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THE
FRESH-WATER FISHES
OF
MEXICO NORTH OF THE
ISTHMUS OF TEHUANTEPEC

BY

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PREFACE.

The following paper is based largely on two collections of fishes, the first being made by the writer and Mr. F. E. Lutz, of the Carnegie Station for Experimental Evolution, Cold Spring Harbor, in the spring of 1901, and the other by the writer during February, March, April, and May, 1903. Through the courtesy of Dr. Barton W. Evermann, assistant in charge of Scientific Inquiry, United States Bureau of Fisheries, I have had at my disposal two small collections made by Mr. E. W. Nelson, one from the Rio Balsas and the other from the Rio Soto la Marina. Dr. W. L. Tower, of the University of Chicago, also placed at my disposal a collection of fishes made by him at Rio Verde, San Luis Potosi. In January, 1903, in Washington, D. C., Dr. Richard Rathbun, Assistant Secretary of the Smithsonian Institution, and Mr. B. A. Bean, Assistant Curator of fishes U. S. National Museum, permitted me to examine a large collection which formed a portion of the Mexican fish exhibit at the Columbian Exposition. I have included only a small portion of this collection in the following list because of the doubtful character of the localities given. To have included the entire collection would have very much confused our study of geographical distribution.

An account of the collection made by Mr. F. E. Lutz and myself is published in Vol. III. of the Zoölogical Series of the Field Columbian Museum, Pub. 65, pages 63 to 128, plates 14 to 31. The results of the second expedition are (1903) included in this paper.

For assistance while making the collection of fishes in 1903, I wish, on behalf of the Museum, to acknowledge my indebtedness to the following gentlemen: Mr. C. R. Hudson and Mr. A. V. Temple, of the Mexican Central R. R.; Mr. D. W. Harvey, of the Mexican R. R.; Mr. R. B. Pegram, Mr. F. M. Ames, and Mr. A. Joy, of the Vera Cruz & Pacific R. R.; Mr. W. B. Ryan and Mr. Newbury, of the Tehuantepec R. R.; Mr. W. L. Morkil and Mr. E. A. White, of the Interoceanic R. R.; Mr. James Parkyn, Treasurer of the Motzorongo Plantation; Gaham & Hudson, Forlon, Tamaulipas; Mr. D. W. Hedrick, Superintendent of the Midland Bridge Company; Mr. P. H. Kilpatrick, a contractor on the Vera Cruz and Pacific R. R.; Mr. George Greenwood, Superintendent of the Jalapa Electric Light Company; Mr. R. G. Ransom, of the Westinghouse Air Brake Company; and the officials of the Atchison, Topeka & Santa Fe R. R. I would especially mention Mr. E. A. White for the personal interest he took in this work,

and for his many courtesies which resulted in considerable substantial aid. I would also mention Mr. D. W. Hedrick, who was superintending the construction of the bridges along the Vera Cruz & Pacific R. R. Mr. Hedrick gave me the freedom of the bridge camps, which proved to be excellent stopping places in that country. The superintendents of these camps were very helpful to me in my work while there. At Perez I met Mr. Julius Freisser, formerly a taxidermist in Chicago, who assisted me in making collections of fishes at Perez, Obispo, and El Hule. In general the railroad and other employees of the organizations mentioned above were very courteous and helpful to me in my work.

Dr. Barton W. Evermann and Mr. Barton A. Bean have assisted me in examining material in the U. S. National Museum. Dr. G. A. Boulenger and Mr. C. T. Regan have done the same in the British Museum, Dr. D. S. Jordan in Stanford University, and Mr. Henry W. Fowler in the Academy of Natural Sciences, Philadelphia. Dr. Theo. Gill, Washington, D. C., has kindly called my attention to a few important references which I would have otherwise omitted. Hon. Geo. M. Bowers, United States Commissioner of Fish and Fisheries, kindly loaned the Museum thirty-one original drawings of fishes for use in illustrating this work. Four other drawings were kindly loaned by Dr. Richard Rathbun. To Dr. Evermann I am under obligations for superintending the making of blocks from these drawings, and also for reading the proof sheets while this work was going through the press. Dr. Wm. Owen, of the University of Chicago, and Prof. H. N. Hoffman, of Indiana University, also rendered me valuable service in correcting the misspelled names of Rafinesque and others. Dr. Frederick Starr, of the University of Chicago, has also kindly revised the proof sheets of this paper with regard to the spelling of geographical names. I also desire to acknowledge the many courtesies I received from Hon. Powell Clayton, U. S. Minister to Mexico, while doing field work in Mexico in 1901 and 1903. In making these acknowledgments I wish to assume responsibility for whatever errors this volume may contain.

In the present paper it has been my purpose to give a descriptive list of the fresh-water fishes of Mexico, and keys to assist in identifying the same. It is impossible to draw an arbitrary line separating the fresh-water fishes from those of the salt water. A few of the species of *Pomadasys*, *Achirus*, *Gobius*, and the like, included in this work, are properly salt-water fishes. I have listed them here rather as fishes found in fresh water.

In the preparation of this publication I have examined every paper to which I have had reference and access that throws light on

the subject in question, and I have drawn from these material suited to my purpose. In the sequence of the orders and families I have followed Jordan and Evermann in Bull. 47, U. S. Nat. Mus. The sequence of genera and species has been changed whenever, in the light of new information, it appeared necessary. I have also made free use of the publication above mentioned for material in the characterization of orders and families. A special effort has been made to bring together, in as useful a form as possible, our present knowledge of the fresh-water fishes of Mexico north of the Isthmus of Tehuantepec. The study of this group of animals in this region is of especial interest, for between these two lines is the meeting place of the northern and the tropical faunas. In this respect these boundary lines are in a measure natural ones, because very few species of tropical fishes reach the northern line, and but few northern representatives are found farther south than the Isthmus of Tehuantepec. In addition the subject presents very interesting material for a study in geographical distribution.

ERRATA.

- Page v, line 33, Gaham should read Graham.
Page xviii, line 9, Steindachner should read Poey.
Page xix, line 5, Steindachmer should read Steindachner.
Page xix, line 6, *Salmonoides* should read *solmonoides*.
Page xxxi, line 49, **Cousius** should read **Couesius**.
Page xxxiii, line 14, CARMAN should read CARMEN.
Page xxxix, line 20, **macularis** should read **macularius**.
Page lii, line 15, Gruelin should read Gmelin.
Page lviii, line 34, after ORDERS into, insert FAMILIES, FAMILIES into.
Page 65, line 28, after 1896 insert , 264.
Page 139, 5th line from bottom, 1 $\frac{2}{3}$ should read 1 $\frac{3}{4}$.
Page 147, line 27, *formosus* should read *formosa*.
Page 162, line 25, *Sygnathus* should read *Syngnathus*.
Page 169, bottom line, after 1900 insert , 152.
Page 193, line 26, elder should read older.
Page 196, line 12, **Ethostomatinae** should read **Etheostomatinae**.
Page 206, line 30, D. XVI should read dorsal spines 16.
Page 216, line 12, after depth insert of caudal peduncle.

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INTRODUCTION.

GENERAL TOPOGRAPHY AND HYDROGRAPHY OF MEXICO.

The greater portion of Mexico is a plateau ranging in elevation from 3,000 to 8,000 feet above the sea. The northern portion is the lower, and the slope to the northeast, especially of that portion drained by the Rio Grande and its tributaries, is more gentle than of any other portion. The eastern border of this plateau is formed by the eastern range of the Sierra Madre Mountains, leaving to the east a plain varying in width from about 150 miles east of Monterey to less than 50 miles west of Tampico and Vera Cruz. This plain north of Tampico is chiefly drained by three rivers: the Rio Conchas and the Rio Soto la Marina, which flow into the Gulf; and the Rio Forlon, a tributary of the Rio Panuco. None of these streams drain any portion of the central plateau. Two of the tributaries of the Rio Panuco, the Rio San Juan and the Rio Tula, have their origin on the central plateau, and reach the main river through a gap in the mountains by a series of cascades and falls. South of Tampico this narrow plain is drained by a number of small streams which are wholly confined to the eastern slope. South of Vera Cruz and in the southern portion of the State of Oaxaca this eastern range of the Sierra Madre meets the southern range, the Sierra Madre del Sur, the two forming the low water shed of the Isthmus of Tehuantepec. The northern portion of this Isthmus is drained by the Rio Coatzacoalcos. Between this river and the City of Vera Cruz is a rather broad, low plain on which from 10 to 15 feet of rain falls each year. This plain is mostly drained by the Rio Papaloapam and its tributaries, the Rio Tonto, the Rio Quiotepec, the Rio Tesechoacan, and the Rio San Juan Evangelista. Owing to the great rainfall in this region, these rivers are very large as compared with the area they drain. The Sierra Madre del Sur extends parallel to the coast as far as Colima, where it becomes the western range of the Sierra Madre. Between the Sierra Madre del Sur and the zone of recent volcanoes which extends west of Puebla and forms the watershed between the Rio Balsas and the Rio Lerma is a considerable plateau drained by the Rio Balsas, the second largest river in Mexico, which flows into the Pacific Ocean. North of the Rio Balsas basin the central plateau is drained by the Rio Lerma, which, after it leaves Lago de Chapala, is known as the Rio Grande de Santiago, the two forming the longest river wholly within the republic. The Rio Santiago reaches the sea by a series of cascades and falls.

The Valley of Mexico is an independent drainage basin, though judging from the nature of its fish fauna, at some previous time its waters probably flowed into the Rio Lerma. The northern limit of the basin of the Rio Lerma is at Zacatecas.

A glance at any map of Mexico reveals the fact that the largest western rivers north of the Rio Grande de Santiago rise to the east of the central range of the Sierra Madre Mountains, or in the western portion of the Central plateau. The western Sierra is exceedingly rough and its western slope very steep. To such an extent is this the case that of the seven railroads which have western terminals not one has yet reached the Pacific coast.

The rainfall in Mexico is variable, the greatest precipitation being in the State of Vera Cruz. On the Isthmus of Tehuantepec the rains begin about the first of May, and continue into December, though there are occasional rains until about the first of February. In the neighborhood of the City of Mexico and the Lerma Valley the rains begin the first of May and continue until about the first of November; between Tampico and Monterey they begin about the last of May and continue until October. In northern Mexico, in the State of Chihuahua, the rainy season commences the last of June and ceases in September. The rainfall in southern Mexico is much more abundant than in the northern part. Where the wet season is much longer than the dry season the larger rivers contain a good supply of water during the entire year. In the height of the wet season many of them overflow, forming, in depressions, shallow lakes, bayous, and ponds; these later become dry, causing the destruction of a great many fishes. The same conditions hold in the dryer portions, but here many of the streams also become partially dry. On the plateau the water in the dry season in many streams is confined to a portion of the upper part of its course, and such streams usually contain a small number of species of fishes. During the wet season many of the isolated streams in northern Mexico form at their mouths lakes of considerable size, such as Lago de Guzman at the mouth of the Rio Casas Grandes, Lago de Patos at the mouth of the Rio Carmen, etc., etc. From the upper part of these river courses the lakes into which they flow become stocked with fishes. There is considerable alkali in the beds of these lakes which the water takes up in solution. As the dry season comes on the lakes gradually become smaller and the water in them more alkaline. When each lake is reduced to about three-fourths of its original size the water becomes so charged with alkali that the fishes die in great numbers. During the latter part of the dry season there is very little water in the Rio Casas Grandes below Terrasas, more than half of its bed being dry. What is true

of this river is also true of many other rivers in the dryer portions of Mexico, and especially so of those streams whose waters never reach the sea.

RECENT GEOLOGICAL CHANGES IN MEXICO AND THEIR GENERAL EFFECT ON THE FISH FAUNA.

Geologically speaking, within more recent times the climatic and hydrographic conditions of Mexico have been less stable than in the Mississippi Valley. The central portion of Mexico has been subject to considerable volcanic disturbances which have continued to within recent times. The northern portion has evidently at some former time been much better watered than it is now. Such streams as the Rio Casas Grandes, Rio Santa Maria, Rio Carmen, the Rio Nazas, and many others in this region whose waters never reach the sea were, perhaps, formerly tributaries of the Rio Grande. This supposition is based on the character of their fish faunas and the general topography of the country. Dr. O. C. Farrington, of the Department of Geology of this Museum, suggests that the reduced size of these streams is due largely to the fact that most of the mountain drainage of this part of Mexico is now to the west; and that the portions of the western rivers which are east of the Sierra Madre Mountains were formerly the upper tributaries of the streams which flow to the east. According to this view the western streams have cut their way back, captured the head-waters of the eastern streams, and with them their portion of the eastern fish fauna. Mr. A. V. Temple, who has traveled extensively over this region for the past thirty-five years, informs me that there is much less water in this portion of Mexico now than when he first visited it. Many lakes have become entirely dry, though occasionally one, as La Laguna in Chihuahua, which has been dry for years, may be partially filled by a heavy rain. When the Mexican Central Railroad built its line from El Paso to the City of Mexico it was extended across the dry bed of this lake. About seven years ago a heavy rain submerged this portion of the track and delayed traffic until the road could lay its present line some distance to one side of the lake. Since then, La Laguna has gradually become smaller and is likely soon to return to a dry basin again. Disturbances of the kind noted above have their influence on the aquatic life of the country. Any change in environment means that animals affected by it must change physically to meet the new conditions; those that are unable to change to suit these conditions sooner or later disappear, while new varieties, and, if the time is long enough, new species, come into existence.

Thus, in a measure at least, species of fishes in Mexico are undergoing changes, and the process of making species or varieties is still actively in progress. There is in general more individual variation in species of Mexican fresh-water fishes than among the species which inhabit the Mississippi Valley. To define properly the species and subspecies of fishes in the country in question a much more extended study of each is necessary, and for this reason I have not recognized any subspecies in the present paper.

A few species, as *Hybognathus episcopus* (Girard), have a wide distribution, besides this they range from near sea level to an altitude of 6,000 or 7,000 feet. If in this case we recognize any subspecies at all, we must recognize one for each important stream in which the species occurs. In such cases I have recognized one species and noted the important, though slight, differences in the specimens from the various localities from which I have material. For examples of extreme individual variation of color markings, I would refer to *Platyæcilus maculatus* Günther, and *Platyæcilus variatus* Meek. The student of Mexican fresh-water fishes must be constantly on the outlook for these variations. In defining species it is certainly better to rely on structural differences rather than on differences in color. On many of the tropical fishes, especially in the streams of the lower lands, there are black blotches which appear more like stains than markings. These are not at all definite in outline, or in position; some may be large, others small, and their position without regularity. An example of this kind is seen in *Xiphophorus helleri* Günther, of which a variety noted by Dr. A. Günther, because of these black blotches, was later for the same reason regarded as a distinct species* by Jordan & Evermann. Many of the *Pæciliidæ* have these blotches, although they are not uncommon in other species. Unless an apparently new species is very different from its nearest relative, it is quite as well not to describe it as new unless a large amount of material is at hand for comparison. I am not certain that I have properly followed this rule myself, still a careful examination of my material will, I believe, show that I have not materially departed from it.

LIST OF LOCALITIES IN MEXICO WHERE COLLECTIONS OF FISHES WERE MADE IN 1901 BY MR. F. E. LUTZ AND THE AUTHOR.

Colonia Juarez, Chihuahua; Rio Casas Grandes, June 26.

Guzman, Chihuahua; spring near railroad station, June 25.

Santa Maria, Chihuahua; springs and ponds near clubhouse, June 24.

San Jose, Chihuahua; spring at San Jose ranch, June 21.

**Xiphophorus guntheri* Jordan & Evermann.

Ahumada, Chihuahua; a large irrigating ditch, June 22.
 Chihuahua, Chihuahua; Rio Chihuahua, June 19.
 Santa Rosalia, Chihuahua; Rio Noavaco, June 10.
 Jimenez, Chihuahua; Rio Conchos, June 9.
 San Andres, Chihuahua; Rio Santa Cruz, June 17, 18.
 Bustillos, Chihuahua; Lago de Castillo, the lake was dry except a few small holes,
 June 14.
 Minaca, Chihuahua; Rio Paphigochic, June 16, 17.
 Aguas Calientes, Aguas Calientes; Rio Verde, June 7.
 Lagos, Jalisco; tributary of the Rio Verde, and small lake near the city, June 6.
 La Barca, Jalisco; Rio Lerma, June 5.
 Ocotlan, Jalisco; Rio Grande de Santiago and a few bayous, June 2 and 3.
 Celaya, Guanajuato; small stream tributary to the Rio Lerma, May 28.
 Acambaro, Guanajuato; Rio Lerma, May 27.
 La Palma, Michoacan; Lago de Chalco, May 30, 31.
 Huingo, Michoacan; Lago de Cuitzeo, May 26.
 Patzcuaro, Michoacan; Lago de Patzcuaro, May 18 to 22.
 Zirahuen, Michoacan; Lago de Zirahuen, May 24.
 San Juan del Rio, Queretaro; Rio San Juan, May 16.
 Chalco, Mexico; Lago de Chalco, April 30, May 1.
 Texcoco, Mexico; Lago de Texcoco, May 13.
 Puente de Ixtla, Morelos; Rio Ixtla, April 24 to 26.
 Balsas, Guerrero; Rio Balsas and Rio Cocula, April 22 and 23.
 Venta Salada, Puebla; Rio Tehuacan, May 6, 1901.
 Cuicatlan, Oaxaca; Rio Quiotepec, May 5, 1901.
 Oaxaca, Oaxaca; Rio Verde, May 4, 1901.
 Jalapa, Vera Cruz; Rio Sordo, May 9.
 La Antigua, Vera Cruz; Rio San Francisco, May 10.

LIST OF LOCALITIES IN MEXICO WHERE COLLECTIONS OF FISHES WERE MADE BY THE AUTHOR IN 1903.

Sauz, Chihuahua; Rio Sauz, May 29.
 Lerdo, Durango; Rio Nazas, May 21.
 Santiago Papasquiario, Durango; Rio Nazas, May 25.
 Labor, Durango; a small spring brook with no outlet from the sea; a small collection received in June from Mr. H. Douglas, conductor on International Railroad.
 Durango, Durango; Rio Mezquital, and a spring near the city, May 23.
 Monterey, Nuevo Leon; Spring in the city, May 20.
 San Juan, Nuevo Leon; Rio San Juan, May 19.
 Montemorelos, Nuevo Leon; Rio Pilon, May 18.
 Linares, Nuevo Leon; Rio Camacho, May 16.
 Linares, Nuevo Leon; Rio Pabillo, May 17.
 Garza Valdez, Tamaulipas; Rio Pilon, May 15.
 La Cruz, Tamaulipas; Rio de Purification, May 13.
 Santa Engracia, Tamaulipas; Rio de Santa Engracia, May 12.
 Victoria, Tamaulipas; Rio de San Marcos, May 11.
 Forlon, Tamaulipas; Rio Forlon, May 9.
 Valles, San Luis Potosi; Rio Valles, May 7.
 Rascon, San Luis Potosi; Tributary of the Rio Valles, May 6.

Rio Verde, San Luis Potosi; Rio Verde, collection made by W. L. Tower, August.

Lerma, Mexico; Rio Lerma, March 17 and 18.

City of Mexico, Mexico; Viga canal, March 20.

Chalco, Mexico; Canals, April 19.

Cuautla, Morelos; Rio Cuautla, March 25.

Yautepec, Morelos; Rio Yautepec, March 27.

Jojutla, Morelos; Rio Apatlaco, March 28.

Puebla, Puebla; Rio Atoyac; April 4 and 18.

Atlixco, Puebla; tributary of the Rio Atoyac, April 1.

Matamoras, Puebla; Rio Atila, April 2.

Chietla, Puebla; Rio Coetzala, April 3.

Jalapa, Vera Cruz; Rio Sordo, March 13.

Xico, Vera Cruz; Rio Texcolo, March 12.

San Francisco, Vera Cruz; Rio San Francisco, March 10.

Vera Cruz, Vera Cruz; small creek north of the city, March 9.

Boca del Rio, Vera Cruz; Boca del Rio, March 7.

Cordoba, Vera Cruz; Rio Blanco, April 6.

Rio Blanco, Vera Cruz; Rio Blanco, March 5.

Otopa, Vera Cruz; Rio Otopa, March 4.

Motzorongo, Vera Cruz; Rio Motzorongo, April 9.

Refugio, Vera Cruz; Rio Tonto, April 10.

El Hule, Oaxaca; Rio Papaloapam, April 22.

Obispo, Oaxaca; Rio Obispo, April 24.

Perez, Vera Cruz; Rio Tesechocan, March 1 and 2, and April 23.

San Juan Evangelista, Vera Cruz; Rio San Juan Evangelista, Feb. 27.

Sanborn, Vera Cruz; tributary of Rio Coatzacoalcos, February 22.

San Geronimo, Oaxaca; Rio San Geronimo, February 26.

Tehuantepec, Oaxaca; Rio Tehuantepec, February 25.

THE RIVER SYSTEMS OF MEXICO AND A LIST OF FISHES KNOWN FROM EACH.

RIO GRANDE SYSTEM.

From El Paso, Texas, east to the Gulf of Mexico the Rio Grande forms the boundary between Mexico and the United States, therefore only this portion of the river and its southern tributaries are concerned in the drainage of Mexico. In the Rio Grande system is included the numerous small independent streams and lakes east of the Sierra Madre Mountains in Chihuahua and Durango, for these were, no doubt, at some former period tributaries to the Rio Grande. This portion of the Mexican plateau in general is a treeless plain with a scant vegetation. The yucca, the mesquite, various species of cacti, sage brush, a few stunted cedars and the like, together with a sparse growth of various species of grasses, comprise the larger part of the vegetation of this region. During the rainy season, and a short time after it, there is promise of a luxuriant growth of plant

life; but after a few months of exposure to the piercing rays of the tropical sun the character of the country changes, assuming the appearance of a parched desert. The rivers, which are large in the rainy season, become very small by the end of the long dry season. Many of the lakes in this region become dry and the streams which flow into them contain little water except in the upper part of their courses where they are fed by mountain springs, and streams of this character contain but few species of fishes.

RIO GRANDE AND ITS PRESENT TRIBUTARIES IN MEXICO.

Below is a list of fishes known from this drainage area:

- Lepidosteus osseus* (Linnæus): Santa Rosalia; San Juan.
Ichthyælorus furcatus (Le Sueur): Brownsville.
Ichthyælorus punctatus (Rafinesque): El Paso.
Amiurus lupus Baird & Girard: San Juan; Montemorelos.
Amiurus natalis (Le Sueur): Brownsville.
Leptops olivaris (Rafinesque): El Paso; Santa Rosalia.
Carpiodes tumidus (Girard): Ft. Brown; Brownsville.
Carpiodes microstomus Meek: Santa Rosalia; Jimenez.
Carpiodes elongatus Meek: San Juan; Montemorelos.
Pantosteus plebeius (Baird & Girard): San Andres.
Catostomus conchos Meek: Jimenez.
Myzostoma congestum (Baird & Girard): Monterey; Santa Rosalia; San Juan; Montemorelos; El Paso.
Campostoma ornatum Girard: Chihuahua; San Andres; Santa Rosalia; Jimenez.
Campostoma anomalum (Rafinesque): Cadereita; Acapulco; San Juan; Montemorelos.
Campostoma formosulum Girard: Brownsville.
Hybognathus episcopus (Girard): Chihuahua; Jimenez; Comanche Spring; Saltillo; Monterey; Cadereita; Montemorelos; Ft. Brown; Brownsville; Buena Vista; Guajuco.
Pimelocephales confertus (Girard): San Andres; Chihuahua; Santa Rosalia; Jimenez; Brownsville.
Leuciscus nigrescens (Girard): Chihuahua; San Andres; Saltillo.
Abramis chrysoleucus (Mitchill): Brownsville.
Cochlognathus ornatus Baird & Girard; Brownsville.
Nototropis braytoni (Jordan & Evermann): Cadereita; San Juan; Montemorelos.
Nototropis robustus Meek: Santa Rosalia; Jimenez.
Nototropis chihuahua Woolman; Chihuahua; San Andres; Santa Rosalia; Jimenez.
Nototropis ornatus Girard: Chihuahua; Jimenez; San Andres.
Nototropis orca Woolman; El Paso.
Nototropis lutrensis (Baird & Girard): China; Cadereita; Monterey; Acapulco; Chihuahua; Santa Rosalia; San Andres; Jimenez; Brownsville.
Nototropis macrostomus (Girard): China; San Juan; Montemorelos.
Nototropis santarosaliæ Meek: Santa Rosalia.
Phenacobius scopifer (Cope): Brownsville.
Rhinichthys simus Garman: "Coahuila"; Santa Rosalia; Montemorelos.
Hybopsis æstivalis (Girard): Cadereita; El Paso; San Juan.
Cousius adustus Woolman: Chihuahua.

