. Soc. London, VI, 1869, 449 (Rio Chagres); Steindachner, Denkschr. K. Ak. Wiss. Wien, XLI, 1880, 56 (Rio Cauca); Regan, Ann. & Mag. Nat. Hist., Ser. 7, XV, 1905, 336, and Biol. Cent. Amer., Pisces, 1906, 16 (Rio Chagres, Panama; N. W. Ecuador).

Æquidens cœruleopunctatus Eigenmann & Bray, Ann. N. Y. Ac. Sci., VII, 1894, 616; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 1514.

Head 2.6 to 2.78; depth 2 to 2.3; D. XIV or XV, 9 to 11; A. III, 7 or 8.

Body robust; anterior profile strongly convex; head short and heavy; snout blunt, 2.53 to 3.8 in head; eye 3 to 4.45; interorbital much broader than eye, except in very young; preorbital broader than eye in large examples, but notably narrower than eye in young; mouth terminal, rather small; the maxillary failing to reach eye, 3.1 to 3.8 in head; lips not thickened, the margin of lower lip free at sides only; teeth in the jaws conical, forming a band in each jaw; gill-membranes broadly connected across isthmus; gill-rakers short, about 8 on lower arm of first arch; lateral line interrupted under anterior rays of soft portion of dorsal, reappearing on third row below its original course; scales rather large, cycloid, 1½ to 2 rows between lateral line and middle of base of dorsal; dorsal fin long, its origin over posterior margin of opercle, the spines rather short and strong, the last one 2.2 to 3.3 in head, the soft portion much elevated in large examples, the produced rays often reaching nearly to tip of caudal, none of the rays much produced in the young and not reaching far beyond base of caudal; caudal fin scaly at base, its margin convex; anal fin with 3 strong spines, the soft portion similar to that of dorsal; ventral fins inserted a little behind base of pectorals, reaching origin of anal in young, a few of the rays produced in adult reaching opposite the soft portion of anal; pectoral fins rather long, .97 to 1.15 in head.

Color in life of a large example: Back bluish black, pale brownish below; sides with 4 indistinct cross-bars, a dark blotch on sides below last half of spinous portion of dorsal; cheeks with 2 distinct blue-green lines and numerous spots of the same color; these spots are also present on sides and breast; base of caudal with a large black spot. Dorsal fin bluish black, the soft rays with a tinge of deep red and with a yellow margin; caudal fin reddish blue with darker spots; anal fin dark blue, the last rays reddish at tips; ventral fins slate; pectorals greenish. The dark cross-bars on sides more numerous and more distinct in young. Cheeks, sides and chest without blue-green lines or spots; fins all paler and without red.

Considerable variation in color is evident among our specimens. Individuals taken in muddy streams are much duller, and do not possess any blue-green lines and spots.

Of this species there are numerous specimens in the present collection, ranging in length from 25 to 157 mm. One of the most abundant species in the streams of Panama, occurring on both slopes, from tide water to the highest mountain streams.

Habitat: Both slopes of Panama and south to Colombia, and Ecuador.

46. Genus *Geophagus* Heckel.

Geophagus Heckel, Ann. Wiener Mus., II, 1840, 383 (type *Geophagus altifrons* Heckel = *Sparus surinamensis* Bloch).

Satanoperca Günther, Cat. Fish. Brit. Mus., IV, 1862, 312 (type *Geophagus acuticeps* Heckel).

Body oblong, compressed; mouth moderate; jaws with conical teeth; premaxillary moderately protractile; outer gill-arch with a compressed lamelliform lobe above, gill-rakers at or near its margin; margin of lower lip not free at its middle; caudal fin emarginate to slightly forked; anal spines 3.

One species of this genus is known to occur in Panama, its range not extending northward far beyond the Canal Zone.

73. *Geophagus crassilabris* Steindachner.

Geophagus (*Satanoperca*) *crassilabris* Steindachner, Sitzb. K. Ak. Wiss. Wien, LXXIV, 1876, 65, Pl. VII (Vicinity of Candelaria, Isthmus of Panama).

Satanoperca crassilabris Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 1542.

Geophagus crassilabris Pellegrin, Étude Pois. Fam. Cichlidés, Lille, 1904, 160 (Isthmus of Panama); Regan, Biol. Cent. Amer., Pisces, 1906, 16.

Head 2.46 to 3.13; depth 2.35 to 2.95; D. XVI, 9 or 10; A. III, 7 or 8; scales 29 to 31.

Body rather deep, compressed; the back elevated; anterior profile distinctly convex in young, straight in adults not possessing a nuchal hump, concave in specimens with nuchal hump; head deep; snout long and pointed in adult, much shorter and more blunt in young, equal to half length of head in specimens about 125 mm. in length, much greater than half length of head in large specimens and much shorter than half head in very young, 1.6 to 4 in head in specimens ranging from 30 to 263 mm. in length; eye circular, placed high, lower margin of pupil about on level with upper angle of gill-opening, 2.95 to 5.85 in head; preorbital broad, about 2 times diameter of eye in large examples, equal to or a little less than diameter of eye in very young; mouth moderate, horizontal; maxillary failing to reach anterior margin of eye, 2.6 to 3.65 in head; jaws equal or the upper slightly projecting; the lips thickened, the lower with a fleshy lobe on each side; teeth conical, in bands in each jaw; gill-membranes broadly connected across isthmus; gill-rakers short, about 13 on lower limb of first arch; lateral line interrupted under soft portion of dorsal, reappearing on the third row of scales below its original course; scales of moderate size, feebly ctenoid, from 2 to 3½ rows between lateral line and middle of base of dorsal; dorsal fin long, its origin over posterior margin of opercle, the spines rather short and strong, the last one 2.7 to 3.3 in head, the soft portion varying greatly in length among different individuals, usually reaching base of caudal, a few of the rays occasionally produced and reaching far beyond this point; caudal fin scaly at base, its margin concave; anal fin short, the spines strong, the soft portion similar to that of dorsal; ventral fins inserted slightly behind base of pectorals, reaching to or past vent; pectoral fins moderate, 1.2 to 1.5 in head.

Color in life greenish brown above, yellowish below. Sides in young with well defined black cross-bars, these less distinct in adult; very young also with a black lateral band. Lips and gill-membranes blue in adult. Dorsal, caudal, anal and ventrals reddish yellow in adult, more greenish in young; pectorals greenish.

This fish is represented by numerous specimens, ranging from 30 to 263 mm. in length. It is common in the streams on both slopes of Panama.

There is considerable variation with respect to the development of the soft portion of the dorsal and anal fins and the number of rows of scales between the lateral line and base of dorsal, but our large series is ample to show that these are only individual variations.

Habitat: Isthmus of Panama.

47. Genus *Cichlasoma* Swainson.

Cichlasoma Swainson, Nat. Hist. Class. Fishes, Amph. and Rept., II, 1839, 230 (type *Sciæna bimaculata* Linnæus).

Theraps Günther, Cat. Fish. Brit. Mus., IV, 1862, 284 (type *Theraps irregularis* Günther).

Parapetenia Regan, Ann. & Mag. Nat. Hist., Ser. 7, XVI, 1905, 324 (type *Acara adspersa* Günther).

Body ovate to oblong, compressed; mouth rather small to large; premaxillary moderately protractile, the maxillary slipping under the preorbital; fold of the lower lip continuous or not; teeth conical, to slightly compressed in a few species; a few anterior teeth canine-like in species with large mouths; anal spines IV to XI.

To this genus belong many species, some are deep, others more or less elongate. In many of the species the mouth is small, the gape horizontal or nearly so, and the anterior teeth conical to slightly compressed. In others the mouth is terminal, oblique, and with some of the anterior teeth enlarged and canine-like. The efforts to break this group into several genera or subgenera have not met with much success, since the characters on which they have been based are too variable and overlap. Only five species are known to occur in central and eastern Panama.

KEY TO THE SPECIES.

- a. The outer series of teeth in the jaws somewhat enlarged, and regularly increased in size anteriorly; mouth small or moderate; the maxillary not reaching past vertical from anterior margin of eye.
- b. Lower lip narrow, its margin not free at symphysis; teeth all sharply pointed.
- c. A large black blotch present at base of caudal, and usually with another large black blotch on sides under tips of pectorals; sides without distinct cross-bars; lateral band present only in very young; scales in lateral series 31 to 33; lower lateral line on third row of scales below upper lateral line.

maculicauda, p. 343.

- cc. Young with cross-bars; adults with a single series of black blotches along middle of sides; spot at base of caudal comparatively small; black dots on rows of scales, forming dark lines; scales in lateral series 34 to 41; lower lateral line present on fifth row of scales below upper lateral line; 6 or 7 rows of scales between lateral line and base of anterior dorsal spines; anal with 6 or 7 spines.

tuyrense, p. 344.

- ccc. Body with cross-bars, forming a series of blotches on upper lateral line and a larger series on middle of sides; each scale with a dark spot; scales in lateral series 30 to 32; 4 rows of scales between lateral line and base of anterior dorsal spines; anal spines 5. *sieboldii*, p. 345.
- bb. Lower lip broad, continuous, and free at symphysis; teeth rather blunt; young with dark cross-bars, these less distinct in adult; sides with a large, black blotch under posterior part of spinous portion of dorsal; a small black spot at base of upper half of caudal. *calobrense*, p. 346.
- aa. The anterior pair of teeth in each jaw enlarged; mouth rather large; the maxillary reaching past vertical from anterior margin of eye; sides with a dark lateral band, ending in a jet black caudal spot. *unbriferum*, p. 347.

74. *Cichlasoma maculicauda* Regan.

Cichlasoma maculicauda Regan, Ann. & Mag. Nat. Hist., Ser. 7, XVI, 1905, 227 (Lake Yzabal and Rio Motagua, Guatemala; Rio Chagres, Panama), and Biol. Cent. Amer., Pisces, 1906, 19, Pl. II, fig. 3.

Head 2.7 to 3.23; depth 1.75 to 2.1; D. XVII or XVIII, 11 or 12; A. VI, 9 or 10; scales 31 to 33.

Body deep, compressed; anterior profile a little concave in large specimens possessing a slight nuchal hump, convex in others; head deep; snout moderate, 2.1 to 4 in head; eye 2.8 to 4.3; mouth small, terminal, slightly oblique; maxillary failing to reach anterior margin of eye, 3.4 to 4 in head; the lips not thickened, the lower one not free at middle; teeth in the jaws pointed, in 2 more or less definite series, the outer and anterior ones enlarged; gill-membranes united across isthmus; gill-rakers short, about 9 or 10 on lower limb of first arch; scales moderate, ctenoid, 5 or 6 rows between lateral line and middle of base of dorsal; lateral line interrupted under soft portion of dorsal, reappearing on the third row of scales below its original course; origin of dorsal over or slightly in advance of base of pectoral, the spines strong, the last one 1.8 to 2.5 in head, the soft portion pointed, a few of the rays somewhat produced in large examples, always reaching notably past base of caudal, its base with small scales; caudal fin scaly at base, its margin convex, more strongly so in adult than in young; anal fin with 6 strong spines, the soft portion similar to that of dorsal; the outer rays of the ventral fins somewhat produced, reaching to or past origin of anal; pectoral fins moderate, 1.14 to 1.3 in head.

Color yellowish-green to brownish, without distinct cross-bars. Lateral band present only in young (25 mm.), which also have a black

band at base of dorsal. A large black blotch present at base of caudal, and most specimens with a black blotch on middle of side under tip of pectoral. An occasional specimen also has many small dark spots on sides. Fins plain translucent, or dusky; the vertical fins often with small dark spots.

There are 237 specimens, ranging from 20 to 250 mm. in length, in the present collection. All are from the lower Chagres and its tributaries. It was frequently found abundant in very brackish water, and in Panama its range seems to be limited to the brackish and sluggish streams of the Atlantic slope.