- Tetragonopterus mexicanus** Filippi: Chihuahua; Santa Rosalia; Jimenez; Monterey; San Juan; Montemorelos; Brownsville; Comanche Spring; Monclova.
- Anguilla chrysypa** Rafinesque: Matamoras; Brownsville; San Juan.
- Dorosoma exile** Jordan & Gilbert: San Juan.
- Fundulus similis** (Baird & Girard): Brownsville.
- Fundulus zebrinus** (Jordan & Gilbert): Brownsville.
- Lucania venusta** (Girard): Matamoras.
- Cyprinodon eximius** Girard: Chihuahua; San Andres; Jimenez; Santa Rosalia.
- Cyprinodon elegans** Baird & Girard: Comanche Spring.
- Gambusia affinis** (Baird & Girard): Comanche Spring; Chihuahua; Cadereita; Matamoras; Jimenez; San Andres; Santa Rosalia; Monterey; Monclova.
- Glaridichthys latidens** (Garman): Chihuahua.
- Pœcilia couchiana** (Girard): Monterey; Cadereita.
- Pœcilia sphenops** Cuvier & Valenciennes; San Juan; Monterey.
- Mollienesis formosa** (Girard): Palo Alto.
- Mollienesis latipinna** Le Sueur: Brownsville; Matamoras.
- Lepidopomus cyanellus** Rafinesque: Eagle Pass; Brownsville.
- Lepidopomus occidentalis** Meek: Jimenez; Santa Rosalia.
- Lepidopomus haplognathus** Cope: Monterey.
- Lepidopomus pallidus** (Mitchill): Brownsville; Cadereita.
- Eupomotis heros** (Baird & Girard): Cadereita.
- Micropterus salmonoides** (Lacépède): San Juan; Montemorelos.
- Etheostoma australe** (Jordan): Chihuahua; San Andres; Jimenez; Santa Rosalia.
- Etheostoma pottsi** (Girard): Chihuahua; San Andres; Santa Rosalia; Jimenez.
- Etheostoma lepidum** (Baird & Girard): Brownsville.
- Haploidonotus grunniens** Rafinesque: Matamoras.
- Cichlasoma pavonaceum** (Garman): Monclova.
- Cichlasoma cyanoguttatum** (Baird & Girard): Brownsville; Fort Brown; Matamoras; Cadereita; San Juan; Montemorelos; Monterey.
- Neetroplus carpintis** Jordan & Snyder: San Juan.
- Philypnus dormitor** (Lacépède): Brownsville.
- Dormitator maculatus** (Bloch): Brownsville.

RIO CASAS GRANDES.

This is a small mountain stream in northern Chihuahua which flows into Lago de Guzman. By the end of the dry season the lake becomes nearly or entirely dry, and there is very little water in the river below Terrasas.

Below is a list of the fishes known from this river and its tributaries:

- Amiurus pricei** (Rutter): San Diego.
- Pantosteus plebeius** (Baird & Girard): Rio Mimbres; Rio Janos; Colonia Garcia; San Diego; Casas Grandes; Colonia Juarez.
- Campostoma ornatum** Girard: Colonia Garcia; Colonia Juarez.
- Pimeloccephalus confertus** (Girard): Colonia Juarez; Guzman.
- Leuciscus nigrescens** (Girard): Rio Janos; Boca Grande; Rio Mimbres; Colonia Juarez; San Diego.
- Nototropis formosus** (Girard): Rio Mimbres; Colonia Juarez.
- Cyprinodon elegans** Baird & Girard: Colonia Juarez; Guzman; San Diego.

RIO SANTA MARIA.

This stream is parallel to the Rio Casas Grandes and flows into Lago de Santa Maria about 10 miles southeast of Lago de Guzman. These lakes are separated by a comparatively low ridge, but so high that their waters have not been connected for a considerable time. The fishes of this stream are but little known. The following is a list of those known from it at present:

- Pimelocephales confertus* (Girard): Santa Maria.
- Leuciscus nigrescens* (Girard): Santa Maria.
- Nototropis lutrensis* (Baird & Girard): Santa Maria.
- Nototropis santamariæ* Evermann & Goldsborough: Santa Maria.
- Nototropis frigidus* (Girard): Santa Maria.
- Cyprinodon elegans* Baird & Girard: Santa Maria.

RIO CARMAN.

This is a small river east of the Rio Santa Maria and flows into Lago de Patos. This lake becomes dry by the end of the dry season, and there is no water in the river for some distance above Ahumada. The few fishes known from this river basin were taken from an irrigating ditch near Ahumada, and from a spring at San Jose.

- Pantosteus plebeius* (Baird & Girard): Ahumada.
- Leuciscus nigrescens* (Girard): Reported above Ahumada.
- Nototropis lutrensis* (Baird & Girard): Ahumada; San Jose.
- Cyprinodon eximius* Girard: Ahumada.

RIO SAUZ.

This is a small stream about fifteen miles in length, situated a short distance north of the City of Chihuahua. At Sauz, about the middle of its course, it contains a small amount of running water during the dry season.

The following four species of fishes are known to occur there:

- Pantosteus plebeius* (Baird & Girard): Sauz.
- Nototropis lutrensis* (Baird & Girard): Sauz.
- Cyprinodon eximius* Girard: Sauz.
- Gambusia affinis* (Baird & Girard): Sauz.

LAGO DE CASTILLOS.

This small mountain lake is situated on the divide between the head waters of a tributary of the Rio Grande and of the Rio Yaqui. It becomes nearly dry by the last of June. There are a number of springs in this region which are said to contain small fishes. The following is the only species I obtained in a pond left by the drying up of this lake:

- Leuciscus nigrescens* (Girard): Bustillos.

RIO NAZAS.

This is a river of considerable size in central Mexico. It rises in the Sierra Madre Mountains and flows into Lago de Mayran. By the

end of the dry season there is no water in its bed and little or none in the river below Lerdo. The Rio Nieves is south of the Rio Nazas and flows into Lago de Parras, which is only a few miles south of Lago de Mayran. It is very probable that at some former time these two streams united near here, and flowed north into the Rio Grande near the border line between the States of Chihuahua and Coahuila.

Below is a list of the fishes known from these rivers:

Amiurus pricei (Rutter): Lerdo.

Carpiodes tumidus Baird & Girard: San Pedro.

Pantosteus plebeius (Baird & Girard): Lerdo; Santiago Papasquiario; Rio Nazas.

Campostoma ornatum Girard: Santiago Papasquiario.

Hybognathus episcopus (Girard): Parras.

Stypodon signifer Garman: Lago de Parras.

Leuciscus nigrescens (Girard): Lerdo; Santiago Papasquiario; Rio Nazas; Parras.

Nototropis ornatus (Girard): Santiago Papasquiario.

Nototropis nazas Meek: Santiago Papasquiario.

Nototropis garmani (Jordan): Parras; Lerdo; Santiago Papasquiario.

Tetragonopterus mexicanus Filippi: Lago del Muerto; Lerdo; Santiago Papasquiario.

Characodon garmani Jordan & Evermann: Parras.

Cyprinodon latifasciatus Garman: Parras.

Etheostoma pottsii (Girard): Santiago Papasquiario.

RIO CONCHAS SYSTEM.

This river drains only a small area east of the Sierra Madre and south of the lower portion of the Rio Grande. The city of Linares is situated between two branches of the stream; both of these branches contain, by the end of the dry season, only a small amount of water. The following is the list of fishes known from this river system. *Amiurus lupus* (Girard) and *Neetroplus carpintis* J. & S. were taken only in the stream north of the city; all the other species were taken in both streams.

Amiurus lupus (Girard): Linares.

Carpiodes elongatus Meek: Linares.

Myzostoma congestum (Baird & Girard): Linares.

Nototropis lutrensis (Baird & Girard): Linares.

Hybopsis æstivalis (Girard): Linares.

Tetragonopterus mexicanus Filippi: Linares.

Fundulus similis (Baird & Girard): Linares.

Pœcilia sphenops (Cuvier & Valenciennes): Linares.

Micropterus salmonoides (Lacépède): Linares.

Cichlasoma cyanoguttatum (Baird & Girard): Linares.

Neetroplus carpintis Jordan & Snyder: Linares.

RIO SOTO LA MARINA SYSTEM.

This river and its tributaries drain a comparatively small area east of the Sierra Madre Mountains and between the Rio Conchas and

the Rio Panuco. I visited the tributaries of this river where they are crossed by the railroad.

At Garza Valdez most of the river bed was dry, the water being confined to deep holes. The bed of the stream was covered with large waterworn rocks, indicating a rapid current during the wet season. Along the banks were many large cedar trees.

The tributary at La Cruz contained at the time of my visit a considerable amount of clear, swiftly running water. This is the largest river between Tampico and Monterey, and it no doubt contains many more fishes than any other of the streams in this region. Big large-mouthed black bass, catfish, trucha, cichlids, and suckers could be seen in abundance from the bank.

At Santa Engracia there was but little running water in the river. Above a dam near the railroad bridge the water in the channel was in many places over six feet deep and very clear. This stream also contained many large-mouthed black bass, a few of which I captured. So far as known this is the southern limit of this species. Along the banks of the stream are also many large cedar trees. The trucha, or trout of the natives, was also abundant, but I was unable to capture any of them.

The stream at Victoria is small, and I found but little water in it. Of the eighteen species known from this river system, twelve* are northern forms and six are tropical.

**Ichthyælus furcatus* (Le Sueur): Rio Soto la Marina.

**Amiurus lupus* (Girard): Garza Valdez; La Cruz.

**Carpiodes tumidus* Baird & Girard: Garza Valdez.

**Carpiodes elongatus* Meek: La Cruz.

**Myzostoma congestum* (Baird & Girard): Garza Valdez; Victoria.

**Nototropis braytoni* (Jordan & Evermann): Garza Valdez; La Cruz; Santa Engracia; Victoria.

Tetragonopterus mexicanus Filippi: Garza Valdez; La Cruz; Santa Engracia; Victoria.

**Anguilla chrysypa* Rafinesque: La Cruz.

**Fundulus similis* (Baird & Girard): Victoria.

**Gambusia affinis* (Baird & Girard): Garza Valdez; La Cruz; Santa Engracia.

Platyæcilus variatus Meek: Garza Valdez; Santa Engracia; Victoria.

Pœcilia sphenops Cuvier & Valenciennes: Garza Valdez; La Cruz; Santa Engracia; Victoria.

**Mollienesis latipinna* Le Sueur: La Vega.

**Micropterus salmonoides* (Lacépède): La Cruz; Santa Engracia.

**Haploidonotus grunniens* Rafinesque: La Cruz.

Cichlasoma cyanoguttatum (Baird & Girard): La Cruz; Garza Valdez; Santa Engracia; Victoria.

Neotroplus carpintis Jordan & Snyder: Garza Valdez; La Cruz; Santa Engracia; Victoria.

Philypnus dormitor (Lacépède): Santa Engracia; La Vega.

RIO PANUCO SYSTEM.

The Rio Panuco is a very large stream flowing into the Gulf at Tampico. Some of its upper tributaries drain a portion of the central plateau, from which it reaches the main river through a gap in the mountains by a series of cascades and falls. Near the mouth of the Rio Panuco are several large salt or brackish water lagoons. The tide backs up into the river and lagoons to some distance above the city of Tampico. There have been only a few collections of fishes made in this river basin.

The Rio Forlon, which at Forlon is a small stream in the dry season, flows over a rocky and gravelly bed.

The Rio Valles at Valles is a broad and rather sluggish stream flowing past the city over a rocky bed; for some distance above it is deep and has a muddy bottom.

A tributary of the Rio Valles at Rascon has a more rapid current, and its water is very clear. It flows through a narrow valley in which is a dense forest of palms, mesquite, and thickets of canes, ferns, and vines.

The Rio San Juan, at San Juan del Rio, becomes nearly dry in the dry season, as does also the Rio Tula at Tula. I spent one day at San Juan del Rio in May, 1901, collecting fishes. I found here but three species,* which properly belong to the fauna of the Rio Lerma.

Dr. W. L. Tower made a small collection in 1904 in the Rio Verde at Rio Verde. Except a few fishes taken by Dr. A. Dugés in Huasteca Potosina in northeastern Guanajuato, collections of fishes have been made in this river basin only at the places mentioned above.

Of the thirty-two species recorded from this river basin, fifteen† belong to the northern fauna, the others are tropical.

Below is given a list of the fishes known from the Rio Panuco and its tributaries:

†*Lepidosteus osseus* (Linnaeus): Forlon; Valles; Tampico.

†*Lepidosteus tristoechus* (Bloch & Schneider): Tampico; "Tamaulipas."

†*Ichthyæurus furcatus* (Le Sueur): Tampico.

†*Ichthyæurus punctatus* (Rafinesque): Forlon.

†*Amiurus australis* Meek: Forlon.

†*Amiurus mexicanus* Meek: Rio Verde; Rascon.

†*Carpiodes tumidus* Baird & Girard: Forlon; Tampico.

†*Carpiodes labiosus* Meek: Valles.

**Algansea tincella* (Cuvier & Valenciennes): San Juan del Rio.

†*Hybognathus rasconis* (Jordan & Snyder): Rio Verde; Rascon; Valles; Forlon.

**Azteca mexicana* Meek: San Juan del Rio.

†*Nototropis forlonensis* Meek: Forlon; Valles.

Tetragonopterus mexicanus Filippi: Rascon; Valles; Forlon; Rio Verde; Tampico.

†*Dorosoma exile* Jordan & Gilbert: Forlon; Valles.

- Signalosa mexicana* (Günther): Valles.
 †*Fundulus heteroclitus* (Linnaeus): Tampico.
 †*Cyprinodon eximius* Girard: Tampico.
 †*Gambusia affinis* (Baird & Girard): Forlon; Valles; Tampico.
Goodea toweri Meek: Rio Verde.
 **Goodea atripinnis* Jordan: San Juan del Rio.
Platyœcilus variatus Meek: Forlon; Valles; Rascon.
Pœcilia latipunctata Meek: Forlon.
Pœcilia sphenops Cuvier & Valenciennes; Forlon; Valles; Rascon; Tampico.
 †*Molienesia latipinna* Le Sueur: Tampico.
Xiphophorus montezumæ Jordan & Snyder: Rascon.
Pomadasys templei Meek: Valles.
Cichlasoma steindachneri Jordan & Snyder: Rascon; Valles; Forlon.
Cichlasoma bartoni (Bean): Rio Verde; Huasteca Potosina.
Cichlasoma cyanoguttatum (Baird & Girard): Forlon; Rascon.
Neotrophus carpinis Jordan & Snyder: Forlon; Valles; Tampico.
Philypnus dormitor (Lacépède): Tampico; Forlon; Valles; Rascon.
Chonophorus taiasica (Lichtenstein): Valles.

RIO MEZQUITAL SYSTEM.

The Rio Mezquital rises east of the central range of the Sierra Madre Mountains and empties into the Pacific Ocean a short distance north of the mouth of the Rio Grande de Santiago. I visited this river at Durango where it is a rather small stream with a sluggish current. The collection of fishes made here is of especial interest because all of them, except three,* belong to the fauna of the Rio Grande. *Characodon furcoides* J. & G., is known from this river only near its mouth. Of the eleven species from this river *Characodon garmani* J. & E., *Characodon furcoides* J. & G., and *Chirostoma mezquital* Meek, are the only ones that can properly be ascribed to the southern or tropical fauna.

The fishes of the upper portion of the river certainly indicate that it was at some former time a portion of the Rio Grande system.

Characodon garmani Jordan & Evermann is very abundant in a large spring in the city of Durango.

Near Labor, about eight miles from Durango, is a large spring from which was taken three species of fishes. The following is a list of fishes known from this river system

- Amiurus pricei* (Rutter): Durango.
Pantosteus plebeius (Baird & Girard): Durango.
 **Myzostoma austrinum* Bean: Durango.
Hybognathus episcopus (Girard): Durango; Labor.
Leuciscus nigrescens (Girard): Durango.
Nototropis ornatus (Girard): Durango.
Characodon garmani Jordan & Evermann: Durango; Labor.
 **Characodon furcoides* Jordan & Gilbert: Tuxpan.
Cyprinodon latifasciatus Garman: Labor; Durango.
 **Chirostoma mezquital* Meek: Durango.
Etheostoma pottsii (Girard): Durango.

RIO PRESIDIO SYSTEM.

The Rio Presidio is a short stream on the western slope of the Sierra Madre Mountains. The only collection of fishes known from this river basin was made by Dr. D. S. Jordan at Presidio, a short distance above its mouth. Here the stream flows with considerable current over a sandy and gravelly bed.

The following is a list of the species taken at this place:

- Pœcilia butleri* Jordan: Presidio.
Pœcilia presidionis Jordan & Culver: Presidio.
Siphostoma starksi Jordan & Culver: Presidio.
Thyrina crystallina Jordan & Culver: Presidio.
Agonostomus monticola Bancroft: Presidio.
Cichlasoma beani (Jordan): Presidio.
Philypnus dormitor (Lacépède): Presidio.
Dormitator maculata (Bloch): Presidio.
Eleotris pictus Kner & Steindachner: Presidio.
Chonophorus taiasica (Lichtenstein): Presidio.
Achirus mazatlanus (Steindachner): Presidio.
Achirus fonsecensis (Günther): Presidio.

RIO YAQUI SYSTEM.

This river, like the Rio Mesquital, has its origin east of the Sierra Madre Mountains, and the fish fauna of its upper tributaries is essentially that of the Rio Grande. Very little is known concerning the fishes in the lower part of this river. The northern tributaries, or those which rise near the head waters of the Rio Gila, contain at least a few Colorado river fishes. Of the fourteen species listed below, four* properly belong to the Rio Colorado fauna; two† are known only from this basin; the remaining eight belong to the Rio Grande fauna.

- Amiurus pricei* (Rutter): Miñaca: "San Bernardino Creek."
Pantosteus plebeius (Baird & Girard): Miñaca.
†*Catostomus sonorensis* Meek: Miñaca.
†*Catostomus bernardini* Girard: San Bernardino Creek; Sonora.
Campostoma ornatum Girard: Rucker Cañon.
Pimelocephales confertus (Girard): Miñaca.
**Gila minacæ* Meek: Miñaca.
Leuciscus nigrescens (Girard): Miñaca; Morse Cañon; Opsura.
Nototropis ornatus Girard: Miñaca.
Nototropis lutrensis (Baird & Girard): Miñaca.
**Agosia chrysogaster* Girard: Morse Cañon; Rucker Cañon; "near summit of Sierra Madre."
Cyprinodon elegans Baird & Girard: Miñaca.
**Pœcilia occidentalis* (Baird & Girard): San Bernardino Creek; Opsura.
**Salmo irideus* Gibbons: Reported by Mr. Jno. Ramsey to be abundant in headwaters of Rio Yaqui.

RIO SONORA SYSTEM.

Concerning the fishes of this river very little is known. The two or three species known from it indicate that its fauna is that of the Rio Colorado.

Ptychocheilus lucius Girard: Northern Sonora. (River basin doubtful.)

Agosia chrysogaster Girard: Hermosillo.

Pæcilia occidentalis (Baird & Girard): Hermosillo.

COLORADO RIVER SYSTEM.

This river drains but a very small portion of Mexico. I have here included only those fishes found between Yuma and the Gulf of California. I am uncertain as to whether the two species of *Agosia* should be credited to the Rio Colorado or to the Rio Yaqui. The Rio Santa Cruz may possibly belong to the Rio Sonora.

Xyrauchen cypho (Lockington): Yuma; Horseshoe Bend.

Ptychocheilus lucius Girard: "Northern Sonora"; Yuma; Horseshoe Bend.

Gila elegans Baird & Girard: Yuma; Horseshoe Bend.

Agosia oscula (Girard): Rio Santa Cruz; Sonora.

Agosia chrysogaster Girard: "Rio Santa Cruz."

Plagopterus argentissimus Cope: Yuma.

Cyprinodon macularis Baird & Girard: Lerdo.

Gillichthys detrusus Gilbert & Scofield: Horseshoe Bend.

LOWER CALIFORNIA.

There are only a few streams in Lower California, and but little is known concerning the fishes which inhabit them. Mr. Heller found but one species, *Salmo irideus* Gibbons, in the streams of the northern part of this peninsula. Three species have been taken from either La Paz or Cape San Lucas, most likely from the former place. The other species known from the fresh waters of this region were taken in the Rio San Jose, near San Jose del Cabo.

Salmo irideus Gibbons: San Antonio.

Fundulus vinctus Jordan & Gilbert: La Paz; or Cape San Lucas.

Fundulus extensis Jordan & Gilbert: La Paz or Cape San Lucas.

Characodon furcoides Jordan & Gilbert: La Paz or Cape San Lucas.

Siphostoma starksi Jordan & Culver: San Jose del Cabo.

Agonostomus monticola (Bancroft): San Jose del Cabo.

Neomugil digueti Vailliant: Sierra de las Cacachilas de Santa Cruz.

Pomadasys bayanus Jordan & Evermann: San Jose del Cabo.

Philypnus dormitor (Lacépède): San Jose del Cabo; Cape San Lucas.

Dormitator maculatus (Bloch): San Jose del Cabo.

Eleotris pictus Kner & Steindachner: San Jose del Cabo.

Chonophorus taiasica (Lichtenstein): San Jose del Cabo.

RIO GRANDE DE SANTIAGO SYSTEM.

The Rio Grande de Santiago and its largest tributary form the longest stream in Mexico, draining a considerably elevated plateau

on which are a number of fresh-water lakes; one of these, Lago de Chapala, is the largest fresh-water lake in Mexico.

A number of lakes in this drainage basin have no outlet, and in some, as Lago de Patzcuaro and Lago de Cuitzeo, the water is quite brackish. The fishes of this drainage basin are quite distinct from those of the neighboring rivers. The Valley of Mexico was no doubt formerly a portion of this river basin. The fishes found in the Rio San Juan at San Juan del Rio indicate that the head waters of that river were also at one time a tributary of the Lerma.

The following is a list of fishes known from this river system:

- Lampetra spadicea* Bean: Guanajuato; Tangancicuaro; Chapala.
Amiurus dugesi Bean: Turbio; Guanajuato; Salamanca; La Barca; La Palma; "Estado de Jalisco"; Ocotlan; Chapala.
Myzostoma austrinum Bean: Piedad; Salamanca; Aguas Calientes; Ataquiza; Ocotlan; La Palma.
Xystrosus popoche Jordan & Snyder: Chapala; Ocotlan; La Palma.
Algansea tincella (Cuvier & Valenciennes): Salamanca; Aguas Calientes; Lagos; Celaya; Acambaro; "Estado de Jalisco."
Algansea dugesi Bean: "Lago de Yuriria."
Algansea rubescens Meek: Ocotlan.
Algansea lacustris Steindachner: Patzcuaro.
Falcula chapalæ Jordan & Snyder: Chapala; Ocotlan; La Barca; La Palma.
Aztecula lermæ (Evermann & Goldsborough): Lerma.
Nototropis calientis Jordan & Snyder: Aguas Calientes; Ocotlan; Acambaro.
Hybopsis altus (Jordan): Tupatario; Salamanca; Rio Cuitzeo; Lagos; Aguas Calientes; Acambaro; Celaya.
Zoogoneticus cuitzeoensis (B. A. Bean): Cuitzeo; Ocotlan; La Barca.
Zoogoneticus dugesi (Bean): Guanajuato; Patzcuaro; Lagos.
Zoogoneticus robustus (Bean): Chapala; Cuitzeo; Ocotlan; Patzcuaro; Zirahuen; "Guanajuato."
Zoogoneticus maculatus Regan: Rio Santiago.
Zoogoneticus diazi Meek: Patzcuaro; Zirahuen.
Characodon multiradiatus Meek: Lerma.
Characodon eiseni Rutter: Tepic.
Characodon variatus Bean: Salamanca; Aguas Calientes; Lagos; Ocotlan; Huingo; Celaya; "Guanajuato."
Characodon lateralis Günther: "Estado de Jalisco."
Chapalichthys encaustus (Jordan & Snyder): Chapala; Ocotlan; La Barca; La Palma; "Estado de Jalisco."
Gambusia infans Woolman: Salamanca; Celaya; Ocotlan; La Barca; Huingo; "Lago de Zacoalco."
Goodea luitpoldi (Steindachner): Patzcuaro; Ocotlan; La Barca; La Palma; "Lago de Zacoalco."
Goodea atripinnis Jordan: Aguas Calientes; Celaya; Acambaro; Huingo; Leon; Lagos.
Skiffia multipunctata (Pellegrin): Ocotlan; Jalisco (Estado).
Skiffia lermæ Meek: Celaya; Patzcuaro.
Skiffia variegata Meek: Zirahuen.
Skiffia bilineata (Bean): Huingo; "Rio Lerma, Guanajuato."

- Poecilia occidentalis* (Baird & Girard): Tepic.
Chiostoma jordani Woolman: Salamanca; Cuitzeo; Aguas Calientes; Lagos; Ocotlan; Acambaro; Huingo.
Chiostoma arge (Jordan & Snyder): Aguas Calientes; Lagos.
Chiostoma bartoni Jordan & Evermann: Lerma; "near Guanajuato."
Chiostoma attenuatum Meek: Patzcuaro.
Chiostoma labarcæ Meek: La Barca; La Palma.
Chiostoma patzcuaro Meek: Patzcuaro.
Chiostoma zirahuen Meek: Zirahuen.
Chiostoma humboldtianum (Cuvier & Valenciennes): La Laguna; Lago de Juan-acatlan; Patzcuaro.
Chiostoma chapalæ Jordan & Snyder: Chapala; Ocotlan; La Palma; "Estado de Jalisco."
Chiostoma grandocule Steindachner: Patzcuaro; Ocotlan; La Palma.
Chiostoma promelas Jordan & Snyder: Chapala; Ocotlan; La Palma; "Estado de Jalisco."
Chiostoma sphyræna Boulenger; Chapala.
Chiostoma lucius Boulenger: Chapala, Ocotlan; La Palma; La Barca.
Chiostoma lermæ Jordan & Snyder: Chapala; Ocotlan; La Palma.
Chiostoma ocotlanæ Jordan & Snyder: Ocotlan; La Palma; "Estado de Jalisco."
Chiostoma estor Jordan: Patzcuaro; Chapala.
Agonostomus monticola (Bancroft); Rio Santiago.
Cichlasoma beani (Jordan): Tepic.

VALLEY OF MEXICO.

The Valley of Mexico was formerly a part of the Lerma drainage system, though it has no natural outlet to the sea. The following is a list of the fishes known to this valley. All of these species except five* have been taken in the basin of the Lerma, and but one of these, *Aztecula vittata* (Girard), in the basin of the Rio Balsas.

- Algansea tincella* (Cuvier & Valenciennes): Chalco; Texcoco; Viga Canal.
 **Aztecula vittata* (Girard): Chalco; Texcoco; Xochimilco; Viga Canal.
 **Evarra eigenmanni* Woolman: Tlahuac; "Valley of Mexico."
 **Evarra tlahuacensis* Meek: Tlahuac.
 **Zoogoneticus miniatus* Meek: Chalco.
 **Girardinichthys innominatus* Bleeker: Chalco; Texcoco; Xochimilco; Viga Canal.
Skiffia variegata Meek: Chalco.
Chiostoma jordani Woolman: Chalco; Texcoco; Xochimilco; Viga Canal.
Chiostoma humboldtianum (Cuvier & Valenciennes): Chalco; Xochimilco; Viga Canal.
Chiostoma estor Jordan: Xochimilco.

RIO SAN FRANCISCO SYSTEM.

At La Antigua and San Francisco the Rio San Francisco is a broad stream with a gravelly or a sandy bottom; the former place is just above tide-water. At San Francisco the stream is quite rapid. I made a small collection of fishes at these two places, also one at Jalapa and one at Xico. The stream at Jalapa is small, and from it were taken only two species.

At Xico there is a waterfall of 260 feet, which is used for power to generate electricity for lighting several cities in this region. I found but one species of fish above these falls. The streams at Perote and at Tezuitlan contain no fishes, and it is probable that none are found in this region at a greater altitude than Xico, or not exceeding 6,000 feet.

The following is a list of species known from the Rio San Francisco and its tributaries:

- Dorosoma exile* Jordan & Gilbert: La Antigua.
Pseudoxiphophorus bimaculatus (Heckel): Jalapa; Xico.
Pœcilia sphenops Cuvier & Valenciennes: La Antigua.
Xiphophorus jalapæ Meek: Jalapa.
Tylosurus marinus (Walbaum): San Francisco.
Centropomus mexicanus Bocourt: San Francisco.
Cichlasoma parma (Günther): La Antigua; San Francisco.
Philypnus dormitor (Lacépède): San Francisco; La Antigua.
Gobius parvus Meek: La Antigua.
Gobius claytoni Meek: La Antigua; San Francisco.
Chonophorus taiasica (Lichtenstein): La Antigua; San Francisco.

LAS LAGUNAS, NEAR VERA CRUZ.

Near the city of Vera Cruz are a large number of sand dunes, among which are ponds, swamps, and small lakes (Las Lagunas) containing fresh water. These usually have an outlet to the sea. One of these, about two miles north of the city, was visited, and from it the following species of fishes, except one,* were taken:

- **Symbranchus marmoratus* Bloch: Vera Cruz.
Pœcilia sphenops Cuvier & Valenciennes: Vera Cruz.
Agonostomus monticola (Bancroft): Vera Cruz.
Cichlasoma hedricki Meek: Vera Cruz.
Cichlasoma parma (Günther): Vera Cruz.
Cichlasoma melanurum (Günther): Vera Cruz.
Dormitator maculatus (Bloch): Vera Cruz.
Eleotris pisonis (Gmelin): Vera Cruz.
Gobius parvus Meek: Vera Cruz.
Gobius claytoni Meek: Vera Cruz.

BOCA DEL RIO SYSTEM.

The river at Boca del Rio is broad and its water brackish. A short distance above the city it is quite fresh, but the fishes are mostly salt-water forms.

Below is given a list of the species taken which I have included as fresh-water fishes:

- Paragambusia nicaraguensis* (Günther): Boca del Rio.
Belonesox belizanus Kner: Boca del Rio.
Pœcilia sphenops Cuvier & Valenciennes: Boca del Rio.
Siphostoma brevicaudum Meek: Boca del Rio.

Centropomus mexicanus Bocourt: Boca del Rio.
Cichlasoma parma (Günther): Boca del Rio.
Philypnus dormitor (Lacépède): Boca del Rio.
Dormitator maculatus (Bloch): Boca del Rio.
Eleotris pisonis (Gmelin): Boca del Rio.
Gobius parvus Meek: Boca del Rio.
Gobius claytoni Meek: Boca del Rio.

RIO BLANCO SYSTEM.

The Rio Blanco rises at the foot of Mt. Orizaba and flows into the Gulf about thirty miles south of Vera Cruz. I visited this river at Rio Blanco and one of its tributaries at Cordoba. The upper part of its course is a mountain torrent. The tributary at Cordoba was nearly dry, the water being confined to holes among the huge boulders along its bed. This stream becomes a mountain torrent in the rainy season. At Rio Blanco the banks were so steep and although the current is sluggish, it was impossible to use a seine here with any success. The fish fauna of this river is certainly much greater than the present list would indicate.

Amiurus australis Meek: Rio Blanco.
Rhamdia oaxacæ Meek: Rio Blanco; Cordoba.
Rhamdia brachyptera (Cope): Orizaba.
Tetragonopterus æneus Günther: Cordoba.
Pseudoxiphophorus bimaculatus (Heckel): Orizaba; Cordoba.
Gambusia gracilis (Heckel): Orizaba.
Xiphophorus helleri Heckel: Cordoba.
Chonophorus taiasica (Lichtenstein): Orizaba.

RIO OTOPA SYSTEM.

The River Otopa is a small stream about 35 miles south of Vera Cruz. When visited the water was very low, and the river consisted of a few deep holes with very little running water between them. The bottom was sandy. At Otopa the railroad bridge is a single span of about 75 feet.

The following fishes were taken at this place:

Ichthyælus meridionalis (Günther): Otopa.
Rhamdia oaxacæ Meek: Otopa.
Tetragonopterus æneus Günther: Otopa.
Dorosoma anale Meek: Otopa.
Pseudoxiphophorus bimaculatus (Heckel): Otopa.
Paragambusia nicaraguensis (Günther): Otopa.
Belonesox belizanus Kner: Otopa.
Heterandria lutzi Meek: Otopa.
Poecilia sphenops Cuvier & Valenciennes: Otopa.
Xiphophorus helleri Heckel: Otopa.
Agonostomus monticola (Bancroft): Otopa.
Cichlasoma melanurum (Günther): Otopa.
Thorichthys helleri (Steindachner): Otopa.

RIO PAPALOAPAM SYSTEM.

The Rio Papaloapam and its tributaries drain nearly all of the eastern slope of Mexico between the Rio Blanco and the Isthmus of Tehuantepec. Owing to the abundance of rainfall in this region this river and its principal tributaries are much larger than their drainage area would indicate.

The largest bridge in the republic crosses the Papaloapam at El Hule. The portion of the bridge which crosses the main channel is 1,100 feet in length. Much of this drainage area is a dense jungle of palms, various other species of trees, shrubs, and vines.

The following is a list of the known fishes from this river system; all except three* properly belong to the tropical fauna.

Galeichthys aguadulce Meek: Perez.

Rhamdia oaxacæ Meek: Cuicatlan; Motzorongo; El Hule; Obispo; Perez.

Rhamdia brachyptera (Cope): Motzorongo.

**Carpiodes meridionalis* (Günther): Perez.

Tetragonopterus mexicanus Filippi: Cuicatlan; Venta Salada.

Tetragonopterus æneus Günther: Motzorongo; Refugio; El Hule; Obispo; Perez; San Juan Evangelista.

Hemigrammus compressus Meek: El Hule; Obispo.

**Dorosoma anale* Meek: El Hule; Perez; San Juan Evangelista.

**Dorosoma exile* Jordan & Gilbert: Cademaco.

Signalosa mexicana (Günther): Obispo; El Hule; Perez.

Cynodonichthys tenuis Meek: El Hule.

Pseudoxiphophorus bimaculatus (Heckel): Motzorongo; El Hule; Obispo; Perez.

Gambusia bonita Meek: Motzorongo; Refugio.

Paragambusia nicaraguensis (Günther): El Hule; Obispo; Perez.

Belonesox belizanus Kner: El Hule; Obispo; Perez.

Platyptæcilus maculatus Günther: El Hule; Obispo; Perez.

Heterandria lutzi Meek: Cuicatlan; Venta Salada; El Hule; Perez; Motzorongo.

Pœcilia sphenops Cuvier & Valenciennes: El Hule; Obispo; Perez; San Juan Evangelista.

Xiphophorus helleri Heckel: Motzorongo; Refugio; El Hule; Obispo.

Tylosurus marinus (Walbaum): Perez.

Menidia lisa Meek: Refugio; El Hule.

Agonostomus monticola (Bancroft): Cuicatlan; Motzorongo.

Centropomus mexicanus Bocourt: El Hule; Perez.

Pomadasys starri Meek: Perez.

Pomadasys templei Meek: Perez.

Cichlasoma salvini (Günther): Motzorongo; Refugio; El Hule; Obispo; Perez.

Cichlasoma hedricki Meek: El Hule; Obispo; Perez.

Cichlasoma parma (Günther): Obispo; Perez.

Cichlasoma melanurum (Günther): Cuicatlan; Motzorongo; Obispo; Perez.

Cichlasoma eigenmanni Meek: Venta Salada.

Cichlasoma nebulifer (Günther): San Juan Evangelista.

Thorichthys helleri (Steindachner): El Hule; Obispo; Perez; San Juan Evangelista.

Thorichthys elliotti Meek: Motzorongo.

Philypnus dormitor (Lacépède): Motzorongo; Obispo; Perez.
Dormitator maculatus (Bloch): El Hule; Obispo; Perez.
Chonophorus taiasica (Lichtenstein): Perez.
Acirus fasciatus Lacépède: Perez.

RIO SAN GERONIMO SYSTEM.

This stream was visited at San Geronimo. It is a small river flowing with considerable current over a sandy bottom.

The following is a list of the species taken from it:

Tetragonopterus æneus Günther: San Geronimo.
Rœboides guatemalensis (Günther): San Geronimo.
Gambusia fasciata Meek: San Geronimo.
Heterandria pleurospilus (Günther): San Geronimo.
Pœcilia sphenops Cuvier & Valenciennes: San Geronimo.
Siphostoma starksi Jordan & Culver: San Geronimo.
Cichlasoma mojarra Meek: San Geronimo.
Cichlasoma melanurum (Günther): San Geronimo.

RIO TEHUANTEPEC SYSTEM.

I visited this river at Tehuantepec. Its water was low, flowing over a sandy bed with a moderate current.

The following fishes are known to occur in this river:

Tetragonopterus æneus Günther: Tehuantepec.
Gambusia fasciata Meek: Tehuantepec.
Anableps dovii Gill: Tehuantepec; Tequisistlan.
Heterandria lutzi Meek: Tehuantepec.
Pœcilia sphenops Cuvier & Valenciennes: Tehuantepec.
Mugil cephalus Linnæus: Tehuantepec.
Cichlasoma evermanni Meek: Tehuantepec.
Philypnus dormitor (Lacépède): Tehuantepec.

RIO VERDE SYSTEM.

The Rio Verde is a small Pacific coast stream heading a short distance above Oaxaca. When we visited this stream near Oaxaca it was nearly dry; its bed being broad and covered with sand. A few holes in the bed contained a few small fishes belonging to two species.

Tetragonopterus æneus Günther: Oaxaca.
Fundulus oaxacæ Meek: Oaxaca.
Heterandria lutzi Meek: Oaxaca.

RIO BALSAS SYSTEM.

The Rio Balsas is the second largest river in Mexico, which flows into the Pacific Ocean. It drains most of the area between the zone of recent volcanoes, which forms the water-shed between it and the Rio Lerma, and the Sierra Madre del Sur. The water in all the tributaries examined by me is clear and flows over a sandy or rocky bottom. In comparison to the size of this river the number of species of fishes known from it is small.

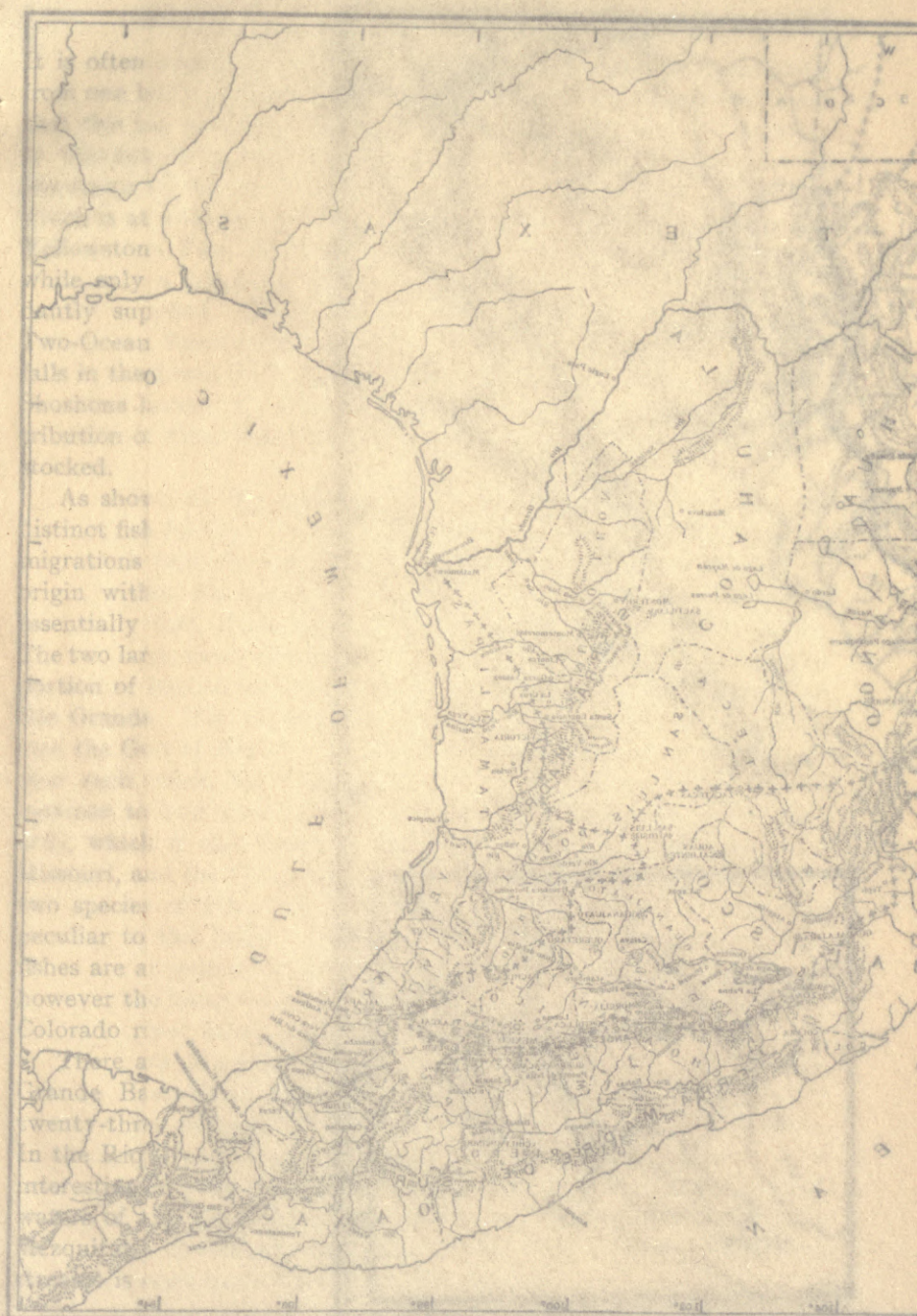
- Istlarius balsanus* Jordan & Snyder: Cuautla; Jojutla; Puente de Ixtla; Balsas.
Aztecula vittata (Girard): Puebla.
Nototropis boucardi (Günther): Puente de Ixtla; Balsas; Cuernavaca; Cuautla; Yautepec; Jojutla; Atlixco; Matamoras; Chietla.
Tetragonopterus mexicanus Filippi: Puente de Ixtla; Balsas; Cuautla; Yautepec; Jojutla; Atlixco; Chietla; Cuernavaca; Matamoras.
Gambusia gracilis (Heckel): Puente de Ixtla; Balsas; Cuautla; Yautepec; Jojutla; Chietla.
Goodea whitei Meek: Cuautla; Yautepec.
Platyæcilus nelsoni Meek: Papayo.
Pœcilia sphenops Cuvier & Valenciennes: Jojutla; Puente de Ixtla; Balsas.
Melaniris balsanus Meek: Balsas.
Agonostomus monticola (Bancroft): Balsas; Puente de Ixtla; Cuautla; Jojutla.
Cichlasoma istlanum (Jordan & Snyder): Puente de Ixtla; Balsas; Yautepec; Jojutla; Chietla; Papayo.
Chonophorus taiasica (Lichtenstein): Puente de Ixtla; Balsas; Cuautla.

LIST OF FISHES FROM VARIOUS LOCALITIES NOT REFERABLE TO ANY OF THE RIVER SYSTEMS NAMED ABOVE.

- Tetragonopterus æneus* Günther: Sanborn, Vera Cruz.
Symbranchus marmoratus Bloch: Santa Maria, Vera Cruz.
Characodon furcoides Jordan & Gilbert: Colima.
Pseudoxiphophorus bimaculatus (Heckel): Sanborn, Vera Cruz; Mirador, Vera Cruz.
Pœcilia butleri Jordan: Salina Cruz, Oaxaca.
Pœcilia sphenops Cuvier & Valenciennes: Santa Maria, Vera Cruz.
Xiphophorus helleri Heckel: Sanborn, Vera Cruz.
Agonostomus monticola (Bancroft): Ixtapa, near the Bay of Banderas, Jalisco; Maria Magdalena Islands; Maria Cleofa Islands; Santa Maria.
Joturus pichardi Poey: Misantla.
Cichlasoma mento (Vaillant & Pellegrin): Rio Negro, Southern Mexico.
Cichlasoma beani (Jordan): Rosario, Sinaloa.
Cichlasoma heterodontum (Vaillant & Pellegrin): Isthmus of Tehuantepec.
Cichlasoma melanurum (Günther): Santa Maria, Vera Cruz.
Ethorichthys helleri (Steindachner): Santa Maria, Vera Cruz; Santo Domingo de Guzman.
Philypnus dormitor (Lacépède): Dominica and Santa Maria, Vera Cruz.
Gobius microdon Gilbert: San Juan Lagoon, north of Rio Ahome.
Chonophorus nelsoni (Evermann): Rosario, Sinaloa.
Chonophorus mexicanus Günther: Santa Maria.

GEOGRAPHICAL DISTRIBUTION OF FRESH-WATER FISHES OF MEXICO.

In the study of the distribution of fishes over any particular area it is necessary to consider the origin of the fauna or faunas represented, the means and routes of travel, and the significance of the barriers along these routes. None of the fishes in Mexico are able to travel overland, their only highways of travel being the streams and lakes.



MEXICO, SHOWING FISH FAUNAL AREAS.

It is often argued that fishes are taken accidentally by water birds from one body of water to the other. We have no positive evidence that this has ever been done, but we have enough negative evidence to warrant us in doubting its possibility. Without going into the discussion of this subject I will mention an example bearing upon it which is at least suggestive. When Shoshone and Lewis lakes in the Yellowstone Park were discovered, there were no fishes in them, while only a few miles distant were lakes and streams quite abundantly supplied. These streams and lakes were stocked through Two-Ocean Pass* from the head waters of the Snake River, but the falls in the Lewis River prevented the fishes from entering Lewis and Shoshone lakes. If water birds were at all active agents in the distribution of fishes, these two lakes would have undoubtedly been well stocked.

As shown by the foregoing lists, there are in Mexico four quite distinct fish faunas. Two of these have migrated or resulted through migrations from the north, one from the south, while the other had its origin within the country. The fish fauna of northern Mexico is essentially that of the Rocky Mountains and eastern United States. The two large rivers which have furnished highways through which this portion of Mexico became stocked with fishes are the Colorado and the Rio Grande. The former flows into the Gulf of California, the latter into the Gulf of Mexico. In their upper courses these two rivers are near each other, but their fishes are not the same. The only fish common to both river basins is a small dace, *Rhinichthys dulcis* (Girard), which is also found in the head waters of the Arkansas, the Missouri, and the Columbia rivers. From the Colorado River thirty-two species of fishes are known, twenty-two of which are thus far peculiar to this basin. Only four or five species of Colorado River fishes are at present known from the Rio Sonora and the Rio Yaqui; however the lower courses of these two rivers, where we would expect Colorado river fishes, have been but little explored.

There are in all about eighty-seven species known from the Rio Grande Basin; and according to Dr. Evermann and Dr. Kendall,† twenty-three of these are found in the Wabash River in Indiana. In the Rio Grande Basin in Mexico there are seventy species. It is interesting to note that eight of these have been found in the head waters of the Rio Yaqui, and eight in the head waters of the Rio Mezquital. In fact, the fish fauna of the head waters of these two streams is essentially that of the Rio Grande.

*Evermann, Bull. U. S. Fish Comm., 1891, 24.

†Bull. U. S. Fish Comm., 1892, 57-126.

The presence in the Rio Yaqui of so many fishes from the Rio Grande basin can be thus interpreted: The head waters of the Rio Paphigochic, a tributary of the Rio Yaqui, lie east of the central range of the Sierra Madre. That portion of this stream no doubt formerly had its outlet into the Rio Conchos and in this way became stocked with fishes from the Rio Grande. The fact that the fauna of the Rio Yaqui is so much like that of the isolated river basins in northern Mexico rather strengthens this belief, though its ultimate proof must depend on the geologist. The same is probably true concerning that portion of the Rio Mezquital which lies east of the central range of the Sierra Madre. It would be interesting to compare the fauna of the upper with that of the lower portion of these rivers. No collection of fishes has been made in the head waters of the Pacific Coast streams between the Rio Yaqui and the Rio Mezquital, but we may reasonably suppose that the portions of those streams east of the main range of the Sierra Madre contain Rio Grande fishes. From the Rio Presidio, which flows into the Pacific Ocean near Mazatlan, a collection of fishes was made (at Presidio) a short distance from its mouth by Dr. D. S. Jordan. Of the twelve species taken here, not one belongs to the northern fresh-water fauna. Two species* are brackish water fishes, one† belongs to the tropical fresh-water fauna, while the other species‡ are salt-water forms which have become more or less established in fresh water. The fishes listed from the lower portion of the Rio Presidio are much the same as those from the Rio San Jose in lower California. It is quite probable that the list of fishes from these two places fairly well represent the fish fauna of the lower portion of all of the Pacific Coast streams between the Rio Yaqui and the Rio Grande de Santiago. As mentioned before, it is probable that the portions of the upper tributaries of these rivers which lie east of the main range of the Sierra Madre have in them fishes belonging to the Rio Grande fauna, and this fauna has been obtained by capturing upper tributaries of the Rio Grande. All of these Pacific slope streams reach the sea evidently in a long series of cascades and falls which are sufficient barriers to prevent fishes from migrating in either direction. Fishes are limited in their ability to ascend falls, and we have reason to believe, as stated below, that they are unable to go over any considerable falls and become established below them. The Falls of the Yellowstone is the dividing line between the fauna of the Missouri River and that of the Upper Yellowstone. The Shoshone

**Pæcilia butleri* Jordan, *Pæcilia presidionis* Jordan & Culver.

†*Cichlasoma beani* (Jordan).

‡*Agonostomus monticola* (Bancroft), *Philypnus dormitor* (Lacépède), and *Chonophorus taiasica* (Lichtenstein) are found only in fresh or brackish water.

Falls is also the dividing line between the fauna of the upper Snake River and of that portion of it below the falls. In both of these instances fishes belonging to the fauna above the falls have not become established below them.

It is quite probable that along the middle course of these Pacific slope rivers in Mexico there are no fishes, or possibly a few species of *Paciliidæ* or of some brackish or salt water form which was associated with the rivers in their formation. Many fishes no doubt go over falls and cascades, but not in quantities sufficiently large to enable the survivors to become established below them. A study of the fishes along the courses of these Pacific coast streams would be very interesting indeed.

The southern portion of the Mexican plateau is drained by two rivers; the one to the east, the San Juan del Rio, is a small stream which flows into the Rio Panuco; the other, the Lerma, is a tributary of the Rio Grande de Santiago, which flows into the Pacific. Judging from the nature of its fish fauna, the Valley of Mexico was formerly a part of the Lerma drainage system. The fish fauna of this region is very different from that either to the north or the south. From the area which includes the valley of Mexico the head waters of the San Juan del Rio and the Lerma basin, there are at present fifty-four species of fishes known, only two of which, *Myzostoma austrinum* Bean, and *Aztecula vittata* (Girard), have been taken in any other river basin. These fifty-four species belong to twenty-one* genera, eight of which are peculiar to this region.

Of the genera found elsewhere and which occur on the plateau, *Characodon* is represented in southern Mexico, central America, and Lower California; *Gambusia* comprises a number of small viviparous fishes usually inhabiting swamps and springs all the way from southern Illinois to Panama; *Goodea* is represented in the Rio Panuco and the Rio Balsas, and *Aztecula* in the Rio Balsas; one species of *Chirostoma* is found in the Rio Mezquitil; *Lampetra*, *Amiurus*, *Myzostoma*, *Nototropis* and *Hybopsis* are northern genera, and all except *Nototropis* are not represented by any species farther south than the Rio Lerma. Thirty-six of the fifty-four species found in this region belong to two families, twenty to *Paciliidæ* (the killifishes), and sixteen to *Atherinidæ* (the silversides). It is curious to note here that all of the killifishes are viviparous, yet only two species, *Gambusia infans*

*The genera in italics are peculiar to this region.