The parents appear to guard their young for quite some time after hatching. On one occasion it was noticed that two large fishes, evidently of this species, were hovering very closely to numerous small ones, at a place where the water was quite shallow. An attempt was made to surround them with a seine. However, the adults by their very quick movement made their escape. A large number of young was taken. Only a few minutes after the seine was hauled the two large fishes reappeared and a second attempt at capturing them failed. The young were all of about equal size, ranging from 20 to 24 mm. in length.

Habitat: Lake Yzabal, Guatemala, south to Rio Chagres, Panama.

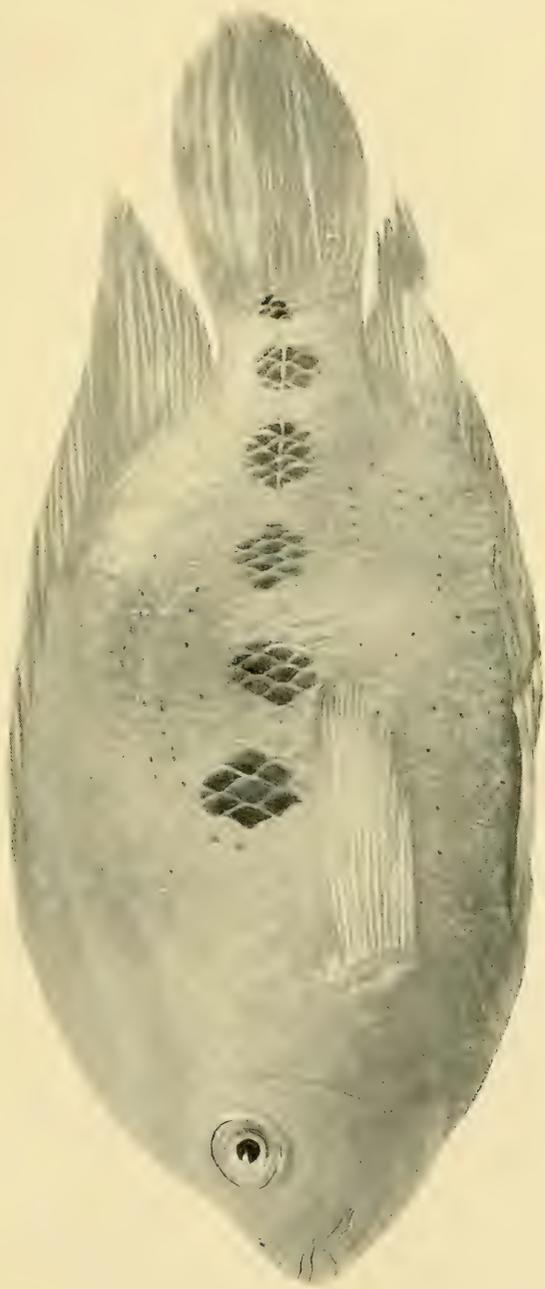
75. *Cichlasoma tuyrense* Meek & Hildebrand.

Heros margaritifera var. Steindachner, Denksch. K. Ak. Wiss. Wien, XLI, 1879, 161 (Rio Mamoni, Chepo).

Cichlasoma tuyrense Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 89 (Rio Tuyra, Boca de Cupe, Panama).

Head 2.75 to 3.45; depth 1.77 to 2.1; D. XVI to XVIII, usually XVII, 11 or 12; A. VI or rarely VII, 8 or 9; scales 34 to 41.

Body deep, compressed; anterior profile nearly straight in young, strongly convex in adult; no nuchal hump; head deep; snout moderately pointed, 2.2 to 3.4 in head; eye 3.33 to 4.3; mouth rather small, terminal, slightly oblique; maxillary failing to reach anterior margin of eye, 2.8 to 3.7 in head; the lips not thickened, the lower one not free at middle; teeth in the jaws pointed, in bands, the outer one somewhat enlarged; gill-membranes broadly connected across isthmus; gill-rakers short, about 8 on lower limb of first arch; scales rather small, weakly ctenoid, 6 or 7 rows between lateral line and middle of base of dorsal; lateral line interrupted under soft portion of dorsal, reappearing on the fifth row of scales below its original course; origin of dorsal over posterior margin of opercle, the spines strong, the last one 1.86 to 2.33 in head; the soft portion with small scales at base, pointed and reaching well past base of caudal in adult; caudal fin scaly at base, its posterior margin strongly



CICHLASOMA TUYRENSE Meek & Hildebrand.
From a specimen 200 mm. in length.

convex; anal with 6 or 7 strong spines, the soft portion similar to that of dorsal; ventral fins more or less produced, reaching to or past origin of anal; pectoral fins equal to or slightly shorter than head.

Color brownish; sides in young with dark cross-bars as wide as interspaces, in adult with a series of black blotches along median line of sides; black dots on rows of scales forming dark lines, these most distinct in large examples. Base of caudal with a short black bar or spot; the vertical fins usually with dark spots; ventral fins dusky.

This species is represented by 114 specimens, ranging from 29 to 300 mm. in length. It was taken only in the Rio Bayano and Rio Tuyra basins.

Our largest specimen sometime during its career had the lower lobe of the caudal fin broken off at its base. The fin regenerated and again formed normal rays, except that at the time of capture they had not grown as long as the uninjured portion.

This species probably resembles *C. sieboldii* (Kner & Steindachner). The last named species was based on specimens from the west slope of Panama. Our fish, however, differs so notably in several respects from the species as described that we are unable to identify our specimens with it. The body in the present species is slightly deeper; eye larger; scales in lateral line more numerous; last dorsal spine is notably longer; the pectoral fin is longer; the caudal fin is always notably rounded; and there is a single series of black blotches placed along middle of side and none on upper lateral line.

Habitat: Rio Bayano and Rio Tuyra basins.

76. *Cichlasoma sieboldii* (Kner & Steindachner).

Heros sieboldii Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München, X, 1864, 13, Pl. II, fig. 2 (New Grenada, west slope, Panama).

Cichlasoma sieboldii Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 1516; Regan, Ann. & Mag. Nat. Hist., Ser. 7, XVI, 1905, 235.

"Depth of body about $2\frac{1}{3}$ in length, length of head about $3\frac{1}{4}$. Snout as long as postorbital part of head. Diameter of eye 4-5 in length of head and $1\frac{1}{2}$ - $2\frac{1}{2}$ in interorbital width. Maxillary not extending to below eye; jaws equal anteriorly, fold of lower lip not continuous; cheek with 5 series of scales; 8 or 9 gill-rakers on lower part of anterior arch. Scales 30-32, $4/13$, $2\frac{1}{2}$ between lateral line and base of anterior part of soft dorsal. Dorsal XVII 11, the spines increasing in length to the last, which is about $\frac{1}{3}$ the length of head; soft fin, when laid back, extending nearly to middle of caudal. Anal V, 8. Pectoral $\frac{2}{3}$ - $\frac{3}{4}$ the length of head; ventral extending to the vent. Caudal sub-

truncate or slightly rounded. Caudal peduncle about $\frac{4}{5}$ as long as deep. Reddish brown, each scale with a dark spot; 5 or 6 dark cross-bars forming a series of blotches on the upper lateral line and a second larger series on the middle of the side; vertical fins dark greyish with series of blackish spots." (Regan.)

This species was not seen by us. The above description is an exact copy from Regan, *Annals and Magazine of Natural History*, Ser. 7, Vol. XVI, 1905, p. 235.

If the type of this species actually came from Panama, it is rather singular that it was not obtained there by us. *C. turyense* is more closely related to this species than any other taken by us, but there are such important differences that it is scarcely possible that the two are confused.

Habitat: Pacific slope of Panama.

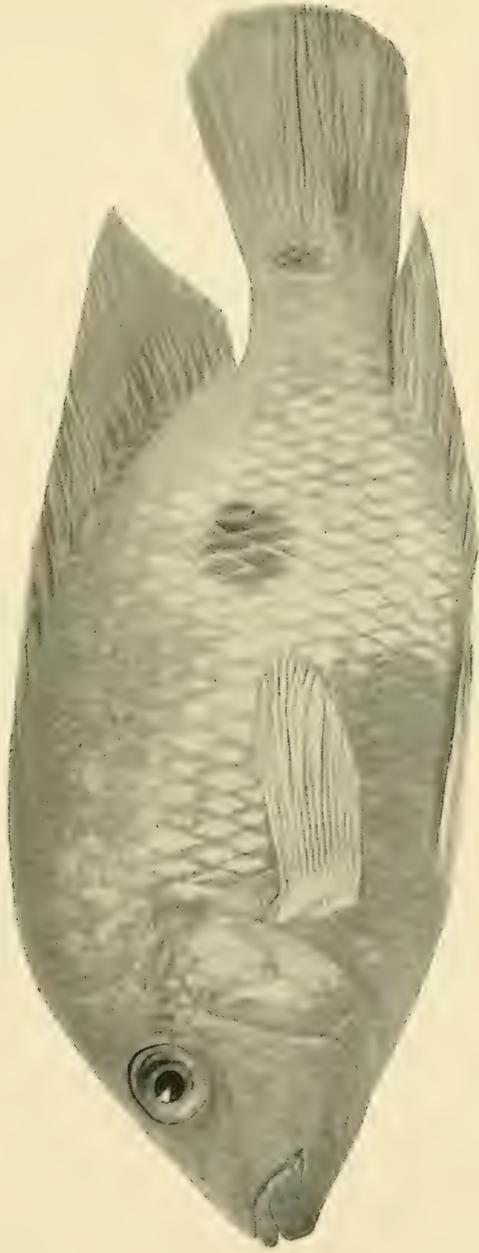
77. *Cichlasoma calobrense* Meek & Hildebrand.

Cichlasoma calobrense Meek & Hildebrand, *Field Mus. Nat. Hist. Pub.*, Zool. Ser., X, 1913, 90 (Rio Calobre, Panama).

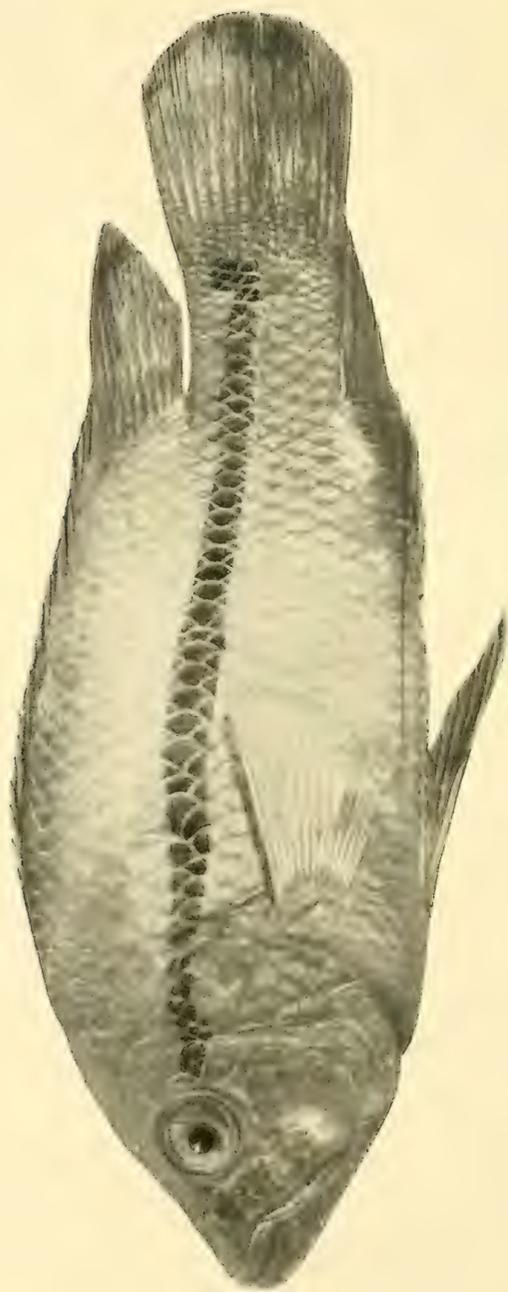
Head 2.73 to 2.9; depth 2.13 to 2.7; D. XVII, 10 to 12; A. VI, 7 or 8; scales 28 to 31.