Lampetra 1, *Amiurus* 1, *Myzostoma* 1, *Xystrosus* 1, *Algansea* 4, *Falcula* 1, *Aztecula* 3, *Nototropis* 1, *Evarra* 2, *Hybopsis* 1, *Zoogoneticus* 6, *Girardinichthys* 1, *Characodon* 4, *Chapalichthys* 1, *Gambusia* 1, *Goodea* 2, *Skiffia* 4, *Poecilia* 1, *Chirostoma* 16, *Agonostomus* 1, *Cichlasoma* 1.

Woolman and *Pæcilia occidentalis* (Baird & Girard), have the anal fin of the male placed well forward and modified into an intromittent organ such as is characteristic of *Heterandria*, *Pæcilia* and the like. In the other species the anal fin of the male has its normal position and size, but it is slightly modified by the shortening of the first five or six rays, and their slight separation from the rest of the fin by a shallow notch. This modification was first noticed by Günther in *Characodon lateralis* Günther. It was also described by Bean in *Zoogoneticus robustus* (Bean), and by Jordan and Snyder in *Goodea atripinnis* Jordan, but no significance was attached to it. Just what part this fin plays in fertilizing the eggs in the body of the female is not known, but it evidently plays a prominent part in this operation.

I was so fortunate as to collect these fishes during the breeding season and thus their viviparity was easily proved. The largest killifish known from the Lerma basin reaches a length of 8 or 10 inches. The accompanying figure was made from a photograph of the largest female of this species I was able to obtain. The ovary consists of a membranous sack with a number of infolded partitions. Removing a portion of one side shows the ovary full of quite well developed young. The little fishes are not arranged in any definite order.

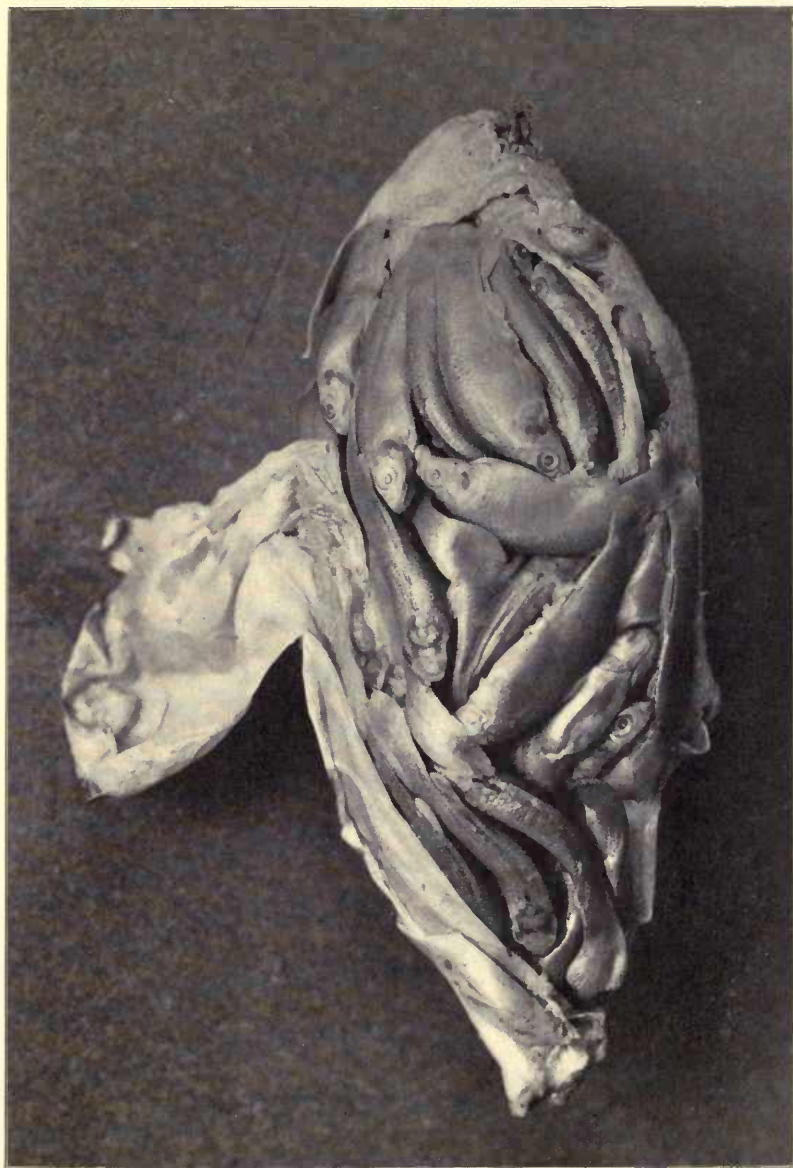
The spawning time of these fishes is near the close of the dry season. At this time the water is more concentrated, as is also the food on which the young must feed. The aquatic insects, crustaceans and small fishes which would feast on the eggs if deposited then are also more concentrated, so that depositing the eggs at this time would mean considerable destruction to the species. As it is, the young are born in a well-developed stage, and reach some size before the wet season sets in. They are then perhaps in the best condition to become widely distributed as the volume and area of water increases. As the dry season approaches again, and the small streams and ponds become dry, some of these small fishes perish. They are, however, present everywhere to establish themselves in any body of water which may carry them through the next rainy season.

The gestation of many tropical fishes presents some strange peculiarities. Some of the catfishes carry the eggs in the mouth till hatched, while a few others are thought to be viviparous. Viviparity among the tropical killifishes seems to be the rule rather than the exception. It would seem that in the tropical fresh waters of America there is much more provision made for the care of the young than in the cooler waters of the northern continent.

It is rather surprising to find such a large number of *Chirostoma*



GOODEA LUITPOLDI (Steindachner). OVARY WITH YOUNG EXPOSED.
No. 3613, Field Columbian Museum.



OVARY OF GOODEA LUITPOLDI (Steindachner).

in the Lerma basin; indeed, no other river in North America has so large a proportion of its fishes belonging to a salt-water* family. It is probable that when this basin is more thoroughly explored the number will be considerably increased. I had seen but few specimens of *Chirostoma* before going to Mexico, and thus had never had an opportunity to study these fishes. And while I was careful to pick up specimens of all species observed, yet my unfamiliarity at that time with the group caused me, no doubt, to overlook some species. Again, there are a number of small isolated lakes which have never been visited. It is known that some of these lakes, as Patzcuaro and Zirahuen, have in them one or more characteristic species, and no doubt most of the others also have. The Lerma River system is far from being thoroughly explored, but apparently its fishes are quite as distinct and characteristic as if the fauna were insular. This area has been in a center of distribution.

The Rio Balsas is one of the largest rivers in Mexico. It is south-east of the Lerma, and drains about an equal area; and though these two rivers are so near each other, only one species is known to be common to them. But one species of silversides and four of killifishes are known from the Rio Balsas, yet these two families comprise two-thirds of the fishes of the Lerma basin. Only the upper and northern tributaries of the Rio Balsas have been explored; however, enough has been done to indicate the nature of its fauna and that it contains comparatively few species of fishes.

The South and Central American faunas prevail largely as far north as the City of Mexico. The few forms which extend farther north apparently keep to the lowland streams; especially is this true on the Pacific side. The most northern representative of the southern American fauna, one of the Cichlids, is found at Mazatlan. On the east coast this family has a representative in Texas.

Mexico in general is not a well watered country. Nearly all of the small streams and many of the large ones become much reduced in size by the end of the long dry season, and such streams never sustain a large number of species of fishes. On the Mexican plateau the largest and most important lakes are found in the Lerma basin; Lake Chapala, being the largest and the only one which has a river outlet and inlet, sustains the largest fish fauna. Patzcuaro, a large lake with no inlet nor outlet, does not have so varied a fauna, but supports a large number of individuals. In view of the fact that more species of fishes belong to tropical Mexico than to a like area farther north,

*The *Chirostoma* are the only fishes belonging to a salt-water family found on the Mexican plateau.

it seems strange that a great river like the Balsas which lies wholly within the tropics should contain so few species. This river is fed by many mountain streams, and even in the dry season contains an abundance of clear water. Collections of fishes have been made at eight places in this river basin, and in all only twelve species of fishes have been taken, a number much fewer than one would expect.

SHORE FISHES WHICH HAVE BECOME MORE OR LESS ESTABLISHED IN THE FRESH WATERS OF MEXICO.

There has been a tendency in this as in other countries for salt-water fishes to become established in fresh water. Some of these may properly be considered as fresh water species.* The others are properly shore fishes found in fresh water, and usually at a considerable distance from the sea. Below is given a list of these species:

<i>Tylosurus marinus</i> (Walbaum).	<i>Dormitator maculatus</i> (Bloch).
<i>Thyrina crystallina</i> (Jordan & Culver).	<i>Eleotris pisonis</i> (Gruelin).
<i>Menidia lisa</i> Meek.	<i>Eleotris pictus</i> Kner & Steindachner.
<i>Mugil cephalus</i> Linnaeus.	<i>Gobius parvus</i> Meek.
* <i>Agonostomus monticola</i> (Bancroft).	<i>Gobius claytoni</i> Meek.
<i>Neomugil digueti</i> Vaillant.	<i>Chonophorus nelsoni</i> (Evermann).
<i>Joturus pichardi</i> Poey.	* <i>Chonophorus taiasica</i> (Lichtenstein).
<i>Centropomus mexicanus</i> Bocourt.	<i>Chonophorus mexicanus</i> (Günther).
<i>Pomadasys templei</i> Meek.	<i>Gillichthys detrusus</i> Gilbert & Scofield.
<i>Pomadasys starri</i> Meek.	<i>Achirus mazatlanus</i> (Steindachner).
* <i>Haploidonotus grunniens</i> Rafinesque.	<i>Achirus fonsecensis</i> (Günther).
* <i>Philypnus dormitor</i> Lacépède.	<i>Achirus fasciatus</i> Lacépède.

The species of *Chirostoma* belong to a salt-water family; they are, however, confined to the Mexican plateau, and cannot be regarded as shore fishes, and so are not included in the foregoing list.

GAME FISHES OF MEXICO.

The large-mouthed black bass which is abundant in the streams of northeastern Mexico as far south as the Rio Soto la Marina, and the trout in the mountain streams of the Pacific slope in Sonora Chihuahua and Durango are the only fishes in northern Mexico which can properly be called game fishes. Each of these species is confined to a rather small area. In the streams of southern Mexico there are no game fishes. The Cichlids are abundant, but will not take the hook in a manner that would best please the professional angler. There are in these southern streams a species of *Centropomus* and two of *Pomadasys*, usually called by the natives Roballo, which are regarded as game fishes. They are not properly fresh-water fishes,

although they are found in the rivers at a considerable distance from the sea; it is quite probable that these are not abundant enough to make them of importance to the angler.

FOOD FISHES OF MEXICO.

Many of the fresh-water fishes of Mexico are used for food by the natives. Of these the trout and the black bass are probably the best. There are several species of the catfish family which are large enough for the market. In the Valley of Mexico, and in the basin of the Rio Lerma are several species of *Chirostoma*, known as Pescados Blancos (whitefishes), which are excellent food fishes, but none of these will take the hook. The smaller species of the whitefishes are dried in large quantities in this region and shipped to different parts of the republic.

The Trucha, or trout (*Agonostomus monticola* Bancroft), is a first-class food fish, but it is found nowhere in any considerable numbers. The Cichlids, which much resemble our sunfishes in form and general habits, are only fair food fishes. They are very abundant in all of the rivers of southern Mexico, and in the Atlantic coast streams north to Texas. Most of the fishes seen in the markets of the City of Mexico are brought from Vera Cruz, and are salt-water forms. A few whitefishes are shipped from Lago de Chapala to the City of Mexico, and some are brought in from the neighboring lakes. Many buffalo fishes are eaten in the region where found, but these are regarded as considerably inferior to the catfishes. Tamales are made of the Juilis, *Algansea tincella* (C. & V.), taken from the lakes in the Valley of Mexico. The species of garpike found in the Rio Panuco find a ready sale in the markets of Tampico. It is quite probable that the flesh of these fishes, like that of the fresh-water drum (*Haploidonotus grunniens* Raf.), improves in southern waters. In the Great Lake region of North America the drum is quite worthless for food, but in Louisiana it is an important market fish. The negroes along the lower portion of the Arkansas river eat many garpike and consider them as good for food as the catfishes. The larger species of the killifishes, *Pæciliidæ*, in the basin of the Rio Lerma, some of which in this region reach a length of eight inches, are quite important food fishes.

FISH CULTURE IN MEXICO.

Very little has been done in Mexico in regard to stocking streams with fishes not native to the country. Goldfish and carp are quite abundant in the lakes in the Valley of Mexico, and also in some of the

tributaries of the Rio Lerma. I was not aware until March 18, 1903, that any effort had ever been made in Mexico to hatch trout, at which time I made a trip from the city of Mexico to Lerma, the head waters of the river of the same name, to collect fishes there. The station agent kindly directed me to a German, Mr. Vincente Richter, living some six miles distant, whom he said had many fishes. On arriving at Mr. Richter's house I was much surprised to see a quite well regulated fish hatchery, which has been in existence for about fifteen years, in full operation. It is on the hacienda owned by Señor Eduardo Gonzales, to whom the government pays a fixed annual sum for its maintenance. One-half to one million of eggs of the rainbow trout are hatched here annually. Several large springs form the source of the Rio Lerma at this place, and from these an abundance of water is obtained for the hatchery. The temperature of the water at its source is about 55° F., and its volume is so great that the temperature is not more than one or two degrees higher when it reaches the hatching troughs. Considering the great abundance of water, and the facility for making suitable ponds at only a moderate expense, the abundance of small crustacea, insect larvæ, and the like, which are excellent food for the young trout, Mr. Richter is certain that trout can be raised here for the markets of the City of Mexico with profit. There are native trout in the Pacific streams of Mexico as far south as Durango. The experience of Mr. Richter indicates that trout will flourish as far south as the Rio Lerma. On the Atlantic slope near Jalapa are many mountain streams flowing through dense forests in which I believe trout would flourish. In many of these streams there are few or no fishes. The fact that there are no fishes in some of these streams, is, however, no indication that fishes will not live in them. Fishes are evidently not there because they have not been able to ascend the many falls and cascades, and at the head waters it is quite evident that there has been no center of distribution.

One of the most promising fields for the introduction of food and game fishes is in the Lerma Basin, for in this region are many streams and lakes in which many species of small fishes abound which would furnish an abundant supply of food for the larger introduced species.

In introducing fishes into a country the conditions should be carefully studied in order to avoid the selection of unsuitable species. The lakes in the Lerma basin should in my opinion be an ideal place for the large-mouth black bass. The rainbow trout would probably do quite as well and not disturb the present fish fauna as much as would the black bass.

COMMON NAMES OF MEXICAN FRESH-WATER FISHES.

Many common names applied to the fresh-water fishes of Mexico are used in a collective sense, and so do not apply to any particular species. Below are given some of these names and the names of the fishes to which they are applied.

The garpikes and the needle fishes are known by the name Muja.* Bagre is the name generally applied to catfishes. I heard no other name applied to these fishes south of the City of Mexico. For the catfishes in the streams north of Tampico several names are used, and rather indiscriminately, and I am uncertain in my distribution of them. Besugo is probably applied to *Leptops olivaris* Raf., and to dark-colored individuals of *Amiurus*. Petonte is applied to the channel cats and to *Amiurus lupus* (Girard), which much resemble them. Metalote is a buffalo fish, this name being applied to all of the species north of Tampico. Lisa is applied to *Myzostoma congestum* (B. & G.), to species of the genus *Mugil*, and to *Menidia lisa* Meek, a species of silverside. *Nototropis boucardi* (Gth.) is known as Salmichi. *Algansea tinella* (C. & V.) is called Juilis. The other species of minnows are known as Sardina. The name Sardina is commonly used for silvery colored fishes as the Dorosomatids or gizzard shads. Anguilla is the name of the eels. Mixpapatl is applied to *Goodea whitei* Meek. Roballo is the name of the black bass; this name is also used for *Centropomus mexicanus* (Boc.). The black bass is sometimes called Besugo. The fresh-water drum and the species of *Pomadasys* in the Rio Panuco are known as Dorado. Mojarra is applied to the Cichlids and some of the larger *Pæciliidæ* where Cichlids are not found. Metapil is applied only to *Philypnus dormitor* Lac. Trucha is the name of *Agonostomus monticola* (Bancroft) and Bobo is *Joturus pichardi* Poey.

DEFINITIONS AND EXPLANATIONS OF TERMS USED IN THE DESCRIPTION OF FISHES IN THIS WORK.

In order to be able to identify a fish, or rather to know just what species any particular fish may be, there are some things regarding its anatomy that should be known. In the accompanying figure of the large-mouth black bass the important parts of the external anatomy are indicated by name. All of the parts represented on this fish do not occur on all fishes, and so it will require some care to make out those that are present. A careful study of this figure, and the following definitions and explanations, will enable one to easily use the keys and descriptions in this work. A little practice will make the identification of most of the species comparatively easy.

*I will not vouch for the correct spelling of some of these names.

- | | |
|-----------------------------|---|
| 1. Head. | 13. Spinous portion of dorsal fin. |
| 2. Snout. | 14. Soft portion of dorsal fin. |
| 3. Eye. | 15. Base of dorsal fin. |
| 4. Premaxillary. | 16. Pectoral fin. |
| 5. Maxillary. | 17. Anal fin. |
| 6. Supplemental maxillary. | 18. Ventral fin. |
| 7. Mandible, or lower jaw. | 19. Base of caudal fin (last vertebra). |
| 8. Symphysis. | 20. Caudal fin. |
| 9. Cheek. | 21. Lateral line. |
| 10. Preopercle, } | 22. Depth of the fish. |
| 11. Opercle, } Gill covers. | 23. Depth of caudal peduncle. |
| 12. Subopercle, } | 24. Caudal peduncle. |

The PROFILE of the fish, unless otherwise mentioned, is the curve from the highest point on the back to the tip of the snout. The ORIGIN of the DORSAL or ANAL FIN is the insertion of its first spine or ray.

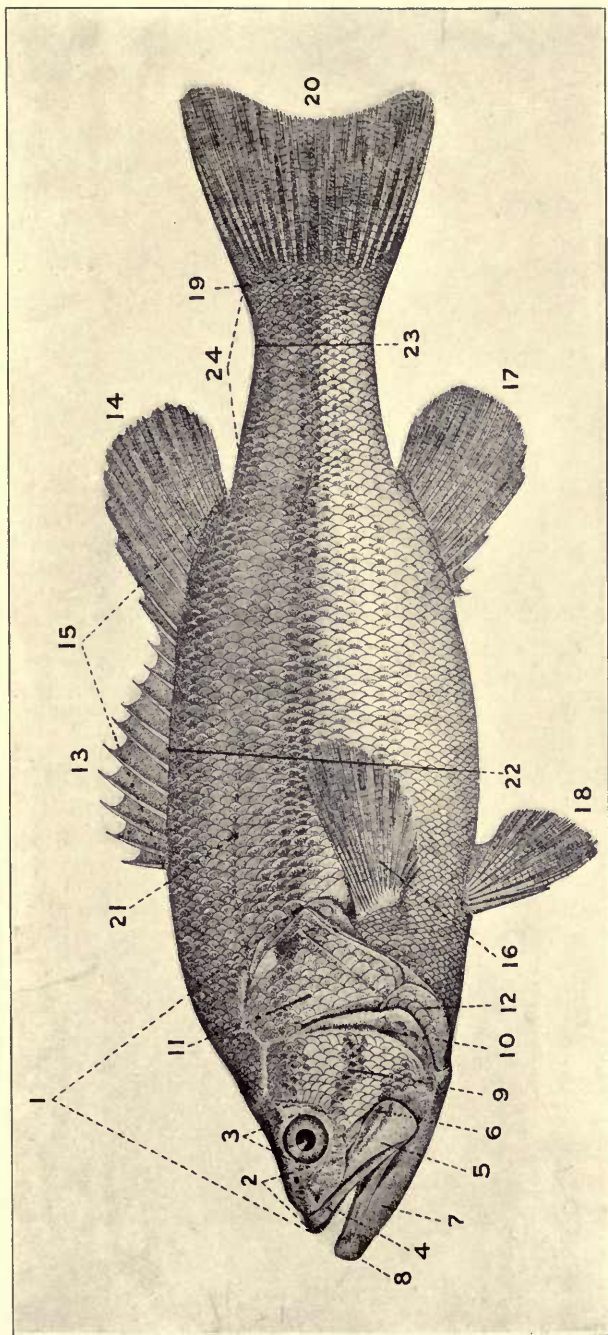
Fishes in general, and especially those treated of in this work, breathe by means of GILLS, which are fine hair-like projections (BRANCHIÆ) usually supported on the outer curves of cartilaginous or bony arches known as GILL ARCHES; in the true fishes the normal number on each side is four. The GILL RAKERS are a series of bony appendages variously formed along the inner edge of the anterior gill arch.

The GILL MEMBRANES usually serve to attach the GILL COVERS to the ISTHMUS, which is the thick, fleshy projection between the gill openings. The BRANCHIOSTEGAL MEMBRANES are attached to the lower posterior portions of the gill covers; the cartilaginous or bony supports of this membrane are the BRANCHIOSTEGAL RAYS.

The PSEUDOBANCHIÆ are small or imperfectly developed gills on the inner side of the opercle, near its junction with the preopercle.

The PHARYNGEAL BONES are behind the gills and at the beginning of the ŒSOPHAGUS; in true fishes they represent a fifth gill arch.

In general the TEETH of fishes are conical and pointed; frequently some are INCISOR or MOLAR-LIKE. Occasionally, as in some of the killifishes (*Characodon*, *Goodea*, and *Skiffia*, etc.), the incisor-like teeth are BICUSPID or (*Cyprinodon*) TRICUSPID. The upper teeth of fishes may be attached to one or more of the following bones: PREMAXILLARY, MAXILLARY, PREFRONTAL, VOMER, PALATINE, PTERYGOID, and UPPER PHARYNGEALS; lower, to the MANDIBLE, TONGUE, and LOWER PHARYNGEALS. In some fishes treated of in this work, as the Large-mouth Black Bass, teeth are present on nearly all of the parts of the mouth and pharynx as above mentioned; in the suckers and minnows teeth are present only on the pharyngeal bones. Fishes do not masticate their food; the teeth are used chiefly for catching, holding, and break-



Large-mouth Black Bass, *Micropterus salmoides* (Lacépède), showing parts referred to in descriptions of fishes.



ing the objects used for food in pieces which will admit of being swallowed.

The fins of fishes are composed of SPINES and RAYS, the former being stiff, bony structures usually connected by a thin membrane; the rays are rather weak, jointed cartilaginous structures and are also connected by a thin membrane. SPINES are present on one or more fins of all of the spiny rayed fishes. The dorsal and the pectoral fins of some of the soft rayed fishes, as the Carp and the Catfishes, are preceded by a spine which is only the modification of one or more of the soft rays. Most fishes, except Catfishes, are covered with SCALES. A CYCLOID SCALE has its posterior margin smooth; such scales are usually found on soft rayed fishes. A CTENOID SCALE has its posterior margin rough or toothed; such scales are characteristic of the spiny rayed fishes.

The LENGTH of the FISH is measured from the tip of the upper jaw to the base of the caudal fin or end of last vertebra, the TOTAL LENGTH from extreme ends of the fish. The LENGTH of the HEAD is measured from tip of upper jaw to the posterior edge of the opercle, the LENGTH of SNOUT from tip of upper jaw to anterior margin of the orbit. The DEPTH of the BODY is measured at its deepest part, none of the fins being included; the DEPTH of CAUDAL PEDUNCLE is measured at its narrowest part, its length from base of last anal ray to end of last vertebra. Only fully developed fin rays are counted, the rudimentary dorsal and anal rays when closely adnate to the first ray is counted as one; when the last ray is double and the two parts have the same base it is counted as one ray. The SCALES in the LATERAL SERIES are counted from upper edge of opercle to base of caudal fin, the TRANSVERSE SERIES from the dorsal fin to ventrals or origin of anal, whichever is nearest the middle of the body. In making the transverse count the scale on the lateral line, when it is present, is counted with those on upper part of body. The LENGTH of the DORSAL and ANAL FINS is measured along their BASES, the HEIGHT is the length of their spines or rays. The length of the other fins is measured from attachment to the body to the tips of longest rays.

Substantially the same order is followed in all descriptions. The comparative measurements which best indicate the general form of the fish are given first; the number of spines and rays of the dorsal and anal fins next, and the number of scales in the lateral and transverse series last. These are followed by a general remark on the form of the fish, and then other important specific points are given in detail. The description of the color is given last.

In order to abbreviate, the following expressions are used: "HEAD

4" or "HEAD $4\frac{2}{3}$ " indicates that the head of the fish is contained 4 times or $4\frac{2}{3}$ times in the distance from the tip of the snout to the end of the last caudal vertebra; "DEPTH 4" that the greatest depth (none of the fins being included) is contained 4 times in the same distance; "D. 8," indicates that the fish has a single dorsal fin which is composed of 8 soft rays; "D. IV, 9," that the dorsal fin is single and is composed of 4 spines and 9 soft rays; "D. IV-9," that there are two dorsal fins, the first one composed of 4 spines and the other of 9 soft rays. Spines are always indicated in roman letters, soft rays by figures. The abbreviations used in the count of other fin rays and spines are similarly explained. The diameter of the eye, the length of the snout, and many other short measurements are compared with the length of the head. "EYE 3 IN HEAD," "SNOUT 3 IN HEAD," indicate that each is contained 3 times in the length of the head. In these particular cases " $\frac{1}{2}$ of the length of the head" would mean the same thing.

All of these measurements are so far as possible intended to apply to mature fish of average size; a certain amount of allowance must, however, be made for age and individual variation. Young fishes usually have larger eyes, shorter snout, smaller mouth, and longer fin rays than adults of the same species; more often they are also deeper, but this is not always true.

At the close of each description the approximate length of the adult of the species is given. The size of fishes is more dependent on environment than in case of any other group of vertebrates. Fishes in large bodies of water grow much more rapidly and larger than the same species under other conditions. If food is plentiful and easily obtained the fish will eat oftener than where less favored. It is not necessary for a fish to eat as much as one meal each day; he may eat once each week, or even once each month, without apparently experiencing the evil effects of hunger, but in such cases his growth will be somewhat retarded.

For convenience in classification, and to afford an expression of relationship, fishes, or fish-like vertebrates, are divided into classes, each class into ORDERS, ORDERS into GENERA, and each GENUS comprises one or more SPECIES.

The catfish of the Rio Balsas is classified as follows:

Class, PISCES.

Order, NEMATOGNATHI.

Family, SILURIDÆ.

Genus, ISTLARIUS.

Species, BALSANUS.

Each of these divisions may be divided into sub-groups.

The scientific name of a fish is a combination of the name of the genus and the species. The large catfish (Bagre) found in the Rio Balsas belongs to the genus *Istlarius* and its specific name is *balsanus*. Its scientific name is *Istlarius balsanus*. The scientific names as they are usually written, and as they appear in this work, are followed by the name of the person or persons who first described the fish and proposed the specific name for it. The name referred to above is properly written *Istlarius balsanus* Jordan & Snyder.

Under the description of each order, family, and genus a key is given to facilitate the identification of the species. These keys are arranged as far as possible on the alternative basis. To use the key, examine the fish in hand and read the first statement lettered "a"; either that or its alternative, lettered "aa," is true. Next read the lettered statement below "a" or "aa" as the case may be, and continue until a letter is reached under which there are no subdivisions, when you will be brought to an order, family, generic, or specific name. The page indicated by the figure following this name contains the description of the family, genus, or species, as the case may be, to which your fish belongs. If a family, read the key to the genera, then to the species, which will refer you to the description of the species of the fish in question.

In order to find at once the family to which the specimen in hand belongs it is better to use the artificial key to the Families of Fishes on the following page.

In all of the keys in this work, except this one, the sequence of the orders, families, genera and species, as the case may be, is the same as the descriptions. It must be borne in mind that this work treats only of fishes known to inhabit the fresh waters of Mexico north of the Isthmus of Tehuantepec.

Reference is made under each genus to the original description, and the type of the genus. No other reference is given unless the synonym is based on forms found in Mexico or is deserving of subgeneric rank. Under the name of each species the first reference is to the original description and the type locality; references are also made to Dr. Günther's Catalogue of Fishes of the British Museum (1), to his Fishes of Central America (2), to Prof. Garman's Cyprinodonts (3), and to Jordan & Evermann's Synopsis of Fishes of North and Middle America (4). All other references relate only to Mexican fresh-water fishes. For aid in geographical study all known local-

(1) Günther, Catalogue, Fishes British Museum, 8 vols. 1859 to 1870.

(2) Günther, Fishes of Central America, 1 vol. 1869.

(3) Garman, The Cyprinodonts, Mem. Mus. Comp. Zool., vol. xix, 1895.

(4) Jordan & Evermann, Bull. 47, U. S. Nat. Mus. 4 vols. 1896 to 1900.

ities from which Mexican fishes have been taken are given with each reference. The names of places mentioned in parentheses preceding each description are localities from which the species was taken by me in 1903. In many cases the localities of the early authors are very indefinite. Frequently "Mexico" only is mentioned. A few of the definite localities as given which appear to be wrong are discussed under the species in question, it being intended that some one may be able to either verify these or to correct them.

DEFINITION OF THE TWO CLASSES OF FISHES OR FISH-LIKE VERTEBRATES INHABITING THE FRESH WATERS OF MEXICO.

The fresh-water fishes, or fish-like vertebrates of Mexico, belong to two classes: the *Marsipobranchii*, Lampreys, hag-fishes, and the like; and *Pisces*, the sharks, skates, and the true fishes. The former is represented by a single species of lamprey known at present only from the Lerma River Basin; the latter is represented by a large number of species of true fishes. Sharks and skates often ascend streams far above tide-water, but at present we have no evidence that any of these forms are permanent residents of the rivers of Mexico.

The fishes, or fish-like vertebrates, may be defined as cold-blooded vertebrates adapted for life in the water, breathing by means of gills, which are persistent throughout life, and having the limbs, if present, developed as fins, never with fingers and toes. The cerebral hemispheres are smaller than the optic lobes.

The two classes of fish-like vertebrates may be briefly defined as follows:

CLASS I. MARSIPOBRANCHII (THE LAMPREYS).

Skull imperfectly developed, without true jaws; gills purse-shaped, not attached to cartilaginous arches; a single median nostril; body eel-shaped.

CLASS II. PISCES (THE FISHES).

Skull well developed, and with jaws; gills attached to arches; nostrils not median, in one or more pairs.

ARTIFICIAL KEY TO THE FAMILIES OF MEXICAN FRESH-WATER FISHES.

- | | | | |
|-----|---|-----------------------|-----------|
| a. | Mouth subcircular, without true jaws; 7 gill openings on each side; no paired fins. | <i>Petromyzontidæ</i> | PAGE
I |
| aa. | Mouth normal, with true jaws; one gill opening on each side. | | |

b. Ventral fins present, abdominal.	
c. Adipose fin on dorsal region present.	PAGE
d. Body without scales; 4 to 8 long barbels about the mouth and nostrils; a single spine in each pectoral and dorsal fin.....	<i>Siluridæ</i> 8
dd. Body with scales, mouth without barbels; pectoral and dorsal fin without spines.	
e. Mouth large; teeth all conical; body elongate, depth $3\frac{3}{4}$ to $5\frac{1}{2}$; anal rays 10 to 12....	<i>Salmonidæ</i> 95
ee. Mouth smaller; teeth incisor-like or else rudimentary; body deep, compressed, depth $1\frac{2}{3}$ to $3\frac{1}{4}$, anal rays more than 18..	<i>Characinidæ</i> 83
cc. Dorsal region without adipose fin.	
f. Tail heterocercal; scales rhomboidal, very hard, ganoid	<i>Lepidosteidæ</i> 4
ff. Tail not heterocercal; scales normal, thin.	
g. Dorsal fin single, composed of soft rays only.	
h. Jaws toothless, head without scales.	
i. Ventral region without bony serræ; body elongate, not much compressed.	
j. Mouth usually inferior; lips thick, fleshy with plicæ or papillæ; pharyngeal teeth very numerous, in a row like the teeth of a comb; dorsal of more than 10 rays....	<i>Catostomidæ</i> 24
jj. Mouth usually terminal, lips thin, not fleshy, without plicæ or papillæ; pharyngeal teeth few, fewer than 8; dorsal fin with less than 10 rays (except in the carp)	<i>Cyprinidæ</i> 36
ii. Ventral region with bony serræ, body deep, much compressed	<i>Dorosomatidæ</i> 92
hh. Jaws with teeth; head more or less scaly.	
k. Lateral line wanting or represented by a few imperfect pores; jaws not produced into a long beak	<i>Pæciliidæ</i> 98
kk. Lateral line present, running as a fold along side of belly; both jaws produced into a beak	<i>Belonidæ</i> 160
gg. Dorsal fins 2, the first composed of spines, the second of soft rays.	
l. Anal spines 3; dorsal spines strong, 4	<i>Mugilidæ</i> 185

11. Anal spines single; dorsal spines slender, 3 to 8	<i>Atherinidæ</i> 165
bb. Ventral fins present, thoracic or jugular.	
m. Ventral fins each composed definitely of one spine and 5 soft rays; eyes symmet- rical, one on each side of the head.	
n. Ventral fins completely united; gill mem- branes joined to the isthmus; no lateral line	<i>Gobiidæ</i> 225
nn. Ventral fins separate.	
o. Nostril single on each side; lateral line in- terrupted; anal spines 3 to 11	<i>Cichlidæ</i> 204
oo. Nostril double on each side; lateral line not interrupted.	
p. Lateral line extending on caudal fin.	
q. Anal spines 3, the second very strong.	
r. Dorsal fins two, separate; preopercle with two margins, the posterior one strongly toothed	<i>Centropomidæ</i> 198
rr. Dorsal fins connected; preopercle with one margin	<i>Hæmulidæ</i> 199
qq. Anal spines 1 or 2	<i>Sciænidæ</i> 202
pp. Lateral line, if present, not extending on caudal fin.	
s. Dorsal fins separate or scarcely con- nected.	
t. Anal spines 3; the second very strong; body elongate, compressed	<i>Hæmulidæ</i> 199
tt. Anal spines 1 or 2; body usually slender, never much compressed.	
u. No lateral line; ventral fins with the inner rays the longest; dorsal spines 8 or less	<i>Gobiidæ</i> 225
uu. Lateral line present; ventral fins with the outer rays the longest; dorsal spines 8 or more	<i>Percidæ</i> 196
ss. Dorsal fin single, the spinous and soft portions being connected; body usually deep and much compressed.	
mm. Ventral fins each not composed definitely of one spine and 5 soft rays; eyes unsym- metrical, both being on the same side of the head	<i>Soleidæ</i> 234

bbb. Ventral fins wholly wanting, pectorals usually present.

PAGE

v. Snout not tubular with the small mouth at its end; body not covered with bony plates, eel-shaped.

w. Gill openings lateral and vertical; snout conic, the jaws not very heavy; gape longitudinal; lips thick; lower jaw projecting; teeth in cardiform bands on jaws and vomer

Anguillidæ 90

ww. Gill openings horizontal, inferior, very close together, apparently confluent; posterior nostrils in front of eye

Symbranchidæ 89

vv. Snout tubular, bearing the small mouth at its end; body angular, covered with bony plates, not truly eel-shaped.

Syngnathidæ 162



1. *Lampetra spadicea* Bean.

Lampetra spadicea Bean, Proc. U. S. Nat. Mus., 1887, 374; Guanajuato: Bean, Proc. U. S. Nat. Mus., 1892, 283; Tanganzicuaro: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 13.



FIG. 1. *LAMPETRA SPADICEA* Bean.
No. 38005, U. S. National Museum.

Basin of the Rio Lerma.

Infraoral lamina with 9 cusps, the outer largest; lingual teeth with about 20 pectinæ; 4 teeth on each side of buccal disk, one or more being tricuspid, the others bicuspid; dorsal fins separate, the interspace equaling half length of snout; second dorsal a little higher than the first, its origin near middle of body.

Color chestnut brown, somewhat lighter on the belly; basal portion of second dorsal pale; the remaining portion somewhat like the body. Length about 8 inches.

This species is probably distributed throughout the Lerma Basin. Dr. Dugès has collected several specimens in the upper waters of the Lerma near Guanajuato. It has also been taken by E. W. Nelson in Lago de Chapala.

CLASS II. PISCES.

THE FISHES.

Skeleton more or less ossified; skull separate from the segmented vertebral column; mouth with true jaws; limbs, shoulder girdle, and pelvic bones usually present; gills attached to imperfect skeletal arches, usually less than 6 gill openings on each side; nostrils one or more pairs; heart with arterial bulb; alimentary canal variable in form, and with pancreas and spleen.

KEY TO THE ORDERS OF PISCES.

	PAGE
a. Tail heterocercal; vertebræ opisthocœlian (concavo-convex); air bladder cellular; scales rhombic, enameled plates. <i>Rhomboganoidea</i>	4
aa. Tail not heterocercal; vertebræ amphicœlian (double concave); air bladder, if present, not cellular; scales, if present, of the ordinary sort.	
b. Anterior vertebræ (about 4) much modified, co-ossified, and provided with ossicula auditus; ventral fins, if present, abdominal and without spines.	
c. Maxillary bone imperfect, forming the base of a conspicuous barbel; no subopercle; no scales. <i>Nematognathi</i>	8
cc. Maxillary bone perfect (rarely wanting), never entering into the base of a barbel; subopercle present; scales usually present. <i>Plectospondylii</i>	24
bb. Anterior vertebræ unmodified, similar to the others or more elongate, separate and without ossicula auditus.	
d. Body eel-shaped; vertebræ numerous (100 to 250); scales minute or wanting; no ventral fins; pectorals usually present; gill openings restricted; four pairs of gill arches.	
e. Premaxillary, maxillary, and palatine bones well developed and distinct from each other as in ordinary fishes; pectoral and ventral fins wanting; gill openings confluent <i>Symbranchia</i>	89

ee. Premaxillary atrophied or lost; maxillaries lateral, more or less confluent with the palatines	<i>Apodes</i>	90
dd. Body not truly eel-shaped; vertebræ in moderate number (14 to 100); ventral fins usually present; gill openings not restricted.		
f. Ventral fins, if present, abdominal; fins without spines.		
g. Body stout, not covered with bony plates; gills laminated; ventral fins present, abdominal, without spines.		
h. Mesocoracoid well developed; pectoral fins inserted low	<i>Isospondyli</i>	92
hh. Mesocoracoid always wanting; head scaly; dorsal and anal fins without spines.		
i. Lateral line none, or imperfectly developed; air bladder with a persistent duct; lower pharyngeals separate	<i>Haplomi</i>	98
ii. Lateral line developed, concurrent with the belly; air bladder without duct in the adult; lower pharyngeals fully united ..	<i>Synentognathi</i>	160
gg. Body elongate, covered with bony plates which are firmly connected, forming a carapace; gills tufted; no ventral fins; gill openings small.	<i>Lophobranchia</i>	162
ff. Ventral fins usually anterior in position; spines usually present in the fins.	<i>Acanthopteri</i>	164

Order II. **Rhomboganoidea.**

THE GARPIKES.

This order comprises one family of living fishes. Tail heterocercal; vertebræ connected by ball and socket joints, the concavity of each vertebra being posterior; air bladder lung-like, but connecting with the dorsal side of the œsophagus.

Family II. **Lepidosteidae.**

THE GARPIKES.

Body elongate, subcylindrical, covered with hard rhombic ganoid scales or plates which are imbricated in oblique series running downward and backward; premaxillary forming most of the upper jaw; jaws long, spatulate or beak-like; teeth on jaws, vomer, and palatines;

some of the teeth in the jaws large and canine-like; tail heterocercal, the vertebræ extending into the upper lobe of the tail; an accessory gill on inner side of the opercle; spiral valve of intestines rudimentary.

This family is represented in North America by four species; three of these have been taken in Mexico, the other one is found in southeastern Texas, and probably occurs in the lower tributaries of the Rio Grande. The fishes of this family are especially interesting, because they are the last living relations of a large group of ganoid fishes now extinct.

2. *Lepidosteus* Lacépède.

THE GARPIKES.

Lepisosteus Lacépède, Hist. Nat. Poiss., v, 331, 1803. (Type, *Lepisosteus gavialis* Lacépède = *Esox osseus* Linnæus.)

Atractosteus Rafinesque, Ich. Ohiensis, 72, 1820. (Type, *Lepisosteus ferox* Rafinesque = *Lepidosteus tristæchus* Bloch & Schneider.)

Cylindrostæus Rafinesque, Ich. Ohiensis, 72, 1820. (Type, *Lepisosteus platostomus* Rafinesque.)

Jaws with one or more series of teeth, some being enlarged and fitting into a depression in the opposite jaw; usually some of the anterior teeth movable; teeth on vomer and palatines; in the young the anterior teeth are often enlarged.

KEY TO THE SPECIES OF LEPIDOSTEUS.

	PAGE
a. Large teeth of upper jaw in a single row on each side.	
b. Jaws long and slender; snout more than twice length of rest of head.....	<i>osseus</i> 5
bb. Jaws shorter and broader, little longer than rest of head.....	[<i>platystomus</i>] 6
aa. Large teeth of upper jaw in two series on each side; jaws short and broad, not longer than rest of head.	
c. Scales 60 in the lateral series; dorsal rays 8.....	<i>tristæchus</i> 6
cc. Scales 53 in the lateral series; dorsal rays 6.....	[<i>tropicus</i>] 7

Subgenus *Lepidosteus* Lacépède.

2. *Lepidosteus osseus* (Linnæus). LONG-NOSED GARPIKE; COMMON GARPIKE.

Esox osseus Linnæus, Syst. Nat., Ed. x, 313, 1758; after *Acus maxima squamosa viridis* of Artedi.

Lepidosteus osseus Günther, Cat., VIII, 330, 1870; North America. *Lepisosteus osseus* Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 109; Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 117; Tampico: Meek, Field Col. Mus. Pub. 65, 1902, 72; Santa Rosalia.

Great Lakes to the Carolinas and Mexico as far south as Tampico. (San Juan; Valles; Forlon.)

Head 3; depth 1½; D. 8; A. 9; scales about 62. Body elongate, cylindrical; jaws long and slender, beak-like; snout more than twice length of rest of head, its least width 15 to 20 in its length; large teeth of the upper jaw in a single row on each side; ventral fins with 6 rays.

Color olivaceous, pale, somewhat silvery below; vertical fins and posterior part of the body with round black spots, which are more distinct in the young; very young with a black lateral band. Length about 3 feet.

The most southern record of this species is Valles, in the Rio Panuco Basin. I saw quite a number in a deep sluggish creek at Forlon, but was unable to capture any of them. This species seldom exceeds a length of 3 feet, and except on the Arkansas River, I have never seen it used for food. It is easily distinguished from the other members of the family by its exceedingly long, narrow, beak-like jaws.

Subgenus *Cylindrosteus* Rafinesque.

Lepidosteus platystomus Rafinesque. SHORT-NOSED GARPIKE.

Lepisosteus platostomus Rafinesque, Ichth. Ohiensis, 72, 1820; Ohio River.

Lepidosteus platystomus Günther, Cat., VIII, 329, 1870; Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 110.

Mississippi Valley south to the Rio Pecos in Texas, ranging as far east as Florida.

Head 3½; depth 8; D. 8; A. 8; scales about 56. Body elongate, cylindrical; jaws broad, beak-like; snout usually about one-third longer than rest of head, its least width 5 to 6 in its length; large teeth of upper jaw in a single row on each side.

Color similar to the preceding, but usually darker. Length 2 or 3 feet.

This species probably occurs in northeastern Mexico.

Subgenus *Atractosteus* Rafinesque.

3. Lepidosteus tristæchus (Bloch & Schneider). ALLIGATOR GARPIKE; MANJUARI.

Esox tristæchus Bloch & Schneider, Syst. Ichth., 395, 1801; Cuba; after Manjuari of Para.

Lepidosteus berlandieri Girard, Pac. R. R. Sur., 353, 1858; Tamaulipas.

Atractosteus lucius Dumeril, Hist. Nat. Poiss., II, 364, 1870; Tampico, Mexico.

Lepidosteus tropicus Günther, Fishes, Cent. Amer., 490, 1866; Huamuchal.

Lepidosteus viridis Günther, Cat., VIII, 329, 1870; Huamuchal; Mexico.

Lepisosteus tristæchus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 111: Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 117; Tampico.

Rio Panuco north to the mouth of the Missouri River, south and east to Cuba. (Tampico.)

Head $3\frac{1}{2}$; D. 8; A. 8; scales about 60. Body elongate, cylindrical; jaws beak-like; snout usually shorter than rest of head, its least width $3\frac{1}{2}$ times its length; 18 to 20 scales in oblique series from ventrals to middle of dorsal fin; ventral fin with 6 rays.

Color greenish, pale below; the adult usually not spotted. Length 10 to 12 feet.

I saw quite a number of this species in the Tampico markets where it was regarded as a very good food fish. This fish is reported to be quite abundant in the large river channels and the lagoons about Tampico. It is one of our largest fresh-water fishes.

Lepidosteus tropicus (Gill). TROPICAL GARPIKE.

Atractosteus tropicus Gill, Proc. Acad. Nat. Sci. Phila., 1863, 172; streams near Panama.

Lepisosteus tropicus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 111: Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 139; Montecristo and Teapa, Tabasco.

Central America and southern Mexico, south of the Isthmus of Tehuantepec.

Head $3\frac{1}{2}$; depth 9; D. 5; A. 7; scales 53. Body cylindrical, rather short and stout; snout short and broad, its length less than half that of head; upper jaw the longer; teeth sharp, those of upper jaw in two lateral rows; enlarged teeth of lower jaw in one row; eye small; origin of dorsal fin slightly behind that of anal; pectoral rays 12; ventral rays 6.

Color leaden silvery above, white on belly; a few spots on posterior part of body; rays of dorsal, caudal, and anal dusky; the membranes pale; pectorals and ventrals pale. Length 2 feet, possibly much larger.

This species has not been recorded farther north than Montecristo, on the Rio Usumacinta, and Teapa on the Rio Teapa, both places being in the State of Tabasco. Its southernmost range is the Isthmus of Panama. It is very closely related to the preceding species.

Order III. **Nematognathi.**

THE CATFISHES.

Fishes with the four anterior vertebræ co-ossified, and with ossicula auditus; maxillary rudimentary, forming the base of a conspicuous barbel; no subopercle; body naked, or more or less covered with bony plates. A large order comprising several families, only one of which is represented in Mexico.

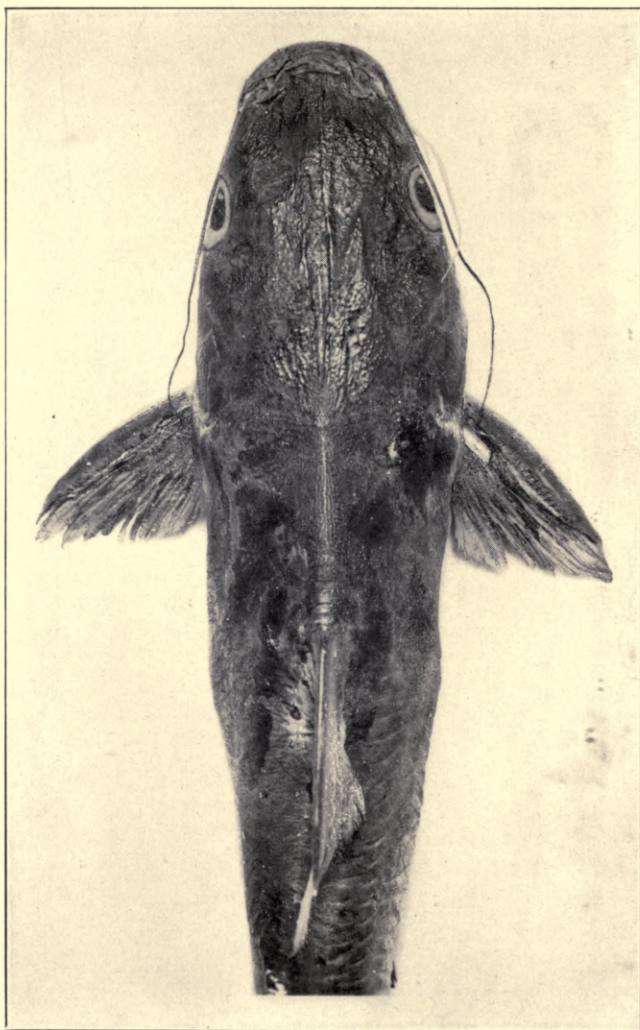
Family III. **Siluridæ.**

Body more or less elongate, naked or covered with bony plates; no true scales; anterior portion of the head with two or more barbels, the base of the longest pair formed by the small or rudimentary maxillary; margin of the upper jaw formed by the premaxillaries only; subopercle absent; opercle present; dorsal fin usually short, opposite to or in front of ventrals; adipose fin present; anterior rays of dorsal and pectoral fins spinous; air bladder usually present, large, and connected with the organ of hearing by means of auditory ossicles; lower pharyngeals separate.

The catfishes of Mexico allied to those found in the United States, have representatives known as far south as the Rio Usumacinta in Guatemala. None of the South American forms have yet been taken farther north than Cordoba and Orizaba.

KEY TO THE GENERA OF SILURIDÆ.

	PAGE
a. Adipose fin small, its posterior margin free.	
b. Nostrils close together, neither with a barbel, the posterior with a valve; teeth on palate <i>Galeichthys</i>	9
bb. Nostrils remote from each other.	
c. Posterior nostril with a barbel; barbels 8, the longest reaching past eye; teeth on the lower jaw well developed.	
d. Premaxillary band of teeth truncate behind, not produced backward at the outer angles.	
e. Supraoccipital bone continued backward from the nape, its notched tip receiving the bone at base of dorsal spine, so that a con- tinuous bony bridge is formed under the skin from snout to base of dorsal <i>Ichthyælorus</i>	10
ee. Supraoccipital bone not reaching inter- spinal bones; the bridge incomplete <i>Amiurus</i>	12



GALEICHTHYS AGUADULCE Meek.

dd. Premaxillary band of teeth with a lateral backward extension on each side.	PAGE
f. Lower jaw shorter than the upper; head not much depressed; anal rays 21 to 24..... <i>Istilarius</i>	17
ff. Lower jaw longer than the upper; head much depressed; anal rays 12 to 15..... <i>Leptops</i>	18
cc. Posterior nostril without a barbel; barbels 6, the longest not reaching eye; teeth in the lower jaw very weak..... <i>Conorhynchus</i>	19
aa. Adipose fin long, its posterior margin adnate to the back..... <i>Rhamdia</i>	20

Súbfamily **Tachysurinæ.**

3. Galeichthys Cuvier & Valenciennes.

Galeichthys Cuvier & Valenciennes, Hist. Nat. Poiss., v, 28, 1840.
(Type, *Galeichthys feliceps* Cuv. & Val., etc.)