Body moderately elongate, compressed; head deep; snout tapering, longer than postorbital part of head (except in young less than 55 mm. in length), 1.87 to 2.75 in head; eye 3.1 to 4.58; mouth moderate, terminal, nearly horizontal; maxillary reaching vertical from anterior margin of eye, 2.5 to 3.3 in head; the lips large, the lower one broad, continuous and free at middle; teeth in the jaws bluntly conical, the outer ones somewhat enlarged, and with brown tips; gill-membranes connected across isthmus; gill-rakers short, about 11 or 12 on lower limb of first arch; scales rather large, feebly ctenoid, 3 or 4 rows between lateral line and middle of base of dorsal; lateral line interrupted under soft portion of dorsal, reappearing on third row of scales below its original course and usually considerably in advance of end of upper lateral line; origin of dorsal over posterior margin of opercle, the spines strong, graduated, the last one 2.2 to 3 in head; the soft portion with only a few scales at base on interradiating membranes, the middle rays somewhat produced, reaching well beyond base of caudal; caudal fin with scales on basal half, its margin always convex; anal fin with 6 strong graduated spines, the soft portion similar to that of dorsal; ventral fins rather long and pointed, the longest rays reaching opposite second or third anal spine; pectoral fins not quite reaching origin of anal, 1.18 to 1.47 in head.

Color brownish. Young with dark cross-bars and a more or less distinct dark lateral band; the dark bars less distinct in adult, and the



CICHLASOMA CALOBRENSE Meek & Hildebrand.
From a specimen 185 mm. in length.



CICHLASOMA UMBRIFERUM Meek & Hildebrand.
From a specimen 100 mm. in length.

lateral band wanting. A large black blotch on middle of side, under posterior part of spinous portion of dorsal; a small black caudal spot at base of upper half of caudal; cheeks, opercle and anterior portion of sides often with small rusty spots. Vertical fins sometimes with small dark spots; ventral and anal fins usually bluish black.

We have 69 specimens of this species, ranging from 33 to 212 mm. in length. These are from the Rio Bayano and Rio Tuyra basins.

78. *Cichlasoma umbriferum* Meek & Hildebrand.

Cichlasoma umbriferum Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1913, 88 (Rio Cupe, Cituro, Panama).

Head 2.5 to 2.83; depth 2.2 to 2.5; D. XVI or XVII, 11 or 12; A. VI, 8 or 9; scales 30 to 32.

Body moderately elongate; anterior profile nearly straight, and oblique; head rather large; snout tapering, a little shorter than post-orbital part of head, 2.8 to 3.2 in head; eye 3.4 to 4.7; mouth moderate, terminal, slightly oblique; maxillary reaching nearly or quite to vertical from anterior margin of pupil, 2 to 2.25 in head; the lips not notably thickened, the lower one of moderate width, continuous and free at middle; teeth in the jaws pointed, the anterior pair in each jaw somewhat enlarged; gill-membranes connected across isthmus; gill-rakers short, about 9 on lower limb of first arch; scales rather large, ctenoid, 5 or 6 rows between lateral line and middle of base of dorsal; lateral line interrupted under soft portion of dorsal, reappearing on third row of scales below its original course; origin of dorsal over or slightly in advance of posterior margin of opercle; the spines rather strong, graduated, the last one 2.65 to 3.65 in head; the soft portion with a sheath of scales at base and with small scales on interradial membranes, the rays not much produced, not reaching very far beyond base of caudal; lower half of caudal fin rather densely scaled, the margin strongly convex; anal fin with 6 strong, graduated spines, the soft portion similar to that of dorsal; ventral fins inserted slightly behind base of pectorals, a few of the rays somewhat produced and reaching a little past origin of anal; pectoral fins moderate, not reaching tips of ventrals, 1.3 to 1.52 in head.

Color from light brown to bluish black; sides without cross-bars, except in young up to 50 mm.; a dark lateral band, extending from eye to upper half of base of caudal, ending in a jet black caudal spot; lower part of sides often with bluish spots, these most evident on light colored specimens. Vertical fins with dark and bluish spots; ventral fins bluish black; pectoral fins plain translucent.

We have 40 specimens of this species, ranging from 28 to 236 mm. in length. All are from the Rio Tuyra Basin.

48. Genus *Neetroplus* Günther.

Neetroplus Günther, Trans. Zool. Soc. London, VI, 1869, 469 (type *Neetroplus nematopus* Günther).

Body ovate to elongate, compressed; mouth small; the anterior teeth in each jaw compressed and incisor-like. In other respects like *Cichlasoma*.

This genus contains three species, one each in Nicaragua, Costa Rica, and Panama.

79. *Neetroplus panamensis* Meek & Hildebrand.

Neetroplus panamensis Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1913, 90 (Rio Mandingo, Bas Obispo, Canal Zone, Panama).

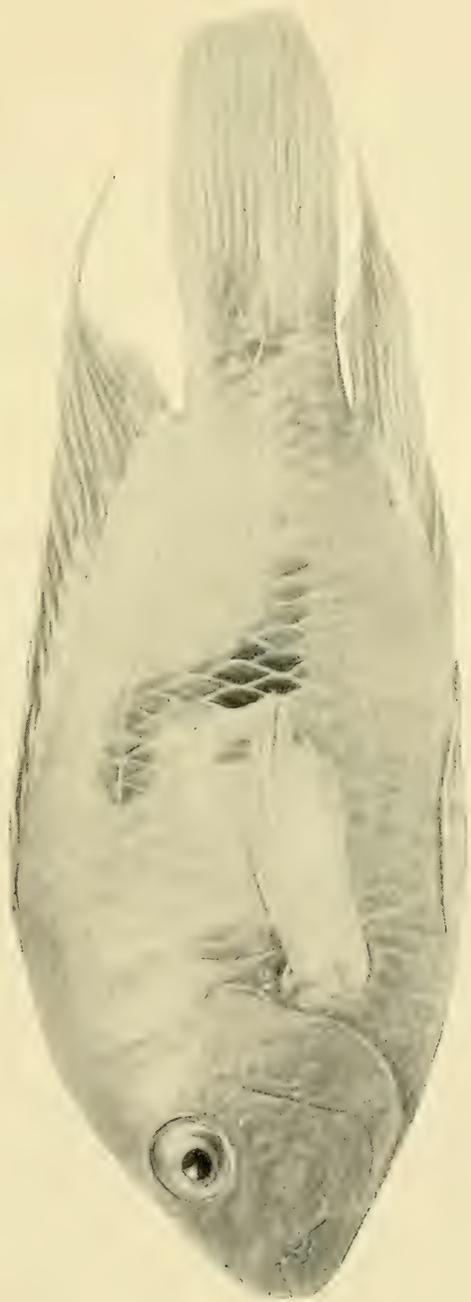
Head 2.9 to 3.1; depth 2 to 2.25; D. XVII (rarely XVIII), 9 or 10; A. VI (rarely VII), 7; scales 27 to 30.

Body rather short, compressed; head moderate; snout blunt, equal to or shorter than postorbital part of head, 2.4 to 3 in head; eye 3 to 3.84; mouth small, terminal; maxillary failing to reach anterior margin of eye, 3.25 to 3.75 in head; cheeks with 3 rows of rather large scales; lips thin, the lower one free only at sides; teeth in the jaws distinctly compressed, incisor-like, with reddish brown tips; gill-membranes broadly connected across isthmus; gill-rakers short, 7 or 8 on lower limb of first arch; scales moderate, ctenoid, $2\frac{1}{2}$ to 3 rows between lateral line and middle of base of dorsal; lateral line interrupted under soft portion of dorsal, reappearing on third row of scales below its original course; origin of dorsal over margin of opercle, the spines graduated, the last one 2.3 to 2.8 in head; the soft portion scaly at base, pointed, a few of the middle rays produced, reaching to distal fourth of caudal; caudal fin scaly at base, its margin evenly convex; anal fin with 6 or rarely 7 strong, graduated spines, the soft portion similar to that of dorsal; ventral fins with the outer rays produced, often reaching opposite the 4th or 5th anal spine; pectoral fins not quite reaching origin of anal, 1.1 to 1.24 in head.

Back bluish black; sides reddish or brownish. Young with blackish bars, these obscure or wanting in adult; a prominent dark blotch on middle of sides below posterior portion of spinous dorsal, and sometimes with a series of irregular black blotches on lower part of side from above base of pectorals to base of caudal; vertical fins dark, tinged with red in adult; ventral fins always pale blue.

There are 42 specimens, ranging from 65 to 103 mm. in length, in the present collection.

Habitat: Rio Chagres Basin.



NEETROPLUS PANAMENSIS Meek & Hildebrand.
From a specimen 100 mm. in length.

Family XI. Gobiidæ.

Body oblong or elongate; teeth various, usually small; premaxillaries protractile; gill-openings usually rather small, the membranes attached to the isthmus; opercle unarmed; preopercle unarmed or with a short spine; orbital margin not free, continuous with skin of head; lateral line wanting; scales present or wanting; dorsal fins 2, separate or connected, the first composed of 2 to 8 slender spines; the second dorsal preceded by a single weak spine; margin of caudal fin convex; anal usually similar to second dorsal; ventral fins close together, separate or united, when united forming a sucking disc, consisting of I, 5 or rarely of I, 4 rays, inserted under base of pectorals; pectoral fins with a broad subvertical base.

Most of the representatives of this family are marine, but some of them enter fresh water and rivers. Only the latter of the Panama species are discussed in the present paper.

KEY TO THE GENERA.

- a. Ventral fins separate.
- b. Vomer with villiform teeth; gill-openings extending forward to below eyes. *Philypnus*, p. 350.
- bb. Vomerine teeth wanting; gill-openings not extending forward to below eyes.
- c. Head very broad; eyes lateral; jaws anteriorly of equal length; teeth compressed at apices; gill-rakers numerous, well developed, in 2 series on each arch. Intestinal canal long; species herbivorous. *Dormitator*, p. 353.
- cc. Head narrower; eyes lateral or not; lower jaw more or less projecting; teeth all pointed; gill-rakers few, poorly developed. Intestinal canal short; species carnivorous.
- d. Preopercle with a small, sharp, concealed spine at its lower posterior angle. *Eleotris*, p. 356.
- dd. Preopercle unarmed.
- e. Scales very small, 100 or more in a lateral series. *Guavina*, p. 360.
- ee. Scales larger, usually fewer than 40 in a lateral series.
- f. Dentary bones broad, expanded, meeting under posterior angle of mouth, leaving an oval-shaped, naked patch at chin. *Leptophilypnus* gen. nov., p. 361.
- ff. Dentary bones narrow, not nearly meeting under posterior angle of mouth.
- g. Head broad depressed; eyes superior; head and chest naked. *Microeleotris* gen. nov., p. 362.

- gg. Head compressed; eyes lateral; head (with the exception of snout) and chest scaly. *Hemieleotris* gen. nov., p. 364.
- aa. Ventral fins united, forming a sucking disc.
- h. Teeth in the jaws in narrow bands; ventral disc longer than wide, free from abdomen; shoulder girdle with 2 or more dermal flaps projecting into gill-cavity. *Awaous*, p. 365.
- hh. Teeth in upper jaw in a single, close-set series, slender, tricuspid, bicuspid or simple, curved inward; lower jaw with 2 series of teeth, the outer series nearly horizontal, partly or completely hidden in the gums, second series erect, pointed; ventral disc circular, more or less adnate to abdomen; no dermal flaps on shoulder girdle. *Sicydium*, p. 369.

49. Genus *Philypnus* Cuvier & Valenciennes.

Philypnus Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 255 (type *Gobiomorus dormitor* Lacépède).

Lembus Günther, Cat. Fish. Brit. Mus., I, 1859, 505 (type *Lembus maculatus* Günther).

Body elongate, anteriorly subcylindrical, posteriorly compressed; head more or less depressed above; mouth large; lower jaw projecting; teeth small, in bands on jaws and on vomer; gill-opening large, extending forward to under eye; scales rather small, ctenoid, covering body and most of head; dorsal fins 2, well separated, with VI-I, 9 rays; caudal fin rounded; anal fin with I, 9 or I, 10 rays.

This genus consists of but two species, both of which usually inhabit lowland streams.

KEY TO THE SPECIES.

- a. Scales small, 61 to 64 in lateral series from upper angle of gill-opening to base of caudal; anal rays I, 9; vertical fins with rather large black spots, forming cross-bars. *dormitor*, p. 350.
- aa. Scales larger, 56 to 59 in lateral series; anal rays I, 10; vertical fins with small and less distinct blackish spots. *maculatus*, p. 352.

80. *Philypnus dormitor* (Lacépède).

Gobiomorus dormitor Lacépède, Hist. Nat. Poiss., II, 1798, 599 (Martinique, from a drawing by Plumier); Jordan & Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, 482.

Platycephalus dormitator Bloch, Syst. Ichthyol., 1801, Pl. 60, t. 12 (Martinique).

Eleotris dormitatrix Cuvier, Règne Animal., Ed. 2, II, 1829, 246; Günther, Cat. Fish. Brit. Mus., III, 1861, 119.

Philypnus dormitator Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 255; Poey, Memorias, II, 1860, 381; Regan, Biol. Cent. Amer., Pisces, 1906, 5.

Eleotris longiceps Günther, Proc. Zool. Soc. London, 1864, 151 (Nicaragua).

Philypnus dormitor Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2194; Meek, Field Col. Mus. Pub., Zoöl. Ser., V, 1904, 226 (Mexico), and Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1914, 129 (Atlantic slope of Costa Rica).

Head 3.2 to 4.3; depth 4.65 to 6.2; D. VI-I, 9; A. I, 9; scales 61 to 64.

Body elongate, nearly as wide as deep anteriorly, compressed posteriorly; head long, somewhat depressed, its width at preopercular margin 1.55 to 2.3 in its length; the cheeks rounded; snout long, depressed, 2.95 to 3.6 in head; eye 4.75 to 7.8; interorbital 3.7 to 6.65; mouth large, oblique; lower jaw projecting; maxillary reaching middle of eye, 2.05 to 2.5 in head; teeth small, pointed, all depressable except the outer ones, in bands on jaws and on vomer; gill-rakers undeveloped; gill-arches with small, elevated patches of pointed teeth; lateral line wanting; scales small, ctenoid; origin of spinous dorsal about an eye's diameter behind base of pectorals, the spines weak and rather variable in length, but never reaching origin of soft dorsal when deflexed; origin of soft dorsal an eye's diameter in advance of origin of anal, the margin convex; caudal fin scaly at base, its margin rounded; anal fin similar to soft dorsal; ventral fins inserted slightly behind base of pectorals, rather short, not nearly reaching vent; pectoral fins reaching to or beyond tips of ventrals, 1.53 to 1.74 in head.

Color brownish. Young with a dark lateral band, becoming more obscure with age. Back and sides often with marbling of dark brown, and sometimes with dark bars. Fins all more or less reddish in life. The dorsals, caudal, and usually the pectorals and anal with rather large dusky spots, so arranged as to form cross-bars.

In the present collections there are 118 specimens, ranging from 40 to 359 mm. in length. It is most common in the brackish and fresh waters of the lowland streams, but stragglers occur in the upper courses of the Chagres and its tributaries. It usually inhabits shallow water where it lies quietly among the vegetation, presumably in wait for its prey. The alimentary canal is short, and without blind sacs. It feeds on crustaceans, fishes, water beetles and apparently any other aquatic animal life of suitable size. In Panama it is of little importance as a food fish.

Habitat: Atlantic coast streams, from Texas south to Brazil, and the West Indian Islands.

81. *Philypnus maculatus* (Günther).

Lembus maculatus Günther, Cat. Fish. Brit. Mus., I, 1859, 505 (Andes of Ecuador).

Philypnus lateralis Gill, Proc. Ac. Nat. Sci. Phila., 1860, 123 (Cape San Lucas); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2195 (Rio Presidio, Mazatlan).

Eleotris lateralis Günther, Cat. Fish. Brit. Mus., III, 1861, 122 (Cape San Lucas).

Eleotris lembus Günther, Cat. Fish. Brit. Mus., III, 1861, 121 (Western Ecuador).

Gobiomorus lateralis Eigenmann & Fordice, Proc. Ac. Nat. Sci. Phila., 1885, 69.

Gobiomorus maculatus Eigenmann & Fordice, Proc. Ac. Nat. Sci. Phila., 1885, 70.

Philypnus maculatus Regan, Biol. Cent. Amer., Pisces, 1906, 5; Meek, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1914, 130 (Pacific slope of Costa Rica).

Head 2.75 to 3.6; depth 4.25 to 5; D. VI-I, 9; A. I, 10 or rarely I, 11; scales 56 to 59.

Body elongate; not much deeper than wide anteriorly, compressed posteriorly; head long, somewhat depressed, its width at preopercular margin 1.73 to 2.2 in its length; cheeks nearly vertical; snout long, depressed, 2.86 to 3.4 in head; eye 4.35 to 7.25; interorbital 3.95 to 6; mouth large, oblique; lower jaw projecting; maxillary reaching middle of eye, 2.2 to 2.4 in head; teeth small, pointed, all depressable except the outer ones, in bands on jaws and on vomer; gill-rakers undeveloped; gill-arches with small, elevated patches of pointed teeth; lateral line wanting; scales a little larger than in preceding species, ctenoid; origin of spinous dorsal about an eye's diameter behind base of pectorals, the spines weak and variable in length, sometimes reaching origin of soft dorsal when deflexed; origin of soft dorsal an eye's diameter in advance of origin of anal, the rays variable in length, the margin convex; caudal fin scaly at base, its margin rounded; anal fin similar to soft dorsal; ventral fins inserted slightly behind base of pectorals, rather short, failing to reach vent; pectoral fins reaching to or past tips of ventrals, 1.4 to 1.84 in head.

Color brownish. Young with a dark lateral band or blotches along side, the blotches usually persisting. Fins with much red in life; the dorsals, caudal and usually the anal with dusky spots, which are, however, notably smaller and less distinct than in the preceding species; pectoral fins without spots or bars.

There are 425 specimens in the present collection, ranging from 40

to 290 mm. in length. This fish is abundant in all the lowland streams of the Pacific slope of Panama. In this region it is more abundant than its Atlantic congener. What is stated regarding the habits of the foregoing species applies equally as well to the present species.

This fish is closely related to its Atlantic slope congener, from which it can, however, be readily separated by the larger scales, by the constant presence of one more ray in the anal fin and by the smaller and less distinct dark spots on the vertical fins. The body is also slightly deeper anteriorly and the head is narrower.

Habitat: Pacific slope streams from Lower California south to Ecuador.

50. Genus *Dormitator* Gill.

Prochilus Cuvier, Règne Animal, Ed. 1, II, 1817, 294 (type *Sciæna macrolepidota* Bloch = *Sciæna maculata* Bloch). (Name preoccupied.)

Dormitator Gill, Proc. Ac. Nat. Sci. Phila., 1862, 240 (type *Eleotris gundlachi* Poey = *Sciæna maculata* Bloch).

Body elongate, compressed; head broad, flat above; interorbital broad; snout obtuse; mouth moderate, oblique; the jaws anteriorly of equal length; teeth in jaws small, in bands, with compressed tips, none on vomer; gill-openings extending forward to margin of preopercle; gill-rakers well developed, numerous, each arch bearing 2 series; scales present on entire body, upper surface of head, snout and on cheeks and opercles; dorsal fins 2, well separated, the first with 7 feeble spines; caudal fin rounded; ventral fins close together, but separate, with I, 5 rays. The vertical fins notably higher in males than in females. This genus, as here understood, consists of two closely related species, which, owing to a great deal of variation among individuals, can scarcely be separated.

KEY TO THE SPECIES.

- a. Snout short and very broad, its length 4 to 4.35 in head in specimens from 60 to 80 mm. in length; mouth very oblique, margin of upper jaw usually slightly above level of lower margin of eye; scales 31 to 35, usually 33, in lateral series, 8 to 11 longitudinal rows between anterior part of base of second dorsal and anal; ventral fins long, reaching to or past vent, 1.04 to 1.43 in head; pectoral fins reaching vertical from origin of anal, 1 to 1.23 in head. *maculatus*, p. 354.
- aa. Snout slightly longer and somewhat narrower, 3.85 to 4.2 in head in specimens 60 to 80 mm. in length; mouth somewhat less oblique, margin of upper jaw on or below level of lower margin of eye; scales 34 to 37, usually 35, in lateral series, 11 or 12 longitu-

dinal series between anterior part of base of second dorsal and anal; ventral fins rather short, failing to reach vent, 1.55 to 1.9 in head; pectorals scarcely reaching vertical from vent, 1.3 to 1.45 in head. *latifrons*, p. 355.

82. *Dormitator maculatus* (Bloch).

Sciæna maculata Bloch, Naturgesch. der Ausland. Fische, 1790, Pl. 299, fig. 2 (West Indies).

Eleotris mugiloides Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 226 (Martinique; Surinam).

?*Eleotris grandisquama* Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 229 (America, — locality unknown); Günther, Cat. Fish. Brit. Mus., III, 1861, 113.

Eleotris sima Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 232 (Vera Cruz).

Eleotris somnolentus Girard, Proc. Ac. Nat. Sci. Phila., 1858, 169 (near mouth of Rio Grande).

Eleotris omocyaneus Poey, Memorias, II, 1860, 269 (Havana).

Eleotris gundlachi Poey, Memorias, II, 1860, 272 (Cuba).

Eleotris maculata (in part) Günther, Cat. Fish. Brit. Mus., III, 1861, 112 (Trinidad; Demerara; Surinam):

Dormitator lineatus Gill, Proc. Ac. Nat. Sci. Phila., 1863, 271 (Savannah).

Dormitator gundlachi Poey, Synopsis, 1868, 396 (Cuba).

Dormitator omocyaneus Poey, Synopsis, 1868, 396 (Cuba).

Dormitator maculatus (in part) Jordan & Gilbert, Bull. U. S. Nat. Mus., XVI, 1883, 632; (in part) Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2196; Regan, Biol. Cent. Amer., Pisces, 1905, 8.

Head 2.95 to 3.55; depth 2.8 to 3.34; D. VII-I, 8 or rarely 9; A. I, 10 or rarely 11; scales 31 to 35.

Body rather robust, compressed; head flat above, its upper profile straight or slightly concave over eyes; snout very short and broad, its length 3.85 to 4.35 in head; eye lateral, 4.2 to 4.8; interorbital broad, 2.3 to 3.2; mouth broad, strongly oblique, margin of upper jaw slightly above level of lower margin of eye; jaws anteriorly of equal length; width of mouth at its posterior angles notably longer than snout; maxillary reaching vertical from anterior margin of eye, 2.95 to 3.4 in head; teeth all small, somewhat compressed at tips, in a band in each jaw; gill-membranes attached to the isthmus, the openings extending forward to margin of preopercle; gill-rakers well developed, a double series on each arch, about 45 in anterior series on lower limb of first arch; scales cycloid on upper surface of head, cheeks, chest and predorsal region, elsewhere ctenoid; snout and cheeks completely covered with scales,

usually 33 in a lateral series (average for 14 specimens 33); 8 to 11 rows between base of second dorsal and base of anal; origin of first dorsal midway between tip of snout and base of last ray of second dorsal, the spines weak, usually reaching to or past first ray of second dorsal; origin of second dorsal slightly in advance of origin of anal, the rays varying in length, the posterior ones the longest, often reaching base of caudal; caudal fin scaly at base, its margin strongly convex; anal fin similar to second dorsal; ventral fins rather long, reaching vent and sometimes to or past origin of anal, 1.04 to 1.43 in head; pectoral fins long, usually reaching vertical from origin of anal, 1 to 1.23 in head.