Body more or less elongate; head armed with a bony shield above, behind which is an occipital shield; skull with a fontanelle; mouth rather small, the upper jaw the longer; villiform or granular teeth in each jaw; teeth on vomer and palatines; barbels 6, none at nostrils; adipose fin small, its posterior margin free; caudal fin deeply forked.

A large group of marine catfishes, especially numerous on sandy shores in tropical seas. It is not known to what extent these fishes enter fresh water.

4. Galeichthys aguadulce sp. nov. BAGRE.

Type, No. 4678, F. C. M., 11½ inches in length; Perez, Vera Cruz. Basin of the Rio Papaloapam.

Head 3¾; depth 4¾; D. 1, 6; A. 17. Body elongate, moderately compressed posteriorly; head long and slender, narrow forward, its greatest width 1½ in its length, not much depressed; mouth rather small, its width 3 in head; upper jaw the longer; teeth in jaws in villiform bands; vomerine teeth in two large patches, slightly separate from each other, and without backward projection; snout 2½ in head; diameter of eye 5½ in head; tip of maxillary barbel reaching slightly past base of pectoral, outer mental barbel to gill opening; gill membranes broadly connected to isthmus, their hinder margin free; top of head posterior to orbits granular; occipital process longer than broad; posterior margin of fontanelle midway between tip of snout and base of dorsal spine, the fontanelle extending as a groove nearly to occipital process; dorsal spine rather slender, its length 1½ in head; anterior margin of dorsal spine nearly smooth, its posterior margin slightly serrate; anterior margin of pectoral spine smooth,

the posterior finely denticulate; length of pectoral spine $1\frac{3}{8}$ in head; caudal fin deeply forked, the upper lobe the longer.

Color dark bluish above, much lighter below; the dark color on lower half of sides and on fins made up of small dark punctulations; ventral and pectorals and distal half of anal nearly black; caudal and dorsal with tips of rays black; belly white.

One specimen (type) from Perez.

Subfamily **Ichthyælorinæ**.

4. **Ichthyælorus** Rafinesque.

CHANNEL CATS; BAGRES.

Ictalurus Rafinesque, Ichth. Ohiensis, 61, 1820. (Type, *Pimelodus maculatus* Rafinesque = *Ictalurus punctatus* Rafinesque.)

Body elongate, slender, compressed posteriorly; head slender and conical; supraoccipital bone or process prolonged backward, its emarginated apex receiving the acuminate anterior point of the second interspinal, thus forming a continuous bony ridge from the head to the dorsal spine; mouth small, terminal, the upper jaw the longer; teeth in a short band in each jaw; dorsal fin with one spine and usually 6 soft rays; adipose fin short, with free posterior margin opposite posterior margin of anal fin; anal fin long, 25 to 35 rays; pectoral spine strong, retrorse-serrate within; caudal fin elongate, deeply forked.

The fishes of this genus live chiefly in river channels. As food fishes they are superior to other members of the catfish family in North America.

KEY TO THE SPECIES OF ICHTHYÆLORUS.

- | | | |
|-----|---|------------------------|
| a. | Anal fin very long, its base nearly $\frac{1}{3}$ its body, | PAGE |
| | its rays 32 to 35..... | <i>furcatus</i> 10 |
| aa. | Anal fin shorter, its rays 25 to 29. | |
| b. | Barbels long, extending considerably beyond | |
| | gill opening; anal rays about 26..... | <i>punctatus</i> 11 |
| bb. | Barbels short, the longest only reaching gill | |
| | opening; anal rays 28 or 29..... | <i>meridionalis</i> 11 |

5. **Ichthyælorus furcatus** (Le Sueur). CHUCKLE-HEADED CAT.

Pimelodus furcatus Le Sueur, in Cuvier & Valenciennes, Hist. Nat. Poiss., v, 136, 1840; New Orleans.

Pimelodus affinis Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854, 26, Rio Grande: Girard, Mex. Bd. Sur., 32, pl. xvi, 1859; mouth of the Rio Grande, at Brownsville, Texas.

Amiurus furcatus Günther, Cat., v, 103, 1864.

Amiurus affinis Günther, Cat., v, 103, 1864.

Ictalurus furcatus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896; 134: Jordan & Snyder, Bull. U. S. Fish Com., 1900, 171; Rio Tamesin, Tampico.

Rio Panuco north to Iowa and Ohio.

Head $4\frac{1}{2}$; depth 4 (in adults) to $5\frac{1}{2}$ (in young); D. 1, 6; A. 32 to 35. Body elongate; profile from snout to dorsal somewhat concave, especially in adults; head small; eye small, the middle of the head being behind its posterior margin; pectoral spine rather long; humeral spine stout, shortish, not reaching middle of pectoral spine; anal fin long, its base about 3 in body, its rays 32 to 35.

Color silvery, plain or somewhat spotted. Length about 4 feet.

A specimen of this species, which was reported to have been caught in the Rio Tamesoe, was purchased by Dr. Jordan in 1899 in the Tampico Markets. This species is known to reach a weight of 150 pounds, being the largest catfish known in American waters. It lives in clear running streams, and is an excellent food fish. Dr. Evermann informs me that this species was taken by E. W. Nelson in the Rio Soto la Marina, Tamaulipas.

6. *Ichthyælus punctatus* (Rafinesque). CHANNEL CAT; WHITE CAT.

Silurus punctatus Rafinesque, American Monthly Magazine, 1818, 359; Ohio River.

Ictalurus punctatus Woolman, Bull. U. S. Fish Com., 1894, 56; Rio Grande, El Paso, Texas: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 134.

Rio Panuco and streams tributary to the Gulf of Mexico, north in the Mississippi Valley to the rivers of the Great Lake region. (Forlon.)

Head 4; depth 5; D. 1, 6; A. 25 to 30. Body elongate, slender, back little elevated; head rather small, narrow, convex above; eye large, a little anterior of middle of head; mouth small; barbels long, the maxillary barbel reaching more or less beyond gill opening; humeral process long and slender; more than $\frac{1}{2}$ length of pectoral spine; pectoral spine strongly serrate behind.

Color light bluish above, the sides pale or silvery, and almost always with irregular, small, round dark spots; fins often with dark edging. Length about 3 feet.

This fish, though smaller, is very similar in appearance and habits to the preceding species.

7. *Ichthyælus meridionalis* (Günther). TROPICAL CATFISH; BAGRE.

Amiurus meridionalis Günther, Cat., v, 102, 1864; Rio Usumacinta.

Ictalurus meridionalis Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 135.

Large streams on the Atlantic side of the Isthmus of Tehuantepec. (Otopa.)

Head 4 to $4\frac{1}{2}$; depth 5; D. 1, 6; A. 28 to 29. Body elongate; head $\frac{1}{2}$ to $\frac{1}{3}$ longer than broad; snout obtusely rounded, the upper jaw longer than the lower; premaxillary teeth in a band, 5 or 6 times as broad as long; maxillary barbels reaching to end of head; outer mandibular barbels reaching to posterior margin of gill membranes; distance of origin of dorsal fin from tip of snout 2 to $2\frac{1}{6}$ in its distance from caudal fin, its spine finely retrorse-serrate on posterior margin; length of base of adipose fin equaling that of dorsal, the fin short; pectoral spine strongly retrorse-serrate on inner margin, its length $1\frac{1}{2}$ in head, the spine stronger and a little shorter than the dorsal spine; pectoral fin longer than ventral, $1\frac{1}{3}$ in length of head; ventral extending to origin of anal fin; caudal fin deeply forked.

Color brownish above, with steel blue reflections; lower half of body silvery, with a reddish tinge and finely punctulate with dark dots. Length of adults not known.

One specimen $5\frac{3}{4}$ inches in length was taken in the Rio Otopa at Otopa.

5. *Amiurus* Rafinesque.

THE HORNED POUTS.

Amiurus Rafinesque, Ichth. Ohiensis, 65, 1820. (Type, *Pimelodus cupreus* Rafinesque = *Pimelodus natalis* LeSueur.)

Haustor Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 135. (Type, *Gadus lacustris* Walbaum.)

Body moderately elongate, robust anteriorly, the caudal peduncle much compressed; head large, wide; supraoccipital extended backward, terminating in a more or less acute point, which is entirely separate from the second inter-spinal buckler; skin covering the bones usually thick; mouth large, the upper jaw in most species the longer; teeth in broad bands on the premaxillaries and dentaries; band on upper jaw convex in front, of equal breadth and without backward prolongation; adipose fin short, its hinder margin free; anal fin of 15 to 35 rays; caudal fin usually short, truncate or deeply forked; lateral line usually incomplete; all Mexican species so far known, except one (*Amiurus natalis*), with a deeply forked caudal fin.

KEY TO THE SPECIES OF AMIURUS.

a. Caudal fin lunate or forked.	PAGE
b. Base of anal fin longer than head, its rays 24 or more; upper jaw the longer.	
c. Head very broad, not narrowed forward; dorsal spine $2\frac{2}{3}$ in head; pectoral spine $2\frac{2}{7}$, its inner margin rough, but without teeth.....	<i>australis</i> 13
cc. Head less broad, and narrowed forward; dorsal spine long, its length $1\frac{1}{3}$ in head; pectoral spine $1\frac{3}{4}$ in head, its hinder margin with 7 to 9 retrorse teeth	<i>lupus</i> 14
bb. Base of anal fin equal to or shorter than the head; anal rays about 20.	
d. Dorsal spine long, $1\frac{2}{3}$ to $1\frac{5}{8}$ in head; pectoral spine weakly serrate on inner margin.	
e. Pectoral spine strong, its length 2 in head; caudal fin deeply forked, its inner rays less than half its outer	<i>dugesi</i> 14
ee. Pectoral spine moderate, its length $2\frac{2}{3}$ in head; caudal fin moderately forked, its inner rays $1\frac{1}{2}$ in the outer.....	<i>mexicanus</i> 15
dd. Dorsal spine short, $2\frac{1}{2}$ in head; pectoral spine short and strong and strongly serrate on its inner margin, its length $2\frac{1}{2}$ in head.....	<i>pricei</i> 15
aa. Caudal fin truncate, or very slightly lunate; anal rays 24 to 27	<i>natalis</i> 16

Subgenus *Haustor* Jordan & Evermann.

8. *Amiurus australis* sp. nov.

Type, No. 4474, F. C. M., 17.7 inches in length; Forlon, Tamaulipas.

Rio Panuco to the Rio Blanco in Southern Vera Cruz. (Forlon; Rio Blanco.)

Head $3\frac{3}{4}$; depth $5\frac{1}{4}$; D. 1, 6; A. 26. Body elongate, head broad and much depressed, its greatest width $1\frac{1}{4}$ in its length; interorbital $2\frac{1}{8}$; eye rather small, $6\frac{1}{2}$ in head; upper jaw considerably the longer; teeth on jaws in bands, and without backward projections; maxillary barbels long, their tips reaching middle of pectoral fin; dorsal spine $2\frac{2}{3}$ in head; pectoral spine rather strong, $2\frac{2}{7}$ in head, its inner margin rough, but without teeth; anal fin long, its base slightly longer than head; caudal fin forked, but less so than in species of *Ichthyolurus*; least depth of caudal peduncle 3 in head.

Color dark slaty blue, belly white, somewhat marbled with brownish; all of the fins very dark.

While in the Midland Bridge Company's Camp at Rio Blanco, one of the men caught a catfish 25 inches in length, which I identify with this species. The following are some of the notes made concerning it: total length, 25 inches; length to base of caudal $21\frac{3}{4}$ inches; length of head $5\frac{3}{4}$ inches; depth $5\frac{1}{4}$ inches; length of base of anal 6 inches; bridge from snout to dorsal fin not complete; maxillary teeth without backward extension; caudal fin forked, but not sharply, its lobes rounded; inner margin of pectoral fin but slightly serrate; body marked with dark blotches. Large catfish are reported from all of the large rivers which I visited south of Vera Cruz, but the specimen noted above is the only large one I saw.

9. *Amiurus lupus* (Girard). BAGRE; PETONTE.

Pimelodus lupus Girard, Pac. R. R. Sur., x, 211, 1858; Rio Pecos.

Amiurus lupus Günther, Cat., v, 101, 1864.

Ameiurus lupus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 137.

Rivers of northeastern Mexico and southeastern Texas. (San Juan; Montemorelos; Linares; La Cruz; Garza Valdez.)

Head $3\frac{3}{4}$; depth $4\frac{1}{3}$ to $4\frac{1}{2}$; D. 1, 6; A. 23 or 24. Body elongate, moderately compressed; head flat above, narrowed forward; upper jaw the longer; interorbital area $2\frac{1}{3}$ in head; snout $2\frac{2}{3}$ in head; diameter of eye $3\frac{2}{3}$ in head; maxillary barbel reaching almost to tip of pectoral spine; outer mandibular barbels reaching to base of pectoral; origin of dorsal nearer tip of snout than adipose fin; dorsal spine rather long and slender, its length $1\frac{1}{3}$ in head, weakly serrate on hinder margin; pectoral spine strong, with 7 to 9 retrose teeth on hinder margin (these becoming somewhat smaller in specimens 12 inches in length); pectoral spine $1\frac{3}{4}$ in head; base of anal fin longer than head, $3\frac{1}{2}$ to $3\frac{2}{3}$ in body; caudal fin deeply forked.

Color slaty brownish above, lighter below; sides finely punctulate; occasionally a few black spots on side made up of dots; fins dusky with more or less orange base; margin of vertical fins black. Length about 18 inches.

This species very much resembles in color and form *Ichthyaelurus punctatus*, from which it differs in having a somewhat less forked tail, larger eye, and a shorter anal. The supraoccipital is entirely separate from the interspinal buckler which makes it a true *Amiurus*. This species is abundant in the streams of northeastern Mexico. It lives mostly in river channels.

10. *Amiurus dugesi* Bean. BAGRE.

Amiurus dugesi Bean, Proc. U. S. Nat. Mus., 1879, 304; Rio Turbio, Guanajuato: Woolman, Bull. U. S. Fish Comm., 1894, 61; Rio Lerma, Salamanca, Guanajuato: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 138; Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 117; Lago de Chapala & Guadalajara market: Meek, Field Col. Mus. Pub. 65, 1902, 73; Ocotlan; La Barca; La Palma.

Amiurus catus Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 204; Estado de Jalisco.

Rio Lerma, and in Lago de Chapala, but does not occur in the lakes about the City of Mexico, nor in Lago de Patzcuaro.

Head $3\frac{2}{3}$; depth 5; D. 1, 6; A. 20. Body rather elongate; head moderate, flattish above; interorbital $2\frac{1}{2}$; eye $5\frac{1}{5}$; upper jaw slightly the longer; maxillary barbels reaching slightly beyond base of pectoral; pectoral spine strong, its length $1\frac{1}{4}$ in head, weakly serrate behind; base of anal $4\frac{1}{3}$ in body, shorter than the head; caudal fin deeply forked, its inner rays less than half length of outer rays.

Color light steel blue above, lighter below; margin of vertical fins black; body without black spots. Length 2 to 3 feet.

As a food fish, this is one of the most important in the region where found.

11. *Amiurus mexicanus* sp. nov. BAGRE.

Type, No. 4507, F. C. M., $11\frac{1}{2}$ inches in length; Rascon, San Luis Potosi.

Basin of the Rio Panuco. (Rio Verde; Rascon.)

Head $3\frac{2}{3}$; depth $5\frac{1}{2}$; D. 1, 6; A. 20 or 21. Body elongate, compressed behind; head flat, considerably depressed; interorbital $2\frac{1}{4}$ in head; upper jaw somewhat the longer; mouth wide, its width $1\frac{1}{3}$ in head; eye 6 in head; snout 3; dorsal spine moderate, its length $2\frac{1}{2}$ in head; pectoral spine nearly smooth on hinder margin (slightly serrate in young specimens), its length $2\frac{1}{4}$ in head; base of anal considerably shorter than head, $4\frac{1}{3}$ in body; caudal fin forked, but much less so than in *Amiurus lupus*; maxillary barbels reaching slightly beyond base of pectorals; outer mandibular barbel not reaching to gill opening.

Color dark steel blue, lighter below; sides of body without black spots; skin very rough, with fleshy hair-like projections. Length 12 to 18 inches.

I secured one large and one small specimen of this species at Rascon, and Dr. Tower collected three specimens at Rio Verde. It is probably one of the smaller catfishes of Mexico.

12. *Amiurus pricei* (Rutter). BAGRE DE SONORA.

Villarius pricei Rutter, Proc. Cal. Acad. Sci., 1896, 257; San Bernardino Creek, a tributary of the Rio Yaqui in southern Arizona: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 2799.

Ameiurus dugesi Bean, Bull. Amer. Mus. Nat. Hist., 1898, 168; Rio Verde, near San Diego, Chihuahua.

Ameiurus pricei Meek, Field Col. Mus. Pub. 65, 1902, 73; Miñaca. Streams of the Sierra Madre Mountains in Chihuahua, Sonora and Durango. (Lerdo; Durango.)

Head $3\frac{4}{5}$; depth 5; D. 1, 6; A. 19. Body elongate, head rather narrow; lower jaw the shorter; interorbital width $2\frac{1}{2}$ in head; eye small, 6 in head; maxillary barbels reaching slightly beyond gill openings; pectoral spine smooth in front, strongly retrose-serrate behind, its length $2\frac{1}{2}$ in head; base of anal $1\frac{1}{2}$ in head, $4\frac{1}{4}$ in body; caudal fin deeply forked, its inner rays about one-half the length of outer ones.

Color bluish above, lighter below; a few dark spots on the body; lobes of caudal edged with black. Length probably 2 feet or more.

All specimens of this species which I have seen were less than 12 inches in length. Mr. C. M. Barber, who has traveled extensively in Chihuahua and Sonora, informs me that there is a large catfish in the upper tributaries of the Rio Yaqui. It is quite likely that this is the species, and that it grows to a length of 2 feet or more.

Subgenus *Amiurus* Rafinesque.

13. *Amiurus natalis* (Le Sueur). YELLOW CAT.

Pimelodus natalis Le Sueur, Mem. Mus., v, 1819, 154; North America.

Ameiurus natalis Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 139.

Amiurus natalis antoniensis Jordan, Bull. U. S. Geol. Sur., 1878, 405; Brownsville, Texas.

Northeastern Mexico to the Great Lake region, and east to Virginia.

Head $3\frac{1}{2}$ to 4; depth 4 to 5; D. 1, 6; A. 24 to 27. Body not much elongate, usually rather deep and chubby; head wide and flattish, not much longer than broad, the mouth very wide; jaws equal or the lower the shorter; pectoral spine with a few teeth on its inner margin, its length about 2 in head; anal fin very long, its base about 4 in body; caudal fin truncate or slightly notched.

Color yellowish, greenish, or blackish, very variable. Length 12 to 18 inches.

The most southern record for this species is the Rio Grande at Brownsville, Texas. It is the only member of the family found in Mexico which does not have a decidedly forked tail.

6. *Istlarius* Jordan & Snyder.

Istlarius Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 118.
(Type, *Istlarius balsanus* Jordan & Snyder.)

Body elongate, somewhat compressed; teeth in villiform bands in both jaws, the one in the upper jaw with an angular posterior extension on each side; band of teeth in lower jaw with a median division growing narrow and pointed posteriorly; gill rakers long and slender, 17 on first gill arch; barbels 8; skin completely covering the head; supraoccipital bone widely separated from interspinal; humeral process short, almost hidden by the skin; adipose fin with its posterior margin free.

14. *Istlarius balsanus* Jordan & Snyder. BAGRE DEL BALSAS.

Istlarius balsanus Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 118; Rio Ixtla, Puente de Ixtla, Morelos: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3138; Meek, Field Col. Mus. Pub. 65, 1902, 72; Puente de Ixtla; Balsas.

Basin of the Rio Balsas. (Cuautla; Jojutla.)



FIG. 2. JAWS SHOWING TEETH OF *ISTLARIUS BALSANUS* Jordan & Snyder.

Head 4; depth $4\frac{2}{3}$; D. 1, 6; A. 24. Body oblong, deep, somewhat compressed; head narrow, not greatly depressed; upper jaw the longer; eye small, $5\frac{1}{2}$ in head; distance from tip of snout to origin of dorsal fin $2\frac{3}{4}$ in body; tips of maxillary barbels reaching slightly past base of pectoral; pectoral spine slightly serrate on inner margin; anal fin long, its base equaling length of head; caudal fin forked, the lobes equal; caudal peduncle robust, its least depth $2\frac{1}{3}$ in the head.

Color bluish slate above, light silvery below; a few small dark spots on head and sides; fins dusky. Length 3 feet or more.

This is the only member of the catfish family yet known from the basin of the Rio Balsas, where it lives in the clear deep water of the main stream and its larger tributaries. It is an excellent food fish.

7. *Leptops* Rafinesque.

MUD-CATS.

Leptops Rafinesque, Ichth. Ohiensis, 64, 1820. (Type, *Silurus viscosus* Rafinesque = *Silurus olivaris* Rafinesque.)

Body elongate, slender, much depressed anteriorly; head large, very wide and depressed; skin very thick, entirely concealing the skull; supraoccipital bone entirely free from the head of second inter-spinal; eyes small; mouth very large, the lower jaw always projecting beyond the upper; teeth in broad villiform bands on premaxillaries and dentaries; band on the upper jaw convex anteriorly, and at insertion of the maxillaries, proceeding backward as an elongated triangular extension; premaxillary band of teeth slightly divided at the symphysis; lower band of teeth attenuated at the corners of the mouth; branchiostigals 12; adipose fin large, its posterior margin free; dorsal and pectoral each with a spine-like ray; anal fin small; caudal oblong and truncate.

15. *Leptops olivaris* (Rafinesque). MUD-CAT; BAGRE; BESUGO.

Silurus olivaris Rafinesque, Amer. Monthly Mag., 1818, 355; Ohio River.

Amiurus punctulatus Günther, Cat., v, 101, 1864.

Leptops olivaris Woolman, Bull. U. S. Fish Comm., 1894, 56; Rio Grande, El Paso, Texas: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1895, 143; Meek, Field Col. Mus. Pub. 65, 1902, 74; Santa Rosalia.

Northeastern Mexico, north of the Rio Panuco, and streams of the southern United States and the Mississippi Valley.

Head $3\frac{1}{2}$; depth 6; D. 1, 7; A. 12 to 15. Body slender, depressed forward, the head extremely flat; lower jaw projecting; snout $3\frac{2}{3}$ in head; barbels short, maxillary barbels reaching slightly beyond base of pectoral; eye small, 7 in head; dorsal spine very weak, 2 in height of the fin; anal fin short, its base $6\frac{1}{3}$ in the body; humeral process short; pectoral spine strong, serrate on both edges, its length 3 in head; caudal fin slightly emarginate.

Color yellowish, much mottled with brown and greenish, whitish below. Length 3 to 4 feet.

This species is not recorded south of Santa Rosalia, but may be expected to range as far south as the Rio Panuco. It is one of the largest in the family, reaching a weight of 75 pounds, and is a much-used, excellent food fish.

Subfamily Pimelodinæ.

Conorhynchus Bleeker.

Conorhynchus Bleeker, Nederl. Tydschr. Dierk, 102, 1863. (Type, *Pimelodus conirostris* Cuvier & Valenciennes.)

Body elongate, nearly terete anteriorly, compressed posteriorly; snout pointed; mouth narrow; barbels 6; teeth in the upper jaw minute, the lower with very weak teeth or none; no teeth on palate.

Conorhynchus nelsoni Evermann & Goldsborough.

Conorhynchus nelsoni Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 140, fig. 1; Rio Usumacinta, Montecristo, Chiapas.

Atlantic streams from Chiapas to Brazil.

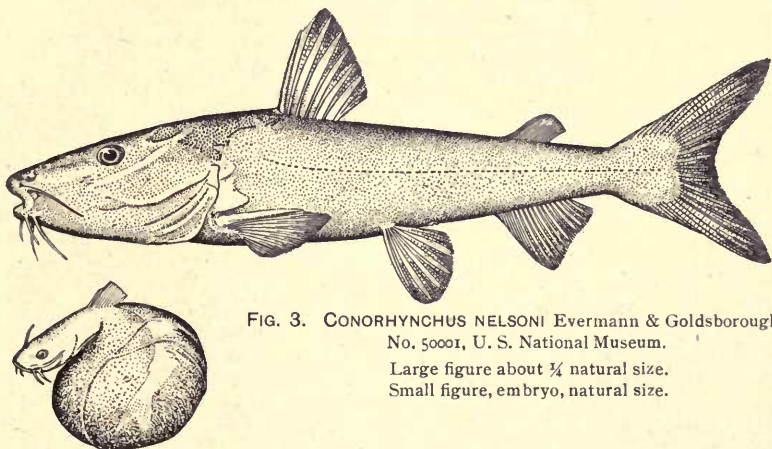


FIG. 3. CONORHYNCHUS NELSONI Evermann & Goldsborough.

No. 50001, U. S. National Museum.

Large figure about $\frac{1}{4}$ natural size.

Small figure, embryo, natural size.

Head $3\frac{1}{2}$; depth 5; D. 1, 6; A. 17. Body elongate, nearly terete, becoming somewhat compressed posteriorly; head conical, about as wide as deep; a granular saddle over occipital region, extending anteriorly to posterior portion of eye; a small granular saddle at base of front of dorsal; fontanelle long and narrow, extending an equal distance in front of and behind eye; a narrow transverse bridge equal to diameter of pupil just back of posterior border of eye; snout very long and pointed; mouth small, nearly circular; upper jaw the longer; barbels all very short; maxillary barbel not nearly reaching eye, its length 2 in snout; other barbels shorter; no teeth on vomer and palatines; teeth on upper jaw confluent in one broad patch, concave posteriorly; teeth in lower jaw very weak; buccal cavity very large; origin of dorsal midway between tip of snout and posterior base of anal; dorsal spine $2\frac{1}{4}$ in head, its upper posterior third roughly serrate; adipose fin large; pectoral spine $2\frac{1}{2}$ in head, its posterior edge very strongly serrate; caudal deeply forked, the upper lobe the longer.