Color variable, usually very dark blue above, yellowish green bars below. Young with oblique, yellowish green bars on sides, and often with a more or less distinct dark lateral band. Sides of head with from 2 to 5 dark lines, these sometimes continued on body. Dorsals and sometimes the anal with dark spots forming bars; caudal fin dusky; distal half of anal usually rusty red, the margin white; ventrals and pectorals yellowish green.

There are at hand 179 specimens of this species, ranging in length from 35 to 115 mm. Our specimens are all from stagnant brackish ponds and streams.

Intestinal canal equal to about twice the length of body; air bladder thin, adnate to the back. Stomach contents, mud, algæ and other plant tissue.

Habitat: Atlantic coast and rivers from North Carolina to southern Brazil and the West Indies.

83. *Dormitator latifrons* (Richardson).

Eleotris latifrons Richardson, Voyage "Sulphur," Fishes, 1837, 57, Pl. 35, figs. 4 & 5 (probably from Pacific coast of Central America).

Eleotris maculata (in part) Günther, Cat. Fish. Brit. Mus., III, 1861, 112 (Guayaquil).

Dormitator micropthalmus Gill, Proc. Ac. Nat. Sci. Phila., 1863, 170 (Panama).

Eleotris maculata (non Bloch) Günther, Trans. Zool. Soc. London, VI, 1869, 440 (Huamuchal).

Dormitator maculatus (non Bloch) Jordan & Gilbert, Proc. U. S. Nat. Mus., IV, 1881, 232 (Cape St. Lucas); (in part) Jordan & Gilbert, Bull. U. S. Nat. Mus., XVI, 1883, 632; (in part) Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2196.

Dormitator latifrons Eigenmann & Fordice, Proc. Ac. Nat. Sci. Phila., 1885, 72 (Pacific coast of Central America); Regan, Biol. Cent. Amer., Pisces, 1905, 9.

Scarcely distinguishable from *D. maculatus*. Head 3 to 3.64; depth 2.86 to 3.7; D. VII-I, 8; A. I, 9; scales 34 to 37.

Body as in *D. maculatus*; the snout somewhat longer and narrower, comparing specimens of like size, 2.7 to 4.5 in head; mouth rather less oblique, the margin of upper jaw on or below level of lower margin of eye; width of mouth at its posterior angles not much longer than snout; maxillary scarcely reaching vertical from anterior margin of eye, 3.15 to 3.55 in head; gill-rakers apparently more numerous than in *D. maculatus*, about 70 to 90 in anterior series on lower limb of first arch; scales rather small, usually 35 in a lateral series (average for 14 specimens, 35.2+), 11 or 12 rows between base of second dorsal and base of anal; fins rather lower than in *D. maculatus*, ventrals failing to reach vent, 1.55 to 1.9 in head; pectorals scarcely reaching vertical from vent, 1.3 to 1.45 in head.

Of this species 71 specimens, ranging in length from 40 to 235 mm., were preserved. It was taken only in the lower courses of streams, seldom far above the head of tide. It was not taken in the Rio Tuyra Basin, but this is very probably due to the fact that little seining was done in the lower parts of this basin. In only one place, the Rio Abaco (a small stagnant, coastal stream), near Panama, was it taken in abundance.

Habitat: Pacific coast and rivers, from California to Ecuador.

51. Genus *Eleotris* Bloch & Schneider.

Eleotris Gronow, Zooph. Gronov., 1763, 83 (nonbinomial).

Eleotris Bloch & Schneider, Syst. Ichth., 1801, 65 (type *Gobius pisonis* Gmelin).

Body elongate, subcylindrical anteriorly, compressed posteriorly; head low, more or less depressed above, mostly covered with scales, which are usually more or less embedded; mouth rather large, oblique; lower jaw projecting; preopercle with a single concealed spine at its lower posterior angle; teeth small, in bands in the jaws, none on vomer; gill-opening not extending forward to under eyes; scales moderate or small; dorsal fins 2, well separated; caudal fin rounded; ventral fins separate.

KEY TO THE SPECIES.

- a. Scales small, 63 to 75 (most frequently 67 to 69) in lateral series, about 22 rows between base of second dorsal and base of anal; color bluish black above; no dark lines along rows of scales; ventral surface of head and body marbled or spotted with light and dark markings. *picta*, p. 357.

- aa. Scales somewhat larger, 59 to 68 (most frequently 64) in a lateral series, about 18 rows between base of second dorsal and base of anal; color brownish, paler below than above; rows of scales everywhere with dark lines; ventral surface of head and body uniform brownish. *pisonis*, p. 358.
- aaa. Scales rather large, 44 to 54 in a lateral series, about 12 rows between base of second dorsal and base of anal; color as in *E. pisonis*. *isthmensis* sp. nov., p. 359.

84. *Eleotris picta* Kner & Steindachner.

Eleotris picta Kner & Steindachner, Abhandl. K. Bayer. Ak. Wiss. München, X, 1864, 18, Pl. III, fig. 1 (Rio Bayano, Panama); Regan, Biol. Cent. Amer., Pisces, 1906, 8.

Culius æquidens Jordan & Gilbert, Proc. U. S. Nat. Mus., IV, 1881, 461 (Rio Presidio near Mazatlan).

Eleotris pictus Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2201.

Head 3 to 3.25; depth 4.45 to 5.55; D. VI-I, 8; A. I, 8; scales 63 to 75.

Body elongate, subcylindrical anteriorly, compressed posteriorly; head depressed above, the profile concave over eyes; snout rather short and broad, 3.56 to 4.95 in head; eye 5.55 to 8.85; interorbital 3.3 to 5.35; mouth large, oblique; the lower jaw projecting; maxillary not quite reaching posterior margin of eye in young, but reaching past this point in adults; cheeks with small, partly embedded scales, visible only in young; chin, cheeks and snout in young with lines of pores, forming a net work, these visible only in specimens of less than 100 mm. in length; a concealed preopercular spine, directed downward and slightly forward; teeth small, pointed, in bands; gill-rakers undeveloped; gill-membranes attached to the isthmus; scales very small (average in lateral series, for 27 specimens, 69-), about 22 longitudinal series between soft dorsal and anal, those on anterior part of body more or less embedded (in very large examples they are more or less embedded over the entire body); scales on sides posteriorly distinctly ctenoid, except in very large specimens, in which they become smoother; origin of first dorsal about midway between end of snout and tips of rays of second dorsal, the spines weak, the longest not much longer than snout; origin of second dorsal about an eye's diameter in advance of origin of anal, the margin of the fin convex; caudal fin with small scales on base, the margin strongly convex; anal fin similar to second dorsal; ventral fins rather small, inserted under base of pectorals; pectoral fins moderate, reaching well beyond the tips of the ventrals, 1.36 to 1.77 in head.

Color bluish black above, paler below; ventral surface of head and body marbled or spotted with light and dark markings. These markings become obscure in large examples (250 mm. and more in length). No dark lines along the rows of scales. Fins all with dark and pale markings, forming alternating dark and pale bars, these also become obscure and disappear in large individuals.

This species is represented by 56 specimens, ranging from 60 to 440 mm. in length. It is common, but not abundant, in the lowland streams on the Pacific coast of Panama eastward to the Rio Bayano, but it was not taken in the Rio Tuyra.

The alimentary canal is short, no pyloric cœca; air bladder thin, adnate to the back. One specimen, 370 mm. in length, had swallowed a fish (*Philypnus maculatus*) 210 mm. in length. The head of this morsel was at the vent and partly digested, and the tail was visible in the mouth.

This species is closely related to *E. pisonis*, from which it apparently differs only in the characters mentioned in the key.

Habitat: West coast and streams, from California to Panama and Ecuador.

85. *Eleotris pisonis* (Gmelin).

Gobius pisonis Gmelin, Linn. Syst. Nat., 1788, 1206 (based on *Eleotris capite plagioplateo* Gronow, Mus. Ichth., II, 1757, 168, which in turn was based on *Amore pixuma* Marcgrave & Piso, Hist. Brasil., IV, 1648, 166 (Brazil)).

Gobius amorea Walbaum, Artedi Piscium, III, 1792, 205 (based on *Eleotris capite plagioplateo* Gronow).

Eleotris pisonis Schneider, in Bloch's Syst. Ichthyol., 1801, 68; Eigenmann & Fordice, Proc. Ac. Nat. Sci. Phila., 1885, 75; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2200; Regan, Biol. Cent. Amer., Pisces, 1905, 7.

Eleotris gyrinus Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 220, Pl. 356 (Martinique; San Domingo; Surinam).

Culius perniger Cope, Proc. Am. Phil. Soc., 1870, 473 (Brazil).

Culius belizianus Sauvage, Bull. Soc. Philom. Paris, 1879, 55 (Belize; Cayenne).

Head 2.9 to 3.23; depth 4.12 to 6; D. VI-I, 8; A. I, 8; scales 59 to 68.

Body elongate, anteriorly subcylindrical, posteriorly compressed, a little deeper and somewhat more robust than in *E. picta*, this difference being most evident in a comparison of specimens of like size; head somewhat depressed above, the profile concave over eyes; snout broad, 3.85

to 4.85 in head; eye 5.13 to 6.4; interorbital 3.65 to 6; mouth rather large, oblique; the lower jaw projecting; maxillary scarcely reaching middle of eye in young, reaching past this point in adult, 2.44 to 3.25 in head; cheeks with partly embedded scales; chin, cheeks and snout with rows of pores, forming a net-work, these most distinct in young; a concealed preopercular spine, directed downward and forward; teeth small, pointed, in bands; gill-rakers undeveloped; gill-membranes attached to the isthmus; scales small (average in lateral series, for 16 specimens, 64+), about 18 longitudinal rows between base of second dorsal and anal, those on anterior part of body more or less embedded, but less so than in *E. picta*; scales on posterior part of body distinctly tenoid, those on anterior part of body and abdomen smooth; origin of first dorsal midway between end of snout and tips of rays of second dorsal, the spines short and weak, reaching second dorsal when deflexed; origin of second dorsal an eye's diameter in advance of origin of anal; caudal fin with small scales on base, its margin convex; anal fin similar to second dorsal; ventral fins rather small, inserted under base of pectorals; pectoral fins moderate, reaching well beyond tips of ventrals, 1.3 to 1.54 in head.

Color rusty brown above, pale brown below; rows of scales everywhere with dark lines. Dorsal fins and sometimes the caudal and anal also with dark and yellow spots or bars; pectoral and ventral fins yellowish green.

This species is represented by 16 specimens, ranging from 45 to 125 mm. in length. It was found in the lower courses of the Rio Chagres and its tributaries, small coastal streams at Porto Bello and in the upper courses of the Rio Trinidad. It is much less abundant and apparently reaches a smaller size in Panama than its Pacific coast congener. It was always found in strictly fresh water.

Habitat: Atlantic coast and rivers, from Florida to southern Brazil, and the West Indies.

86. *Eleotris isthmensis* sp. nov.

Type No. 8951, F. M. N. H.; length 85 mm.; Mindi, Canal Zone, Panama.

Head 2.85 to 3.25; depth 4.2 to 5.4; D. VI-I, 8; A. I, 8; scales 44 to 54.

Body elongate, anteriorly subcylindrical, posteriorly compressed; head somewhat depressed above, the profile slightly concave over eyes; snout broad, 4.1 to 5 in head; eye 4.22 to 5.8; interorbital 3.8 to 5.2; mouth rather large, oblique; the lower jaw projecting; maxillary reaching to or past middle of eye, 2.6 to 3.3 in head; cheeks with partly em-

bedded scales; chin, cheeks and snout with rows of pores, forming a net work, these most distinct in young; a concealed preopercular spine, directed downward and forward; teeth small, pointed, in bands; gill-rakers undeveloped; gill-membranes attached to isthmus; scales rather large (average in lateral series, for 25 specimens, 48—), about 12 longitudinal rows of scales between base of second dorsal and anal, all the scales ctenoid, except the small scales in advance of dorsal and on abdomen; origin of first dorsal midway between end of snout and tips of rays of second dorsal, the spines short and weak, reaching origin of second dorsal; origin of second dorsal an eye's diameter in advance of anal; caudal fin with small scales at base, its margin strongly convex; anal fin similar to second dorsal; ventral fins rather small, inserted under base of pectorals; pectoral fins rather long, reaching well beyond the tips of ventrals, 1.13 to 1.45 in head.

Color uniform brownish, somewhat paler below than above. Rows of scales with dark stripes; dorsal fins and caudal and sometimes the anal with light and dark spots or bars; ventrals and pectorals plain dusky brown.

We have 57 specimens of this species, ranging from 19 to 85 mm. in length. All are from the lowland streams, ditches and ponds on the Atlantic coast. A few of the specimens were taken in strictly fresh water, but the majority of them are from brackish and salt water.

This species differs from *E. pisonis* principally in the notably larger scales. We have designated as the type a specimen 85 mm. in length from Mindi, Canal Zone.

52. Genus *Guavina* Bleeker.

Guavina Bleeker, Esquisse d'un Syst. Nat. Gobioid., 1874, 302 (type *Eleotris guavina* Cuvier & Valenciennes).

This genus is related to *Eleotris*, from which it differs in the structure of the skull, the absence of the preopercular spine and in the very small scales, usually 100 or more in a lateral series.

87. *Guavina guavina* (Cuvier & Valenciennes).

Eleotris guavina Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 223 (Martinique); Günther, Cat. Fish. Brit. Mus., III, 1861, 124 (Demerara); Regan, Biol. Cent. Amer., Pisces, 1905, 7.

Guavina guavina Eigenmann & Fordice, Proc. Ac. Nat. Sci. Phila., 1885, 73; Jordan & Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, 483; Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2198.

Head 3.25 to 3.6; depth 4.65 to 5.5; D. VII-I, 10; A. I, 10; scales 95 to 115.

Body subcylindrical anteriorly, compressed posteriorly; head somewhat depressed, wider than deep, the upper profile slightly convex; snout blunt, 3.3 to 3.8 in head; eye small, 4.9 to 6.15; interorbital 2.7 to 3.33; mouth rather large, oblique; the lower jaw projecting; maxillary reaching a little past middle of eye, 2.22 to 2.35 in head; cheeks and most of head with scales; teeth small, pointed, in bands; gill-rakers little developed; gill-membranes attached to the isthmus; scales very small, those on anterior part of body and head and abdomen smooth, those on posterior part of body ctenoid; origin of first dorsal about midway between tip of snout and base of last ray of second dorsal, the spines rather short and weak, reaching nearly or quite to second dorsal; origin of second dorsal about an eye's diameter in advance of origin of anal, the posterior rays reaching nearly or quite to base of caudal; caudal fin short, with small scales at base, its margin rounded; anal fin similar to second dorsal; ventral fins rather small, inserted under base of pectorals; pectoral fins rather short, reaching but little past tips of ventrals, 1.3 to 1.7 in head.

Color bluish black above, brownish below. Fins in spirits dusky or black; the dorsals, anal and ventrals all with pale margin.

There are 5 specimens, ranging from 105 to 185 mm. in length, in the present collection. These were taken in brackish ditches and creeks at Colon and Toro Point.

Habitat: Atlantic coast and rivers from Mexico to Brazil and the West Indies.

53. *Leptophilypnus* gen. nov.

Type *Leptophilypnus fluviatilis* sp. nov.

Body shaped as in *Philypnus*. The head, chest and predorsal region naked; mouth large, oblique; eyes not wholly lateral; interorbital narrow; dentary bones meeting under posterior angle of mouth; leaving an oval-shaped naked area at chin; preopercular spine wanting; teeth all small, pointed, in broad bands in the jaws, none on vomer. Gill-opening extending forward nearly to vertical from posterior margin of eye. Readily distinguished from all other *Eleotridinæ* by the broad and expanded dentary bones. Carniverous.

88. *Leptophilypnus fluviatilis* sp. nov.

Type No. 8952, F. M. N. H.; length 46 mm.; Mindi, Canal Zone, Panama.

Head 3.06 to 3.4; depth 5.25 to 5.86; D. VI-I, 9; A. I, 9; scales 30 to 34.

Body elongate, anteriorly subcylindrical, posteriorly compressed; head as wide as deep, its width at preopercular margin 1.7 to 2 in its length, the upper profile straight or slightly convex; snout rather broad, 3.7 to 4.1 in head; eye moderate, partly superior, 4.15 to 5.86; interorbital narrow, 8.75 to 10; mouth large, oblique; the lower jaw strongly projecting; maxillary reaching to or past middle of eye, 2 to 2.5 in head; teeth all small, pointed, in a broad band in each jaw; gill-membranes rather narrowly connected with the isthmus, the opening extending forward to vertical from posterior margin of eye; scales rather large, thin, weakly ctenoid, none on head, chest or predorsal region, 7 or 8 rows between base of second dorsal and base of anal; origin of first dorsal about midway between tip of snout and base of last ray of second dorsal, the spines weak, the longest reaching opposite first or second ray of second dorsal when deflexed; origin of second dorsal slightly in advance of origin of anal, the rays rapidly increasing in length posteriorly, the longest reaching base of caudal in our largest examples, proportionately shorter in the smaller ones; caudal fin with only a few scales at base, the margin rounded; anal fin similar to second dorsal; ventral fins rather long, reaching nearly or quite to vent; pectoral fins reaching opposite origin of anal, 1.12 to 1.38 in head.

Color olivaceous; back and sides with dark points and blotches; 4 or 5 saddle-like bars on back; a series of elongate blotches on median line of side; caudal spot present. Dorsals and caudal with dark bars; anal fin dusky; other fins unmarked.

We have 40 specimens of this species, ranging from 38 to 64 mm. in length. These were all taken in a very muddy brackish creek at Mindi near the Atlantic coast of the Canal Zone.

The intestinal canal is short; the air bladder thin, adnate to the back. The ovaries in specimens (captured on Jan. 28, 1911) only 45 mm. in length are distended with well developed eggs, showing that individuals of this size are mature.

54. *Microeleotris* gen. nov.

Type *Microeleotris panamensis* sp. nov.

Body elongate, anteriorly depressed, caudal peduncle compressed; head low and broad; eyes superior; interorbital narrow; mouth large, oblique; lower jaw strongly projecting; gill-openings extending forward to vertical from posterior margin of eyes; no preopercular spine; teeth all small, pointed, in bands on the jaws, none on vomer; scales large, ctenoid, head, chest and part of abdomen naked; dorsal fins 2, well separated; caudal fin rounded; ventral fins separate, I, 5. Carnivorous.

KEY TO THE SPECIES.

- a. Scales in lateral series 33 to 36; second dorsal with I, 8 rays; anal I, 8. *panamensis* sp. nov., p. 363.
- aa. Scales in lateral series 30 to 32; second dorsal with I, 9 rays; anal I, 9. *mindii* sp. nov., p. 364.

89. *Microeleotris panamensis* sp. nov.

Type No. 8953, F. M. N. H.; length 50 mm.; Rio Juan Diaz, Panama.

Head 3.25 to 3.6; depth 4.75 to 5.5; D. VI-I, 8; A. I, 8; scales 33 to 36.

Body anteriorly depressed; caudal peduncle compressed; head depressed, notably wider than deep, its width at preopercular margin 1.25 to 1.42 in its length; the upper profile slightly convex; snout tapering, its length 3.4 to 4 in head; eye rather small, superior, 4 to 5.64; inter-orbital narrow, 5.5 to 7.25 in head; mouth rather large, oblique; the lower jaw strongly projecting; maxillary scarcely reaching middle of eye, 2.04 to 2.8 in head; teeth all small, pointed, in bands in the jaws; gill-membranes rather narrowly attached to the isthmus, the openings extending forward to vertical from posterior margin of eye; scales large, ctenoid, none on head, chest and abdomen, 7 or 8 rows between base of dorsal and base of anal; origin of first dorsal about midway between tip of snout and base of last ray of second dorsal, the spines short and weak, reaching second dorsal when deflexed; origin of second dorsal slightly in advance of origin of anal, the rays short; caudal fin not scaly at base, its margin evenly convex; anal fin similar to second dorsal; ventral fins short, failing to reach vent, inserted under base of pectorals; pectoral fins moderate, 1.18 to 1.4 in head.

Color grayish brown above, pale below. Body above and on sides spotted and marbled with dark markings; back sometimes with a few dark saddle-like bars; sides often with quadrate blotches; a more or less distinct caudal spot present. Dorsals, caudal, and usually the pectorals spotted and barred with dark markings; anal and ventrals pale or dusky.

This species is represented by 38 specimens, ranging from 30 to 58 mm. in length. These were taken in fresh water, not far above the head of tide, in the Rio Chorrera near Chorrera and in the Rio Juan Diaz at Juan Diaz on the Pacific slope.

The intestinal canal is short. The stomachs examined contained small molluscs, principally snails. The ovaries in two specimens, each about 45 mm. in length, taken on April 4, 1911, were distended with well developed eggs, showing that fish of this size are mature.

A specimen 50 mm. in length from the Rio Juan Diaz has been designated as the type.

Habitat: Pacific slope of Central Panama.

90. *Microleotris mindii* sp. nov.

Type No. 8954, F. M. N. H.; length 55 mm.; Mindi, Canal Zone, Panama.

Head 3.2 to 3.5; depth 4.83 to 6.68; D. VI-I, 9; A. I, 9; scales 30 to 32.

Body anteriorly depressed; caudal peduncle compressed; head low, wider than deep, the width at preopercular margin 1.45 to 1.75 in its length; snout broad, 3.25 to 4 in head; eye superior, 3.7 to 4.65; interorbital very narrow, 8.65 to 12; mouth rather large, oblique; lower jaw strongly projecting; maxillary scarcely reaching opposite middle of eye, 2.17 to 2.6 in head; teeth all small, pointed, in bands in the jaws; gill-membranes narrowly attached to the isthmus, the openings extending forward to nearly under posterior margin of eye; scales large, ctenoid; head, predorsal region, chest and median line of abdomen naked; 7 rows between base of second dorsal and base of anal; origin of first dorsal about midway between tip of snout and base of last ray of second dorsal, the spines weak, reaching second dorsal; origin of second dorsal a little in advance of origin of anal, the rays short; caudal fin without small scales on base, the margin rounded; anal fin similar to second dorsal; ventral fins short, failing to reach vent, inserted under base of pectorals; pectoral fins moderate, reaching past tips of ventrals, 1.13 to 1.5 in head.

Color olivaceous; the back with 4 dark saddle-like blotches; median line of sides with elongate dark blotches; a small caudal spot present. Dorsals and caudal with indistinct dark bars or spots; anal fin with more or less dusky, other fins unmarked.

We have 51 specimens of this species, ranging from 30 to 56 mm. in length. These were taken in a brackish creek at Mindi near the Atlantic coast of the Canal Zone.