Color light brown above lateral line with bluish reflections, silvery below, becoming pale on the belly; dorsal pale dusky; spine darker in front; inner edge of caudal lobes black. (Evermann & Goldsborough.)

The male of this species carries the eggs in his mouth during the period of gestation, during which time he is unable to eat any food. This peculiar custom, concerning which but little is known, is practiced by some South American catfishes.

8. *Rhamdia* Bleeker.

Rhamdia Bleeker, Ichth. Arch. Ind. Siluri., 1858, 197. (Type, *Pimelodus quelen* Quoy & Gaimard.)

Body more or less elongate; head not especially widened; occipital process small or wanting, not reaching the dorsal plate; fontanelle variously developed, not continued backward beyond the eye, except in the young; young usually with two bony bridges across the fontanelle, the one behind the eye the other in front of the occiput; in old specimens the entire fontanelle becoming obliterated; adipose fin very long, adnate for its entire length to the back; posterior nostril without a barbel; barbels 6.

Several species of this genus are recorded from Mexico, but the most of them probably occur south of the Isthmus of Tehuantepec. This group of fishes is not well known.

KEY TO THE SPECIES OF RHAMDIA.

	PAGE
a. Head $3\frac{3}{4}$ in length of body; anal rays 10	<i>oaxacæ</i> 20
aa. Head 4 to 5 in length of body.	
b. Head 4 to $4\frac{1}{2}$ in length of body.	
c. Anal rays 12, or 13; adipose fin $3\frac{1}{2}$ in body; eye $2\frac{1}{2}$ in interorbital area; head $4\frac{1}{3}$	<i>laticauda</i> 21
cc. Anal rays 9 or 10.	
e. Eye large, $5\frac{2}{3}$ in head	<i>brachyptera</i> 21
ee. Eye small, $7\frac{1}{2}$ to 8 in head	[<i>wagneri</i>] 22
bb. Head 5; depth 6; anal rays 13	<i>hypsélura</i> 22

16. *Rhamdia* *oaxacæ* Meek. BAGRE.

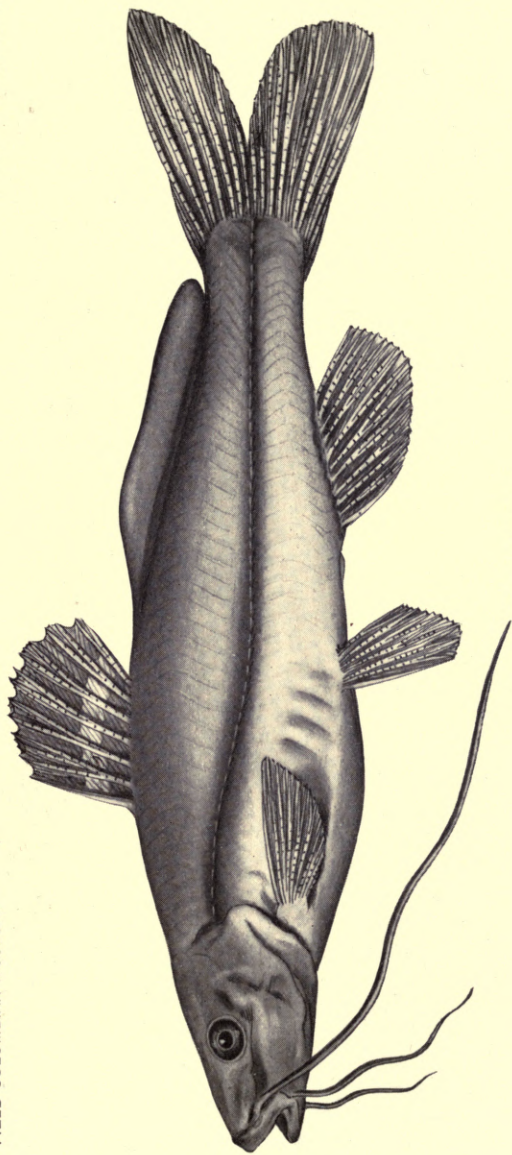
Rhamdia *oaxacæ* Meek, Field Col. Mus. Pub. 65, 1902, 74; Cuicatlan.

Streams of Mexico on the Atlantic side south of Vera Cruz. (Otopa; Cordoba; Rio Blanco; Motzorongo; El Hule; Obispo; Perez.)

Head $3\frac{3}{4}$; depth $5\frac{1}{3}$; D. 1, 6; A. 10. Body slender, stout anteriorly, compressed posteriorly; head large, flat, narrowed forward; interorbital space 3 in head; eye high up, small, its diameter $6\frac{1}{4}$ in head; occipital process $4\frac{1}{2}$ in head; width of mouth 2 in head; teeth in jaws in bands; maxillary barbel reaching to middle of base of adipose fin (slightly shorter in largest specimens, $6\frac{3}{4}$ inches in length); mental barbel reaching $\frac{3}{8}$ distance to base of pectoral; postmental to just past base of pectoral; humeral spine extending to about $\frac{1}{3}$ length of pectoral fin, covered with a membrane; gill rakers 3+7; origin of dorsal fin slightly nearer tip of snout than first anal ray, its margin rounded; origin of adipose fin at tips of dorsal rays, when fin is deflexed and extending to opposite tips of depressed anal fin; origin of anal

FIELD COLUMBIAN MUSEUM.

PLATE V, ZOOLOGY.



RHAMDIA OAXACAE Meek.
No. 3717, Field Columbian Museum

midway between base of caudal and base of next to last dorsal ray; caudal fin forked, its lower lobe broad and round, its upper pointed; fontanelle reaching middle of orbit; dorsal fin slightly higher than long, its base $1\frac{1}{2}$ in head; dorsal spine weak, flexible, its length $1\frac{1}{2}$ in base of fin; pectoral fin small, its spine strong, with small teeth on its outer margin, the largest being near its tip, the inner margin serrate, except the portion nearest tip opposite the large teeth on outer margin; pectoral spine $2\frac{2}{3}$ in head; length of adipose fin $2\frac{2}{3}$ in body; ventrals inserted opposite last dorsal ray.

Color uniform dull brownish, slightly lighter on the lower half of the body; a narrow black lateral band; dorsal fin with a light cross-band occupying the second fourth of the fin from base; no dark dots.

This species reaches a length of about 18 inches. It is very abundant in the streams of Mexico south of Vera Cruz.

17. *Rhamdia laticauda* (Heckel).

Pimelodus laticaudus Heckel, in Kner, Sitz. Wien, Ac., xxvi, 420, 1857; Mexico: Günther, Cat., v, 127, 1864.

Rhamdia laticauda Jordan & Evermann., Bull. 47, U. S. Nat. Mus., 1896, 152.

Head $4\frac{1}{3}$; D. 1, 6; A. 13. Body elongate; head covered with soft skin above; occipital process short; lower jaw the shorter; the eyes situated somewhat before the middle of the head, their diameter $\frac{2}{3}$ width of interorbital; pectoral spine only half as long as rays; base of adipose $3\frac{1}{2}$ in body; caudal peduncle nearly as deep as body; caudal fin subtruncate. (Kner.)

We know this species only from the above account.

18. *Rhamdia brachyptera* (Cope).

Pimelodus brachypterus Cope, Trans. Amer. Phil. Soc., 1866, 404; Orizaba, Mexico.

Rhamdia brachyptera Jordan & Evermann., Bull. 47, U. S. Nat. Mus., 1896, 151.

Mountain streams of the south central portion of Vera Cruz. (Motzorongo.)

Head $4\frac{2}{3}$; depth 5; D. 1, 7; A. 10. Body rather elongate, robust anteriorly, compressed posteriorly; back slightly elevated; head elongate, rather narrow, flattened with rather steep sides; snout little broader than long, its length $2\frac{5}{7}$ in head; eye small, high up on head, directed outward and upward; diameter of eye $5\frac{2}{3}$ in head; width of mouth $2\frac{1}{3}$; teeth small, sharp, conic; interorbital $2\frac{3}{4}$; maxillary barbel short, its tip reaching base of ventral; outer mental barbel extending to the tip of the humeral process; fontanelle extend-

ing from internasal space to scarcely beyond the posterior margin of the eyes; opercle with fine radiating striæ; humeral spine extending for about the first third of its length of the pectoral fin, covered with a thin membrane; origin of dorsal fin nearly midway between the tip of the snout and origin of anal, its margin rounded; origin of adipose fin near dorsal and extending to tips of depressed rays of anal; origin of anal a little nearer base of the caudal than the dorsal; caudal fin deeply emarginate, its lobes pointed; pectoral fin small, reaching a little over half-way to the base of ventrals, its compressed spine about two-thirds its length; ventrals inserted below the posterior base of the dorsal fin, reaching about $\frac{5}{8}$ of its distance to the anal.

Color uniform dull russet brown; the upper half a little darker than the lower; a pale shade on dorsal. Length $6\frac{7}{8}$ inches.

The above description was taken by Mr. Henry Fowler from the type which is in the Museum of the Acad. Nat. Sci. Philadelphia. This species is known only from this and one other specimen, 11 inches in length, collected by the writer at Motzorongo.

Rhamdia wagneri (Günther).

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

Rhamdia wagneri Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 150; Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 146; Teapa and Frontera, Tabasco.

Southern Mexico to Panama.

Head 4 to $4\frac{1}{2}$; depth 5 to $5\frac{1}{2}$; D. 1, 6; A. 9 or 10. Body elongate, tapering backward from head and much compressed posteriorly; head broad and flat, slightly longer than wide, covered with soft, smooth skin; interorbital width $2\frac{1}{2}$ in head; eye small, high up on the head, its diameter $7\frac{1}{2}$ to 8 in head; mouth moderate, jaws equal; teeth in broad cardiform bands on each jaw; maxillary barbel reaching adipose fin; mental barbel reaching beyond base of pectoral; occipital process narrow, reaching about half-way to dorsal spine; base of adipose fin $2\frac{2}{3}$ to 3 in body, reaching slightly farther than anal; fontanelle not continued beyond the eye.

Color brown, lighter below; many dots over the body; a dark lateral band; base of dorsal pale. Length probably about 18 inches. Specimens described are from Teapa and Frontera.

This species was taken at Teapa and Frontera, Tabasco, by Mr. E. W. Nelson. So far this is the most northern record we have of it. The largest specimen collected by Mr. Nelson is $14\frac{1}{4}$ inches in length.

19. Rhamdia hypselura (Günther).

Pimelodus hypselurus Günther, Cat., v, 126, 1864; Mexico.

Rhamdia hypselura Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1895, 152.

Head 5; depth 6; D. 1, 6; A. 13. Body elongate, apparently quite slender; lower jaw the shorter, the band of teeth in the upper jaw about five times as broad as long; eyes near middle of head, their diameter being $\frac{2}{3}$ width of interorbital space; head covered with soft

skin; occipital process triangular, rather short; dorsal fin with a weak spine, the fin higher than long; base of adipose fin 4 in body; pectoral spine 2 in body; the posterior anal rays, if the fin is deflexed, extending nearly to the vertical from the end of the adipose fin; caudal peduncle deeper than long; caudal fin forked, with both lobes rounded.

Color uniform blackish (Günther).

We know this species only from the above account.

Order IV. **Plectospondyli.**

THE CARP-LIKE FISHES.

The anterior vertebræ modified as in the preceding order; opercular bones all present; maxillary developed, not entering into the base of a barbel; body covered with ordinary scales, rarely naked; ventral fins abdominal.

KEY TO THE FAMILIES OF PLECTOSPONDYLI.

a.	Braincase produced between the orbits; jaws toothless; no adipose dorsal fin; lower pharyngeal bones falciform.	PAGE
b.	Pharyngeal teeth numerous, pectinate; maxillary forming part of the margin of the upper jaw	<i>Catostomidæ</i> 24
bb.	Pharyngeal teeth few; margin of the upper jaw formed by the premaxillaries only	<i>Cyprinidæ</i> 36
aa.	Braincase not produced between the orbits; jaws usually with teeth; adipose fin usually present	<i>Characinidæ</i> 83

Family IV. **Catostomidæ.**

THE SUCKERS.

Body oblong or elongate, usually more or less compressed; head more or less conical; mouth usually protractile and with fleshy lips; margin of the upper jaw formed in the middle by the small premaxillaries and outside by the maxillaries; jaws toothless; lower pharyngeal bones falciform, armed with a single row of numerous comb-like teeth; branchiostegals 3; gill membranes more or less united to the isthmus; gills 4; pseudobranchiæ present; scales cycloid; lateral line usually present; ventrals abdominal; alimentary canal long; no pyloric cœca; air bladder in two or three parts. Fishes inhabiting the fresh waters of Eastern Asia and North America. The buffalo fishes are much used for food, but the other members of the family are of little value for this purpose.

KEY TO THE GENERA OF CATOSTOMIDÆ.

a.	Dorsal fin elongate, with 25 to 50 rays, its first 6 or 8 rays much longer than the others	PAGE
aa.	Dorsal fin short, with 10 to 18 rays.	<i>Carpiodes</i> 25

	PAGE
b. Scales small, more than 55 in the lateral series; air bladder in two parts.	
c. Scales very small, more than 80 in the lateral series; jaws with hard sheathes; under lip very broad and deeply incised; fontanelle wanting, or very small in the young. <i>Pantosteus</i>	30
cc. Scales moderate, less than 80 in the lateral series; fontanelle present in the adult.	
d. Nuchal region without a hump. <i>Catostomus</i>	31
dd. Nuchal region developed in a high sharp-edged hump <i>Xyrauchen</i>	33
bb. Scales large, less than 45 in the lateral series; air bladder in 3 parts; lateral line complete. . . . <i>Myzostoma</i>	34

Subfamily **Ichthyobinæ**.**9. Carpiodes** Rafinesque.

Carpiodes Rafinesque, Ichth. Ohiensis, 56, 1820. (Type, *Catostomus cyprinus* Le Sueur.)

Head comparatively short and deep, its upper surface always rounded; mouth small, horizontal and inferior; suborbital bones well developed; fontanelle present; lips thin or moderately thick, more or less plicate; pharyngeal bones very thin; teeth compressed, nearly equally thin all along the length of the bone, forming a fine, comb-like crest of minute serratures; gill rakers slender and stiff above, becoming reduced downward; caudal peduncle rather short and deep; scales large, about equal all over the body; lateral line well developed, nearly straight; dorsal fin long, with 23 to 30 rays; caudal fin forked, lobes about equal. The fishes of this group reach a large size. They inhabit the larger streams of the Mississippi Valley, extending as far south as the Rio Usumacinta in Guatemala.

KEY TO SPECIES OF CARPIODES.

	PAGE
a. Tips of pectoral fins reaching nearly or quite to base of ventrals; lips moderate.	
b. Dorsal rays 28 or 30; scales 40 in the lateral series; depth $2\frac{4}{5}$; lower lip slightly thicker than the upper <i>meridionalis</i>	26
bb. Dorsal rays 24; scales 36 in the lateral series; depth $2\frac{3}{5}$ <i>tumidus</i>	26
aa. Tips of pectoral not nearly reaching base of ventral; distance from tip of pectoral to base of ventral about half the length of pectoral fin.	

c. Lips thin; mouth small; lower lip about twice as thick as upper.	PAGE
d. Body robust, its depth $2\frac{3}{4}$ to 3 in length of body; head large, $3\frac{3}{8}$ <i>microstomus</i>	27
dd. Body elongate, its depth $3\frac{1}{4}$ to $3\frac{2}{3}$ in length of body; head rather small, $4\frac{1}{3}$ <i>elongatus</i>	28
cc. Lips very thick; mouth large; lower lip about as thick as upper; lips strongly papillose; body very slender, its depth $3\frac{1}{2}$ <i>labiosus</i>	29

20. *Carpiodes meridionalis* (Günther).

Sclerognathus meridionalis Günther, Cat., VII, 23, 1868; Rio Usumacinta, Guatemala.

Ictiobus meridionalis Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 164.

Large rivers of Mexico south of the City of Vera Cruz and of the east slope of Guatemala. (Perez.)

Head $3\frac{3}{4}$; depth $2\frac{4}{5}$; D. 28 to 30; A. 9; scales 9-40-6. Body elongate, compressed, dorsal region elevated; head small; mouth inferior; lips moderately thick, papillose, the lower slightly the thicker; hinder margin of lower lip rounded, the lobes not forming an angle; snout short, blunt, its length 4 in head; diameter of eye 4 in head; opercles striate; origin of dorsal fin midway between tip of snout and base of caudal; dorsal fin falcate, its longest rays shorter than the head; base of dorsal $2\frac{1}{2}$ in head; tips of pectorals not reaching base of ventrals by a distance equaling $\frac{1}{4}$ length of the fin; pectoral $1\frac{1}{3}$ in head; ventral $1\frac{1}{4}$; least depth of caudal peduncle 2 in head; caudal fin forked, the lower lobe the broader and the shorter.

Color brownish olive above, below silvery. Length 2 feet or more.

The most southern range of this species, so far as known at present, is the Rio Usumacinta in Guatemala. This fish is reported to reach a weight of 20 to 30 pounds. It was very abundant in isolated ponds near Perez. None of the specimens taken by me exceeded a length of 12 to 14 inches.

21. *Carpiodes tumidus* Baird & Girard. METALOTE; BUFFALO.

Carpiodes tumidus Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854, 28; Rio Grande, Ft. Brown, Tex.: Jordan, Bull. U. S. Geol. Sur., 1878, 404, 666; Brownsville, Texas: Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 119, lagoons near Tampico.

Ictiobus tumidus Girard, Mex. Bd. Sur., 34, pl. XIX, figs. 1-4, 1859; Rio Grande, Ft. Brown, Texas.

Ichthyobus tumidus Garman, Bull. Mus. Comp. Zool., 1881, 89; Rio Nazas, San Pedro, Coahuila.

Carpiodes velifer, in part, Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 167.

Lowland streams from the Rio Panuco to the Rio Grande. (Garza Valdez; Forlon.)

Head $3\frac{3}{4}$; depth $2\frac{3}{8}$; D. 24; A. 8; scales 9-36-5. Body deep, compressed, back considerably arched; head broad, convex; interorbital $2\frac{1}{4}$ in head; eye 5; snout $3\frac{2}{3}$; mouth moderately large, inferior; lips rather thick, the lower plicate, each plication broken into two or three parts; upper lip papillose, the greatest diameter of papillæ at right angles to mouth; opercles faintly striate; origin of dorsal slightly nearer tip of snout than base of caudal; dorsal fin falcate, tips of its longest rays reaching beyond middle of fin; longest ray $1\frac{1}{2}$ in base of fin, which is $2\frac{2}{3}$ in body; tips of pectorals reaching base of ventrals; length of pectoral $1\frac{1}{3}$ in head, and slightly longer than ventrals; tips of ventrals reaching $\frac{2}{3}$ of distance between its base and origin of anal; caudal peduncle deep, its least depth nearly equal to its length and $1\frac{3}{4}$ in length of head; caudal fin forked, the two lobes about equal.

Color light plumbeous above, lighter below; fins plain, rather darker in the larger specimens. Length probably 18 inches to 2 feet.

Longest specimen seen by me $12\frac{1}{2}$ inches, taken at Forlon. A large, rather dark colored buffalo fish inhabiting the larger rivers of northeastern Mexico.

22. *Carpiodes microstomus* sp. nov.

Type, No. 3542, F. C. M., $4\frac{1}{2}$ inches in length; Santa Rosalia, Chihuahua.

Carpiodes tumidus Meek, Field Col. Mus. Pub. 65, 1902, 74; Santa Rosalia; Jimenez (not *Carpiodes tumidus* Girard).

Basin of the Rio Conchos in Chihuahua.

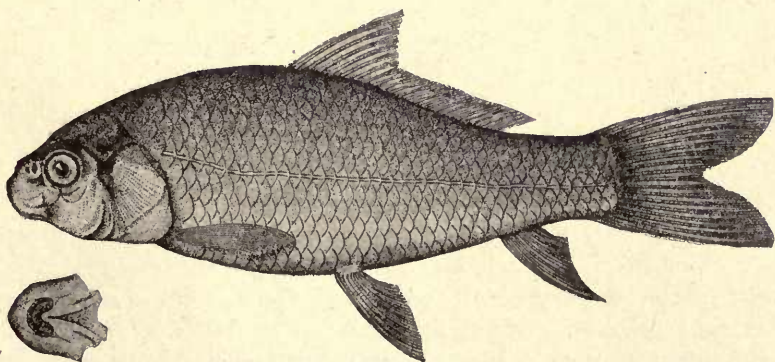


FIG. 4. *CARPIODES MICROSTOMUS* Meek.

Head $3\frac{3}{8}$; depth $2\frac{2}{3}$ to 3; D. 24 to 26; A. 8; scales 7-38 to 41-6. Body robust, compressed, back arched; head moderately large; lips very thin papillose, the long diameter of papillæ at right angles to mouth, giving the lips a plicate appearance; opercle strongly striate; lower lip slightly broader than upper, lobes somewhat U-shaped; interorbital convex, $2\frac{1}{4}$ in head; snout $3\frac{2}{3}$ in head; dorsal fin falcate, tips of longest rays when deflexed reaching past middle of its base; longest rays $1\frac{1}{2}$ in its base; origin of dorsal slightly nearer tip of snout than base of caudal; distance between tip of pectoral and base of ventral 2 in length of pectoral; pectoral $1\frac{2}{3}$ in head; ventral $1\frac{1}{2}$; caudal peduncle deep, its least depth $1\frac{1}{4}$ in its length; caudal fin forked, its lobes about equal.

Color light brownish, silvery below; middle of each scale silvery, forming indistinct silvery lines along rows of scales; these more conspicuous on lower half of body. Length about 10 inches.

A small species inhabiting the tributaries of the Rio Grande, on the Mexican Plateau.

23. *Carpiodes elongatus* sp. nov. METALOTE.

Type, No. 4425, F. C. M., 9 inches in length; Linares, Nuevo Leon.

Rivers of northeastern Mexico between the Rio Panuco and the Rio Grande. (San Juan; Montemorelos; Linares; La Cruz.)

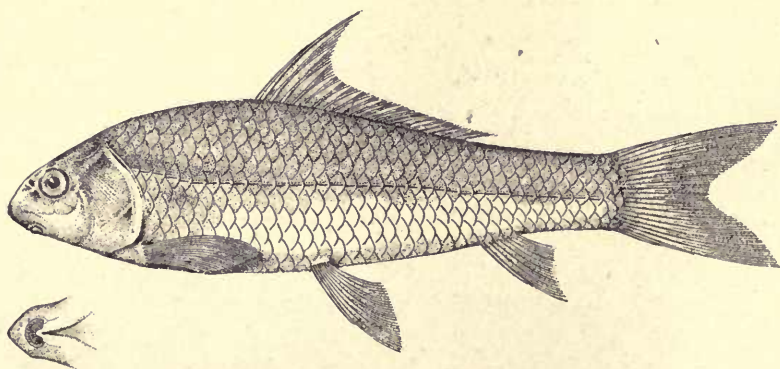


FIG. 5. *CARPIODES ELONGATUS* Meek.

Head 4 to $4\frac{1}{3}$; depth $3\frac{1}{4}$ to $3\frac{2}{3}$; D. 23 to 26; A. 7; scales 8-38-5. Body elongate, not much compressed, back little elevated; head small; interorbital convex, its width $2\frac{2}{3}$ in head; diameter of eye $3\frac{3}{4}$ to 4; snout $3\frac{1}{2}$; mouth small; lips thin, the lower about twice as thick as the upper; lips papillose, the papillæ with long diameter at right angles to the mouth, giving the lips a plicate appearance; opercles

strongly striate; dorsal fin falcate, the tip of first rays when deflexed reaching past middle of the base of fin; base of dorsal $2\frac{9}{10}$ in body; origin of dorsal fin nearer tip of snout than base of caudal by a distance equal to the length of the snout; length of pectoral $1\frac{1}{3}$ in head; distance from tip of pectoral to base of ventral 2 in length of pectoral; ventrals $1\frac{1}{3}$ in head; caudal peduncle long and slender, its least depth $1\frac{1}{2}$ in its length (measured from last dorsal ray); caudal forked, the lobes about equal; lateral line decurved anteriorly.

Color light brownish above, lighter below, silvery; fins all plain. Length about 12 inches.

This species is more slender and has thicker lips than the preceding, which it most resembles.

24. *Carpiodes labiosus* sp. nov.

Type, No. 4492, F. C. M., $10\frac{1}{4}$ inches in length; Valles, San Luis Potosi.

Basin of the Rio Panuco. (Valles.)

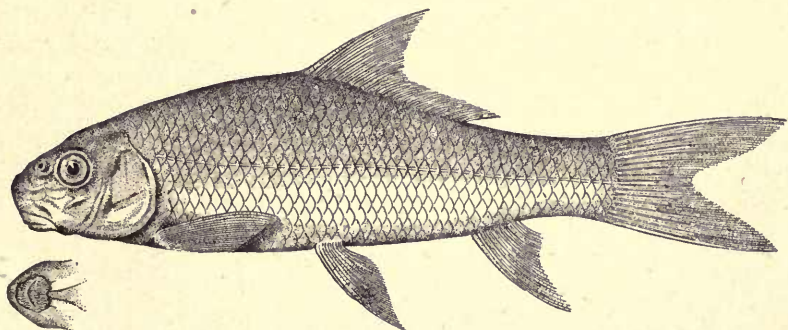


FIG. 6. *CARPIODES LABIOSUS* Meek.