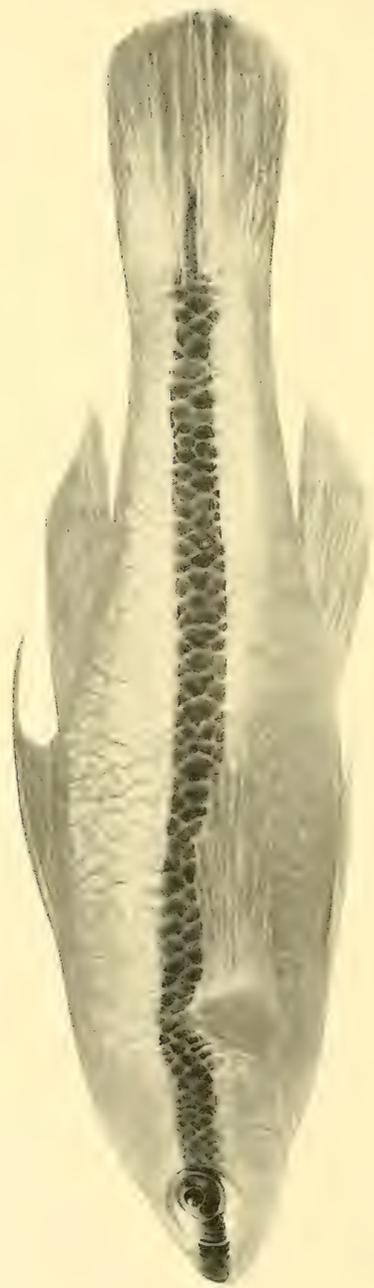
This species differs from *M. panamensis* in the somewhat less strongly depressed body, narrower interorbital, fewer scales in the lateral series, one more ray each in the second dorsal and anal, and in the lighter coloration.

A specimen 55 mm. in length has been designated as the type.

55. *Hemieleotris* gen. nov.

Type *Eleotris latifasciatus* Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1912, 68.

Body elongate, compressed; head compressed, not flat above, mostly covered with scales, the upper surface from eyes forward naked; mouth moderate, oblique; lower jaw projecting; no preopercular spine; teeth small, in bands on the jaws, none on vomer; gill-openings extending



HEMIELEOTRIS LATIFASCIATUS (Meek & Hildebrand)

From a specimen 78 mm. in length.

forward to posterior margin of eye; scales large, ctenoid, present on body and chest; dorsal fins 2, well separated; caudal fin rounded; ventral fins separate. Carniverous.

91. *Hemieleotris latifasciatus* (Meek & Hildebrand).

Eleotris latifasciatus Meek & Hildebrand, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1912, 68 (Rio Cardenas, Pacific slope, Panama); Meek, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1914, 131 (Jesus Maria, Costa Rica).

Head 3.4 to 4; depth 3.6 to 4.75; D. VI-I, 9; A. I, 10; scales 35 to 39.

Body compressed; head compressed, notably deeper than broad, not flat above, profile straight or slightly concave over eyes; snout tapering, 3.8 to 4.7 in head; eye rather large, 3.5 to 4.15; interorbital 3.9 to 5.2; mouth moderate, oblique; the lower jaw projecting; maxillary reaching to or slightly past anterior margin of eye, 3.25 to 3.9 in head; teeth small, pointed, in bands in the jaws; gill-rakers feebly developed; gill-membranes attached to the isthmus, the openings extending forward to under posterior margin of eye; scales large, ctenoid, 10 or 11 rows between base of second dorsal and base of anal; origin of first dorsal about midway between tip of snout and base of last ray of second dorsal, the spines weak, the anterior ones somewhat produced, reaching opposite the second or third ray of second dorsal; origin of second dorsal slightly in advance of origin of anal, or about midway between middle of eye and base of caudal; caudal fin with a few small scales at base, its margin rounded; anal fin similar to second dorsal; ventral fins long, reaching vent, inserted under base of pectorals; pectoral fins moderate, reaching tips of ventrals, 1.04 to 1.25 in head.

Color dark green above, paler below. Sides with a well defined, black band, extending from tip of snout through eye to and on base of caudal. Fins unmarked.

This species is represented by 11 specimens, ranging from 27 to 80 mm. in length. This fish was taken in fresh water streams on the Pacific slope from the Rio Chorrera to the Rio Bayano.

The air bladder is thin, adnate to the back; intestine very short; stomach without blind sacs.

Habitat: Pacific slope rivers, from Costa Rica to Panama.

56. Genus *Awaous* Steindachner.

Awaous Steindachner, Verh. Mat. Phys. Naturw., 1860, 289 (after Cuvier & Valenciennes, *les Awaous (ocularis, etc.)*).

Chonophorus Poey, *Memorias*, II, 1861, 274 (type *Chonophorus bucculentus* Poey = *Gobius taiasica* Lichtenstein).

Body elongate, anteriorly subcylindrical, posteriorly compressed; head rather low and broad; eyes placed high; mouth large, horizontal; upper jaw more or less projecting; the lips thickened; shoulder girdle with 2 or more dermal flaps, projecting into gill-cavity and covered by opercle; gill-openings rather small, scarcely produced forward; teeth pointed, in narrow bands in the jaws, none on vomer; scales small, mostly ctenoid; head and chest mostly naked; dorsal fins 2, well separated; caudal fin rounded; ventral fins completely united, forming a disc, free from the body. This genus is represented by 2 species in Panama, which are closely related, but differ somewhat in several characters.

KEY TO THE SPECIES.

- a. Scales very small, 69 to 76 in lateral series; about 20 rows between base of anterior rays of second dorsal and anal; mouth moderate, the maxillary failing to reach vertical from anterior margin of eye, about 2.7 in head in specimens 150 mm. in length; fins low, the spinous dorsal failing to reach origin of second dorsal when deflexed; sides with dark blotches, but without black cross-bars.
taiasica, p. 366.
- aa. Scales somewhat larger, 60 to 67 in lateral series, about 16 rows between base of anterior rays of second dorsal and anal; mouth large, the maxillary reaching vertical from anterior margin of eye, about 2.1 in head in specimens 150 mm. in length; fins high, the spinous dorsal usually reaching to or past origin of second dorsal when deflexed; sides with dark blotches and with narrow, black cross-bars.
transandeanus, p. 368.

92. *Awaous taiasica* (Lichtenstein).

Gobius taiasica Lichtenstein, *Berl. Abhandl.*, 1822, 273 (Brazil).

Gobius banana Cuvier & Valenciennes, *Hist. Nat. Poiss.*, XII, 1837, 103 (San Domingo); Günther, *Cat. Fish. Brit. Mus.*, III, 1861, 59.

Gobius martinicus Cuvier & Valenciennes, *Hist. Nat. Poiss.*, XII, 1837, 105 (Martinique).

Chonophorus bucculentus Poey, *Memorias*, II, 1861, 275 (Cuba).

Rhinogobius contractus Poey, *Memorias*, II, 1861, 424 (Cuba).

Rhinogobius bucculentus Poey, *Synopsis*, 1868, 394.

Gobius dolichocephalus Cope, *Trans. Amer. Philo. Soc. Phila.*, 1869, 403 (near Orizaba, Mexico).

Euctenogobius latus O'Shaughnessy, *Ann. & Mag. Nat. Hist.*, Ser. 4, XV, 1875, 146 (Bahia, Brazil).

Chonophorus taiasica (in part) Jordan & Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, 500; Meek, Field Mus. Nat. Hist. Pub., Zoöl. Ser., X, 1914, 131 (East slope of Costa Rica).

Chonophorus mexicanus Jordan & Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, 501 (Eastern slope of Mexico).

Awaous taiasica Jordan, Proc. Cal. Ac. Sci., 2d Ser., V, 1895, 494 (Presidio); (in part) Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2236.

Awaous mexicanus Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2237.

Chonophorus banana (in part) Regan, Biol. Cent. Amer., Pisces, 1905, 11.

Head 3.4 to 3.9; depth 4.75 to 5.55; D. VI-I, 10; A. I, 10; scales 69 to 76.

Body anteriorly subcylindrical, posteriorly compressed; head rather large, wider than deep; snout long, 2.04 to 2.6 in head; eye small, 5.25 to 7.5; interorbital 6.25 to 9.7; mouth large, horizontal; upper jaw projecting, the lip thickened; maxillary not quite reaching anterior margin of eye, 2.5 to 3 in head; teeth small, pointed, in a narrow band in each jaw; gill-openings rather small, the membranes broadly attached to isthmus; scales small, ctenoid, except the reduced scales on predorsal region and abdomen; about 20 rows of scales between anterior rays of second dorsal and anal; head and chest mostly naked; origin of first dorsal notably nearer snout than base of last ray of second dorsal, the spines short and weak, rarely reaching second dorsal; origin of second dorsal about midway between posterior margin of eye and base of caudal, the rays rather short; caudal fin scaly at base, the margin rounded; anal fin similar to second dorsal; ventral fins not much longer than snout; pectoral fins rather short, 1.3 to 1.73 in head.

Color yellowish green; back and sides spotted and mottled with dark brown; a series of dark blotches along side; sides of head usually with a few dark stripes. Dorsals, caudal and sometimes the pectorals with dark spots on the rays forming cross-bars; pectorals with a short black bar at base of upper rays, running downward and backward; anal and ventrals unmarked.

Of this species we have 48 specimens, ranging from 50 to 215 mm. in length. These were taken at various places in the Chagres Basin, but always in fresh water, most usually in the lower courses of the streams, but a few of them are from the Upper Chagres.

We have compared specimens from Guatemala and Costa Rica with our Panama material and find that the differences between the Pacific and Atlantic slope forms as set forth in the above key also are true for

these specimens. It is probable that all the Atlantic slope specimens from Mexico to Brazil belong to this species.

Habitat: Atlantic slope rivers, from Mexico south to Brazil, and the West Indies.

93. *Awaous transandeanus* (Günther).

Gobius transandeanus Günther, Cat. Fish. Brit. Mus., III, 1861, 62 (Western Ecuador).

Chonophorus taiasica (in part) Jordan & Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, 500.

Awaous taiasica (in part) Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2236.

Awaous nelsoni Evermann, Proc. Biol. Soc. Wash., XII, 1898, 3 (Sinaloa, Mexico); Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2235.

Gobius güntneri Regan, Ann. & Mag. Nat. Hist., Ser. 7, XII, 1903, 629 (Western Ecuador).

Chonophorus transandeanus Regan, Biol. Cent. Amer., Pisces, 1905, 12; Meek, Field Mus. Nat. Hist. Pub., Zool. Ser., X, 1914, 131 (West slope of Costa Rica).

Head 3 to 3.8; depth 5.1 to 5.9; D. VI-I, 10; A. I, 10; scales 60 to 67.

Body anteriorly subcylindrical, posteriorly compressed; head large; wider than deep; snout long, 2.1 to 2.5 in head; eye small, 5 to 6.9; inter-orbital 6.5 to 10; mouth large, horizontal; upper jaw projecting, the lips much thickened; maxillary reaching vertical from anterior margin of eye, 2 to 3.1 in head; teeth small, pointed, in a narrow band in each jaw; scales rather larger than in *A. taiasica*, about 16 rows between anterior rays of second dorsal and anal; head and chest mostly naked; origin of first dorsal slightly nearer tip of snout than base of last ray of second dorsal, the spines of moderate length, usually reaching to or more often past origin of second dorsal; origin of second dorsal a little in advance of anal, about midway between anterior margin of eye and base of caudal, the rays rather long; caudal fin scaly at base, its margin rounded; anal fin similar to second dorsal; ventral fins somewhat longer than snout; pectoral fins of moderate length, 1.38 to 1.8 in head.

Color yellowish green; back and sides with dark markings; a series of dark blotches along median line of side, at each blotch there is a narrow, black cross-bar; sides of head with dark bars. Dorsals, caudal and usually also the pectorals with dark spots on the rays, forming cross-bars; pectoral with a short black bar at base of upper rays, running backward and downward; anal and ventrals unmarked.

This species is represented by over 100 specimens, ranging from 33 to 200 mm. in length. Common in all the streams of the Pacific slope of Panama from the Rio Chame eastward to the Rio Tuyra, ranging from the head of tide to the upper courses of the streams.

This species differs slightly from the preceding in several respects. The principal differences are mentioned in the key. We have compared our specimens with specimens from the Pacific slope of Costa Rica and of Colombia and find them all to be identical. It is probable that all the Pacific slope specimens from Mexico to Ecuador belong to this species.

Habitat: West slope rivers from Mexico south to Western Ecuador.

57. Genus *Sicydium* Cuvier & Valenciennes.

Sicydium Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 1837, 167 (type *Gobius plumieri* Bloch).

Cotylopus Guichenot, in Maillard, Notes sur l'Isle de la Réunion, II, 1864, Addendum 9 (type *Cotylopus acutipinnis* Guichenot).

Sicya Jordan & Evermann, Report U. S. Fish Comm., 1896, 456 (type *Sicydium gymnogaster* Grant).

Body elongate, anteriorly subcylindrical, posteriorly compressed; head low, broad; eyes lateral, placed high; snout very blunt; mouth horizontal; upper jaw in advance of the lower; the lips thick; teeth in upper jaw in a single series, numerous, slender, curved inward, tricuspid, bicuspid, or simple; lower jaw with 2 series, the outer series nearly horizontal and partly or completely hidden in the gums, the second series pointed and nearly vertical, none on vomer; gill-opening vertical, not extended forward; body nearly or entirely covered with small ctenoid scales; dorsal fins 2, well separated; caudal fin rounded; ventral fins united, more or less attached to abdomen, forming a sucking disc. But one species of this genus was taken by us. *S. pittieri* Regan, recorded from Panama, was not seen.

94. *Sicydium salvini* Grant.

Sicydium salvini Grant, Proc. Zool. Soc. London, 1884, 159, Pl. XII, fig. 2 (Panama); Regan, Biol. Cent. Amer., Pisces, 1905, 10 (Panama; Western Ecuador).

Sicyopterus salvini Jordan & Eigenmann, Proc. U. S. Nat. Mus., IX, 1886, 485.

Cotylopus salvini Jordan & Evermann, Bull. U. S. Nat. Mus., XLVII, 1898, 2208.

Oreogobius rosenbergii Boulenger, Ann. & Mag. Nat. Hist., Ser. 7, IV, 1899, 126 (Western Ecuador).

Head 4.17 to 4.85; depth 4.85 to 5.75; D. VI-I, 10; A. I, 10; scales 70 to 86.

Body elongate, anteriorly subcylindrical, posteriorly compressed; head short, quadrate, as wide as deep; snout very short and blunt, anterior profile nearly vertical, its length 2.2 to 2.96 in head; eye small, lateral, placed high, 4.7 to 5.75; interorbital 3 to 4.3; mouth large, horizontal, inferior; the upper jaw notably in advance of the lower, the lip thickened; maxillary reaching to or past posterior margin of eye, 1.7 to 2.2 in head; teeth in upper jaw in a single series, very slender, recurved, somewhat compressed and grooved at apices, tricuspid in young, with nearly smooth cutting edge in adult; lower jaw with 2 series of teeth, the outer series nearly horizontal, directed forward, more or less exposed in young, but completely hidden in the gums in adult; second series composed of comparatively few, rather strong, vertical or slightly recurved, pointed teeth; gill-openings vertical, not extending forward; scales small mostly ctenoid, extending forward nearly to interorbital region; abdomen completely covered with scales; those on predorsal region and abdomen very small and partly embedded; origin of first dorsal about midway between posterior margin of eye and origin of second dorsal, the spines produced in adult males, sometimes reaching past middle of base of second dorsal; origin of second dorsal midway between posterior margin of eye and base of caudal or slightly nearer the latter, notably higher in adult males than in females; caudal fin scaly at base, the margin rounded; anal fin similar to second dorsal, but scarcely as high; ventral fins forming almost a perfect circular disc; pectoral fins broad at base, rounded, 1.05 to 1.4 in head.

Color dark green. Young with a dark lateral band, which later breaks up into more or less confluent spots; sides also with dark cross-bars, which are very indistinct in our largest specimens; back in young with dark reticulations; scales usually with roundish spots which are largest and most distinct on caudal peduncle. Dorsal fins spotted or not; anal fin with a dark stripe near its margin.

We have 8 specimens of this species, ranging from 55 to 100 mm. in length. One of these was taken at Paraiso, on the Pacific slope, in a small tributary of the Rio Grande, and the others are from various places in the Chagres Basin. We are unable to separate the Pacific slope specimen from those of the Rio Chagres. Our specimens were all taken in upland streams where the species inhabits the rocky rapids. By means of its ventral sucking disc, it is able to cling closely to the rocks and is extremely difficult to capture. It is therefore quite certainly not as rare as the small number captures would indicate.

Habitat: Both slopes of Panama and Western Ecuador.

GLOSSARY OF TECHNICAL TERMS.

- Abdomen. The belly; the cavity containing the digestive and reproductive organs.
- Adipose fin. A peculiar, fleshy fin without rays but occasionally with a spine, occurring on the back behind the dorsal fin of most cat fishes, characins, etc.
- Air-bladder. A sac filled with air, lying beneath the backbone and in or behind the abdominal cavity; also known as swim-bladder.
- Anal. Pertaining to the anus or vent.
- Anal fin. The fin on the median line behind the vent.
- Antrorse. Turned forward.
- Anus. The external opening of the intestine; the vent.
- Articulate. Jointed; said of soft fin rays.
- Azygous. Occurring singly; not paired.
- Barbels. An elongate fleshy projection, usually about the head; also called whiskers, present in most cat fishes.
- Bicuspid. Having two points.
- Branchiæ. The gills.
- Branchiostegals. Slender bones forming the support for the branchiostegal membranes lying under the head and below the opercular bones.
- Canines. Long conical teeth.
- Carinate. Keeled; having a single ridge along median line.
- Caudal. Pertaining to the tail.
- Caudal fin. The fin on the tail.
- Caudal peduncle. The region between the anal and caudal fins.
- Cirri. Fringes.
- Cœcum. An appendage of the form of a blind sac connected with the posterior end of the stomach, or pylorus.
- Compressed. Flattened from side to side.
- Ctenoid. Rough-edged; said of scales when the posterior margin is spinous or pectinate.
- Cycloid. Smooth-edged; said of scales when the posterior margin is not rough; scales showing concentric lines or striations.
- Deciduous. Falling away or out.
- Decurved. Curved downward.
- Dentary. The principal or anterior bone of the lower jaw or mandible.
- Depressed. Flattened vertically.

- Distal. Remote from the point of attachment.
- Dorsal. Pertaining to the back.
- Dorsal fin. The fin on the median line of back.
- Emarginate. Slightly notched at the end.
- Falcate. Scythe-shaped; long, narrow and curved.
- Fauna. The animals inhabiting any one region, taken collectively.
- Filament. Any slender or thread-like structure.
- Filiform. Thread form.
- Fontanel. An opening between the bones of the skull.
- Foramen. A hole or opening.
- Frontal bone. Anterior bone on top of head, usually paired.
- Fusiform. Spindle shaped; tapering toward both ends.
- Gape. Opening of the mouth.
- Gill-arches. The bony arches to which the gills are attached.
- Gill-openings. Openings reaching to or from the gills.
- Gill-rakers. A series of bony projections placed along the inner edge of the gill arch.
- Gills. Organs for breathing the air contained in water.
- Hæmal spine. The lowermost projection of a caudal vertebra.
- Incisors. Cutting teeth, usually in front of jaws.
- Interorbital. Space between the orbits or eyes.
- Isthmus. The region between the lower part of the gill-openings.
- Keeled. Having a ridge along the median line.
- Lamellæ. A thin plate, layer or process.
- Larva. The immature form.
- Lateral. Referring to the side.
- Lateral line. A series of mucus pores along the side of the fish and containing sense organs.
- Mandible. The lower jaw.
- Marbled. Variegated; clouded.
- Maxillaries. The outermost bones of the upper jaw, joined to the premaxillaries in front, and usually extending farther back than the latter.
- Nape. The back of the neck.
- Nares. Nostrils.
- Nasal. Pertaining to the nostrils.
- Nuchal. Referring to the nape.
- Obsolete. Poorly developed; scarcely evident.
- Obtuse. Blunt.
- Occipital. Relating to the occiput.
- Occiput. The back of the head.
- Ocellated. Having an ocellus or ocelli.

- Ocellus. An eye-like spot; a dark spot with a lighter border.
- Opercle. The thin flat bone on sides of head covering the gills; also called gill-covers.
- Orbit. Eye socket.
- Osseous. Bony.
- Oviparous. Reproducing by means of eggs laid and hatched outside of the body.
- Ovum (plural ovi). Egg.
- Palate. The roof of the mouth.
- Palatines. Bones of the roof of the mouth, one on each side of the vomer, often provided with teeth.
- Papilla. A small fleshy projection.
- Papillose. Covered with papillæ.
- Parietal. Bone of the side of the head.
- Pectinate. Having teeth like a comb.
- Pectoral. Pertaining to the breast.
- Pectoral fins. The anterior or uppermost paired fins, corresponding to the anterior limbs of the higher vertebrates.
- Peritoneum. The membrane lining the abdominal cavity.
- Pharyngeal bones. Bones behind the gills and at the beginning of the œsophagus, usually provided with teeth.
- Plicate. Folded; showing folds or wrinkles.
- Plumbeous. Lead colored; dull bluish gray.
- Postorbital. Behind the eye.
- Premaxillaries. The bones, one on each side, forming the front of the upper jaw, usually bearing most of the upper teeth.
- Preopercle. A thin bone lying just in front of the opercle.
- Preorbital. The bone lying just in front of the eyes.
- Protractile. Capable of being drawn forward.
- Pseudobranchiæ. Small gills developed on the inner side of the opercle.
- Punctate. Dotted with fine points.
- Ray. One of the bony or cartilaginous supports of a fin. Rays are either spiny or soft, the latter are either simple or branched.
- Recurved. Turned backward or toward the point of origin.
- Reticulate. Marked with a net work of lines.
- Retrorse. Turned backward.
- Rudimentary. Undeveloped.
- Rugose. Rough, wrinkled.
- Scute. An external horny or bony plate.
- Serrate. Notched like the edge of a saw.
- Setiform. Having the form of a bristle.
- Snout. That portion of the head which projects beyond the eyes.

- Spinous. Stiff or composed of spines.
- Striate. Striped or streaked.
- Suborbital. The bone immediately below the eye.
- Supraoccipital. The bone at posterior part of skull.
- Suture. The line of union of two bones, as in the skull.
- Symphysis. The tip of chin; point of juncture of the two bones of lower jaw.
- Synonym. A different word having the same meaning; a technical name given to a fish already described is said to be a synonym.
- Synonymy. A list of technical names applied to a certain genus or species.
- Tail. In ichthyology the part posterior to the anal fin.
- Temporal. Referring to the region of the temples.
- Terete. Cylindrical or tapering.
- Thoracic. Pertaining to the thorax; said of the ventral fins when attached beneath the pectorals.
- Trenchant. Compressed to a sharp edge.
- Truncate. With a square or straight margin.
- Tubercle. A small projection, like a pimple.
- Type. The particular specimen upon which the original description of the species was based or the species upon which was based the genus to which it belongs.
- Type locality. The particular place or locality at which the type was collected.
- Vent. The posterior opening of the alimentary canal.
- Ventral. Relating to the abdomen.
- Ventral fins. The paired fins behind, in front of or below the pectoral fins, corresponding to the hind limbs in the higher vertebrates.
- Ventral plates. The plates lying on the belly.
- Vertical fins. The fins on the median line of the body; the dorsal, caudal and anal fins.
- Villiform. Slender, minute teeth crowded into compact patches or bands.
- Viviparous. Bringing forth living young.
- Vomer. A bone in the center of the roof of the mouth, just behind the premaxillaries, often bearing teeth.

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