Head $4\frac{1}{6}$; depth $3\frac{3}{8}$; D. 23; A. 9; scales 10-43-6. Body rather elongate, moderately compressed; back not much arched; head rather small; mouth large, overhung by the rather blunt snout; lips very thick, papillose, resembling those of *Catostomus*; eye 4 in head; snout $2\frac{3}{8}$; opercles not striate; dorsal fin falcate, when deflexed the tips of longest rays reaching $\frac{3}{4}$ distance to base of last ray; origin of dorsal fin midway between base of caudal and tip of snout, slightly in advance of ventrals; base of dorsal fin $3\frac{3}{8}$ in length of body; distance from last dorsal ray to base of caudal $1\frac{1}{3}$ in the base of the dorsal fin; caudal peduncle slender, its least depth $1\frac{2}{3}$ in distance from last dorsal ray to base of caudal; pectoral fin $1\frac{1}{10}$ in head, its tips not reaching base of ventrals by a distance equal to $\frac{1}{3}$ of their length; ventrals $1\frac{1}{8}$ in head, their tips not reaching origin of anal fin.

Color silvery plumbeous on upper half of body, lower white; middle of each scale more silvery than the margin, forming indistinct silvery lateral stripes along the rows of scales.

This species is easily distinguished by being more slender than any other member of the genus and having thick papillose lips like the species of *Catostomus*. One large (type) and one small ($1\frac{1}{4}$ inches) specimen were taken at Valles.

Subfamily **Catostominae**.

10. Pantosteus Cope.

MOUNTAIN SUCKERS.

Pantosteus Cope, Lieut. Wheeler's Expl. W., 100th Mer., v., 673, 1876. (Type, *Minomus platyrhynchus* Cope.)

Body rather elongate, not much compressed; head rather small; suborbital bones narrow; bones of the head rather thick; the parietal bones in the adult more or less uniting, partly or wholly obliterating the fontanelle; mouth large, entirely inferior; each jaw with a developed cartilaginous sheath; upper lip broad, papillose, with a rather broad free margin, and two or more series of tubercles; lower lip largely developed, the broad deep margin deeply incised behind; pharyngeal bones and teeth essentially as in *Catostomus*; isthmus broad; scales small, 80 to over 100 in lateral series; lateral line well developed, nearly straight; fins rather small; caudal short, emarginate; air bladder in two parts.

25. Pantosteus plebeius (Baird & Girard).

Catostomus plebeius Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854, 28; Rio Mimbres, a tributary of Lago de Guzman.

Minomus plebeius Girard, Proc. Acad. Nat. Sci. Phila., 1856, 173; Rio Janos, tributary of Lago de Guzman: Girard, Mex. Bd. Sur., 38, pl. xxii, figs. 1-4, 1858; Rio Mimbres.

Catostomus guzmaniensis Girard, Proc. Acad. Nat. Sci. Phila., 1856, 173; Rio Janos, tributary of Lago de Guzman.

Acomus guzmaniensis Girard, Mex. Bd. Sur., 39, pl. xxiii, figs. 1-10, 1858; Rio Janos, tributary of Lago de Guzman.

Catostomus nebuliferus Garman, Bull. Mus. Comp. Zool., 1881, viii, 89; Rio Nazas, Coahuila.

Pantosteus plebeius Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 171; Bean, Bull. Amer. Mus. Nat. Hist., 1898, 167; San Diego, Chihuahua: Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 146; Rio Piedras, Colonia Garcia and Rio Casas Grandes, Casas Grandes, Chihuahua: Meek, Field Col. Mus. Pub. 65, 1902, 75; Colonia Juarez; Ahumada; San Andres; Miñaca.

Streams and lakes on the plateau in northern Mexico, ranging as far south as the headwaters of the Rio Mezquital in Durango, and the Rio Nazas. (Sauz; Lerdo; Santiago Papasquiaro; Durango.)

Head $4\frac{1}{2}$ to $4\frac{2}{3}$; depth $4\frac{1}{2}$; D. 9 to 11; A. 8; scales 14-85 to 100-14. Body elongate, rather stout, little compressed; upper surface of head convex, mouth inferior; lips papillose, papillæ on upper lip in about six rows; free margin of lower lip incised, the incision reaching about half-way to margin of jaw; interorbital convex, its width $2\frac{1}{5}$ in head; eye small, high up on the head, its diameter about from $5-6\frac{1}{2}$ in head; snout $2\frac{1}{5}$ in head; origin of dorsal nearer tip of snout than base of caudal; dorsal low, its margin convex, its longest ray about $1\frac{5}{8}$ in head; base of dorsal $2\frac{1}{5}$ in head; pectorals moderate, $1\frac{1}{3}$ in head, and slightly more than the space between their tips and base of caudal; ventral fins $1\frac{3}{5}$ in head, their tips reaching half-way to base of anal; caudal peduncle somewhat compressed, its least diameter $2\frac{1}{5}$ in head; caudal fin very short, emarginate, its longest rays $1\frac{3}{4}$ in head; scales small, those on anterior half of body smaller than those on posterior half, or on ventral surface; about 50 scales in a series between nape and dorsal fin.

Color dark brown, the sides mottled with darker; in small specimens a dark lateral band; in large males in life, the side has a bright orange band. Length 12 to 18 inches.

This species is easily recognized on account of the small scales, hard cartilaginous lips, and short fins, and especially by the short caudal fin. It is usually very abundant where found, and seldom exceeds 12 inches in length.

11. *Catostomus* Le Sueur.

FINE-SCALED SUCKERS.

Catostomus Le Sueur, Jour. Acad. Nat. Sci. Phila., 1817, 89. (Type, *Cyprinus catostomus* Forster.)

Body elongate, terete anteriorly, not much compressed; mouth rather large, inferior; upper lip thick, papillose; lower lip greatly developed, with broad, deeply incised free portion; scales small, those on anterior half of the body much reduced in size; pharyngeal teeth compressed vertically, rapidly diminishing in size upward; lateral line nearly straight, well developed; air bladder in two parts; vertebræ 45 to 47. Species chiefly North American.

KEY TO THE SPECIES OF CATOSTOMUS.

- a. Scales large, 60 to 75 in the lateral series; not more than 35 in a series between nape and dorsal fin.

b.	Scales in the lateral series 65; 30 scales in a series between nape and dorsal fin.....	<i>sonorensis</i>	PAGE 32
bb.	Scales in the lateral line 75; 31 scales in a series between nape and dorsal fin.....	<i>bernardini</i>	32
aa.	Scales in the lateral line 80; about 45 scales in a series between nape and dorsal fin.....	<i>conchos</i>	33

26. *Catostomus sonorensis* Meek.

Catostomus sonorensis Meek, Field Col. Mus. Pub. 65, 1902, 75; Miñaca.

Upper tributaries of the Rio Yaqui.

Head 4; depth $4\frac{1}{3}$; D. 12; A. 7; scales 11-65-10. Body robust, profile very convex; top of head flattish, broad; interorbital $2\frac{1}{2}$ in head; lips thick, papillose, the papillæ on upper lip in 8 or 9 rows; lower lip very broad, from anterior to posterior margin $4\frac{1}{2}$ in head; the two halves meeting at a very obtuse angle; dorsal fin as high as long, its base $1\frac{2}{3}$ in head; origin of dorsal fin slightly nearer base of caudal fin than tip of snout; margin of dorsal fin slightly convex; base of ventrals under middle rays of dorsal fin; pectoral fin $1\frac{2}{3}$ in head; distance from tip of pectoral to base of ventral $1\frac{4}{5}$ in pectoral fin; ventrals $1\frac{2}{3}$ in head, their tips nearly reaching anal fin; lateral line slightly decurved anteriorly; no fontanelle; caudal fin deeply emarginate; lobes equal; scales on anterior half of body much reduced.

Color steel blue to brownish, white below; young specimens have the dark lateral blotches. Length about 12 inches.

27. *Catostomus bernardini* Girard.

Catostomus bernardini Girard, Proc. Acad. Nat. Sci. Phila., 1856, 175; San Bernardino Creek, tributary of Rio Huagui, west of Sierra Madre Mts., Mexico: Girard, Mex. Bd. Sur., 40, XXIII, figs. 1-5, 1858; San Bernardino Creek: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 178; Rutter, Proc. Cal. Acad. Sci., 1896, 258; Rio Yaqui, Sonora: Bean, Bull. Amer. Mus. Nat. Hist., 1898, 166, Sonora.

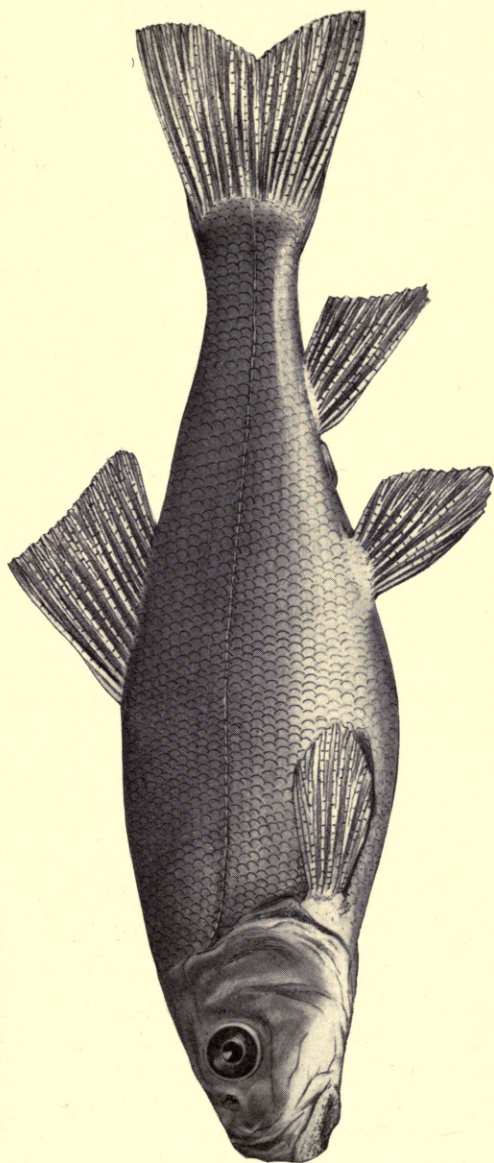
Pacific slope streams in Sonora.

Head $4\frac{1}{2}$; depth about $4\frac{1}{2}$; D. 12; A. 7; scales 75. Body elongate, rather slender; head small; lips broad, the lower deeply incised; eye large, 4 in head; origin of the dorsal fin slightly nearer tip of snout than base of caudal; margin of dorsal fin subconvex; base of dorsal a little less than length of longest ray; pectorals about $1\frac{1}{2}$ in the head; scales on anterior half of the body much reduced in size, 31 in a series between nape and first dorsal ray; fontanelle large.

Color uniform, purplish black and yellowish white beneath. This species probably reaches a length of 12 inches.

FIELD COLUMBIAN MUSEUM.

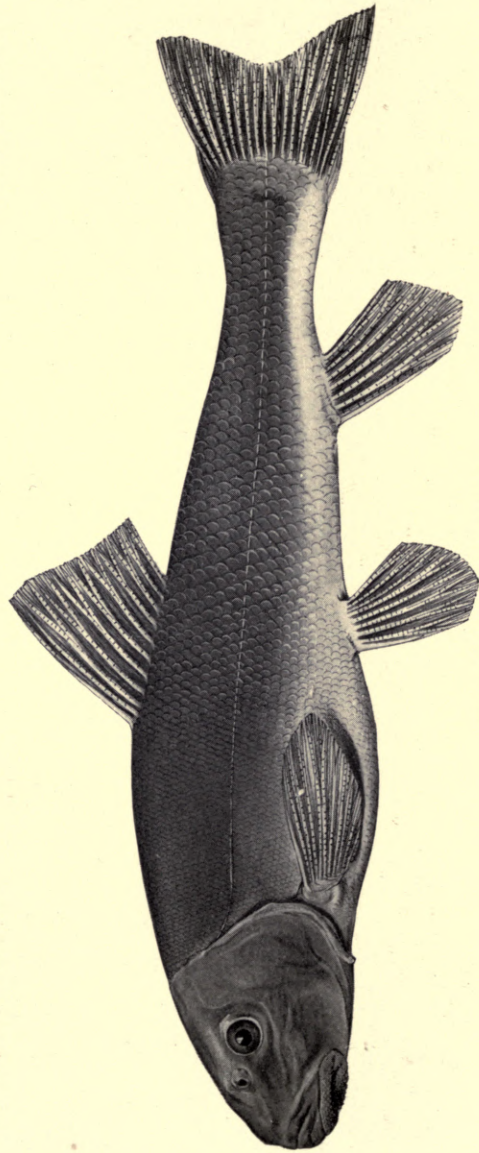
PLATE VI, ZOOLOGY.



CATOSTOMUS SONORENSIS Meek.
No. 3564, Field Columbian Museum.

FIELD COLUMBIAN MUSEUM.

PLATE VII, ZOOLOGY.



CATOSTOMUS CONCHIOS Meek.
No. 3557. Field Columbian Museum.

28. *Catostomus conchos* Meek.

Catostomus conchos Meek, Field Col. Mus. Pub. 65, 1902, 75; Jimenez. Basin of the Rio Conchos, in Chihuahua.

Head $4\frac{1}{4}$; depth $4\frac{1}{3}$; D. 9; A. 7; scales 13-80-13. Body robust, terete, not much compressed, except posterior third; profile convex; head broad; interorbital area convex, its width $2\frac{1}{4}$ in head; lips thick, papillose, the papillæ on the upper lip in about 9 rows; lower lip broad, $4\frac{1}{3}$ in head from anterior to posterior margin; lower lip deeply incised, its lobes meeting at a very obtuse angle; dorsal fin as high as long, its base $1\frac{1}{2}$ in head; origin of dorsal fin nearer tip of snout than base of caudal by a distance equaling $\frac{1}{3}$ head; margin of dorsal fin slightly convex; base of ventrals under seventh dorsal ray; pectoral fin $1\frac{1}{3}$ in head; distance from tip of pectoral to base of ventral 2 in pectoral fin; ventral fins $1\frac{2}{3}$ in head, their tips not reaching anal; lateral line slightly decurved anteriorly; no fontanelle; caudal fin not deeply emarginate the lobes about equal.

Color light steel blue on back, shading into dark olive; sides lighter below, especially on posterior half of body where the line between the light and dark color is very marked; on anterior half of the body the colors gradually merge into one another; young with the black lateral blotches. Length 12 inches or more.

At present this species is known only from the type locality.

12. *Xyrauchen* Eigenmann & Kirsch.

RAZOR-BACK SUCKERS.

Xyrauchen Eigenmann & Kirsch, Proc. U. S. Nat. Mus., 1888, 556. (Type, *Catostomus cypho* Lockington.)

Body rather elongate, compressed; nuchal region with a large sharp-edged hump, formed by a singular development of the inter-neural bones, otherwise as in *Catostomus*.

29. *Xyrauchen cypho* (Lockington). RAZOR-BACK SUCKER.

Catostomus cypho Lockington, Proc. Acad. Nat. Sci. Phila., 1880, 237; Colorado River at mouth of the Gila, Arizona: Gilbert & Scofield, Proc. U. S. Nat. Mus., 1898, 491; Colorado River at Yuma, and Horseshoe Bend.

Basin of the Colorado River.

Head 4; depth 4; D. 13 or 14; A. 7; scales 14-72 to 77-13. Body stout, compressed; the head small, low, the profile ascending to the prominent nuchal hump, which is largest in adults; anterior edge of hump straight, sharp, and without scales; mouth wide, inferior; upper lip with two rows of papillæ; lower lip deeply divided, with 8 rows;

dorsal fin low, long, with concave edge; caudal fin broad and strong, with numerous rudimentary rays; pectorals moderate.

Color plain, olivaceous. Length 2 feet or more.

A very peculiar Sucker, known only from the basin of the Colorado River. It reaches a weight of 8 to 10 pounds.

13. *Myzostoma Rafinesque.*

RED-HORSE SUCKERS.

Moxostoma Rafinesque, Ichth. Ohiensis, 54, 1820. (Type, *Catostomus anisurus Rafinesque*.)

Body more or less elongate, nearly terete: usually more or less compressed posteriorly; suborbital bones very narrow; fontanelle present; mouth inferior; lips plicate, the lower not deeply incised; jaws without cartilaginous sheath; opercular bones moderately developed, nearly smooth; isthmus broad; gill rakers weak, rather long; pharyngeal bones rather weak; teeth compressed, the lower 5 or 6 stronger than the others, which rapidly diminish in size upward, each with a prominent internal cusp. Scales large, nearly equal in size over the body and not especially crowded anywhere; lateral line developed, slightly curved anteriorly, fins all developed; caudal forked; anal fin short and high; air bladder with three chambers. A group of large-scaled suckers chiefly inhabiting the streams of United States east of the Rocky Mountains.

KEY TO THE SPECIES OF MYZOSTOMA.

- | | | | |
|-----|---|------------------|---------|
| a. | Distance from tips of pectorals to base of ventrals $5\frac{1}{2}$ in the length of the pectoral fin..... | <i>congestum</i> | PAGE 34 |
| aa. | Distance from tips of pectorals to base of ventrals $2\frac{1}{2}$ in length of pectoral..... | <i>austrinum</i> | 35 |

30. *Myzostoma congestum* (Baird & Girard). LISA.

Catostomus congestus Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854, 27; Rio Salada, Texas.

Ptychostomus albidus Girard, Proc. Acad. Nat. Sci. Phila., 1856, 172; Rio San Juan, Monterey, Nuevo Leon; near Monterey.

Moxostoma congestum Woolman, Bull. U. S. Fish Comm., 1894, 56; Rio Grande, El Paso, Texas: Jordan & Evermann, Bull. U. S. Nat. Mus., 1896, 192; Meek, Field Col. Mus. Pub. 65, 1902, 76; Santa Rosalia.

Basin of the Rio Soto la Marina north to the Rio Grande and west to the upper tributaries of the Rio Conchos in Chihuahua. (San Juan; Montemorelos; Linares; Garza Valdez; Victoria.)

Head $4\frac{2}{3}$; depth 4; D. 11; A. 7; scales 7-45-5. Body elongate, terete; head large; interorbital area flat, its width 2 in the length of the head; eye $4\frac{2}{3}$; snout $2\frac{1}{2}$; origin of dorsal fin midway between tip of snout and tip of last anal ray; about 16 scales in a series before dorsal fin; margin of dorsal fin slightly concave, the length of its first rays $1\frac{1}{6}$ in head, its base $1\frac{1}{2}$; shortest dorsal ray $2\frac{1}{2}$; caudal fin forked, its lower lobe slightly the larger; longest caudal ray $1\frac{1}{6}$ in head; length of pectorals equals the length of the head; distance from tip of pectorals to base of ventrals $5\frac{1}{2}$ in length of pectoral; ventrals $1\frac{2}{3}$ in head, their tips reaching $\frac{2}{3}$ distance to anal fin; least depth of caudal peduncle $2\frac{1}{2}$ in head.

Color light olivaceous above, lighter below; middle of each scale silvery, forming faint longitudinal stripes along rows of scales; dorsal membranes blackish; other fins plain. Length 12 to 14 inches.

This species has not been taken in the Rio Nazas or in other isolated bodies of water in northern Mexico.

31. *Myxostoma austrinum* Bean.

Myxostoma austrina Bean, Proc. U. S. Nat. Mus., 1879, 302; La Piedad in Morelia, Michoacan.

Moxostoma austrinum Woolman, Bull. U. S. Fish Comm., 1894, 61; Rio Lerma, Salamanca, Guanajuato: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1876, 192; Jordan & Snyder, Bull. U. S. Fish. Comm., 1900, 120; Rio Verde, Aguas Calientes; Rio Santiago, Ataquiza, Jalisco: Meek, Field Col. Mus. Pub. 65, 1902, 76; Ocotlan; La Palma.

Basin of the Rio Lerma and headwaters of the Rio Mezquital. (Durango.)

Head $4\frac{1}{3}$ to $4\frac{4}{5}$; depth 4; D. 11; A. 6; scales 7-44 to 48-6. Body rather stout; head rather small; interorbital area $2\frac{1}{3}$ in head; eye $4\frac{1}{2}$ to 6; snout $2\frac{1}{2}$; origin of dorsal fin midway between tip of snout and base of last anal ray; 16 scales in series before dorsal fin; margin of dorsal fin slightly concave, its longest ray $1\frac{1}{3}$ in head; base of dorsal $1\frac{2}{3}$ in head; shortest dorsal ray $2\frac{1}{2}$ in head; caudal fin forked, lobes about equal; the length of the pectorals equals the length of the head; distance from tip of pectoral to base of ventrals $2\frac{1}{3}$ in length of pectoral; ventrals $1\frac{2}{3}$ in head, their tips reaching $\frac{2}{3}$ distance to vent; least depth of caudal peduncle $2\frac{1}{6}$ in head.

Color light brown above, lower parts yellowish white; dorsal membrane blackish, other fins plain. Length about 15 inches.

Family V. **Cyprinidæ.**

THE MINNOWS.

Body elongate, more or less compressed; mouth large or small, terminal or subinferior; margin of the upper jaw formed by the premaxillaries; no teeth in the jaws; pharyngeal bones well developed, falciform, and nearly parallel with the gill arches, each provided with 1 to 3 rows of teeth, usually 4 to 7 in the main row; fewer in the other rows if present; barbels usually none, never more than 2 to 4; belly rounded, rarely compressed to an edge, and never serrate; gill membranes broadly joined to the isthmus; branchiostegals always 3; gills 4; pseudobranchiæ usually present; ventral fins abdominal; air bladder large, usually in two lobes; stomach without appendages.

This family comprises many small fresh-water fishes. A few of our western forms reach a large size. On this continent the southernmost limit of this family is in the Balsas basin in southern Mexico.

This large group of small fishes which so much resemble each other in form, size and coloration is one of the most difficult in which to distinguish genera and species. Before one can make much progress in the study of these species, careful attention must be given to the teeth, as the genera are based largely on dental characters. The teeth are confined to the pharyngeal bones which are just back of the gill openings on either side of the œsophagus. In American species the teeth on each pharyngeal bone are in one large row of 4 or 5, in front of which is usually a smaller row of one or two teeth. The pharyngeal bones must be removed with great care to avoid breaking the teeth from them. It is best to clean the teeth by tearing away the flesh with a needle or other sharp-pointed instrument, after which they are easily examined with a hand lens. The herbivorous species have teeth usually not hooked and with a flat or concave surface. In the carnivorous species they usually have a sharp cutting or a serrated edge and hooked tips. Their number is indicated by a dental formula. Thus "teeth 4-4," indicates that only the principal row is present. "Teeth 2, 4-5, 2," indicates the principal row on one side contains four teeth, the other five, while the lesser row on each side contains two each, and so on.

During the breeding season the males are more or less covered with tubercles, outgrowths of the epidermis. Usually these are confined to the head, but often are found over the entire body. The lower parts of the body and the fins are often highly colored; the prevailing color being red, although in some genera it is satin white, yellow, or black. In some cases the males are deeper than the females. Young examples are always difficult to identify; these are usually more

slender and have a larger eye than the adults. Often the young have a lateral band and a dark caudal spot which the adults do not possess. In the following descriptions the rudimentary rays of the dorsal and anal fins are not counted. Besides the native species here mentioned, two other species* from Europe and Asia have been introduced into some of the streams and lakes of Mexico, where they have become quite abundant, especially so in the Rio Lerma and the lakes in the Valley of Mexico. Both of these species are offered for sale in the markets in the City of Mexico. They are easily distinguished from the native fresh-water fishes by the long dorsal fin which is preceded by a serrated spine.

KEY TO THE GENERA OF CYPRINIDÆ.

- | | |
|---|----------------------|
| a. Dorsal fin short, without developed spine. | PAGE |
| b. Air bladder surrounded by many convolutions of the long alimentary canal; pharyngeal teeth 4-4, or 1, 4-4, 0, with oblique grinding surface, the tips slightly hooked; peritoneum black..... | |
| | <i>Campostoma</i> 40 |
| *Dorsal fin elongate, its rays 18 or more; dorsal and anal fins each preceded by a serrated spine; teeth molar. | |
| | PAGE |
| a. Barbels 4; teeth 1, 1, 3-3, 1, 1..... | <i>Cyprinus</i> 37 |
| aa. Barbels none; teeth 4-4..... | <i>Carassius</i> 37 |

Genus *Cyprinus* (Artedi) L.

Body deep, robust; mouth moderate, terminal, with 4 long barbels; snout blunt, rounded; pharyngeal teeth 1, 1, 3-3, 1, 1, molar-like; dorsal fin very long, with a stout spine, serrate behind; lateral line complete; scales large. Large fishes of the fresh waters of Asia.

Cyprinus carpio Linnæus. CARP; CARPA.

Dorsal III, 20; A. III, 5; scales 5-38-5. Body stout, more or less compressed, heavy anteriorly; color silvery. Length 3 feet.

This species was introduced into Europe and America from Asia. The carp is normally covered with large scales; in domestication several varieties have arisen, the prominent ones being the "Leather Carp," having no scales, and the "Mirror Carp," with a few series of very large scales.

Genus *Carassius* Nilsson.

Body oblong, compressed and elevated; mouth terminal, without barbels; teeth 4-4, molar-like, but compressed; dorsal fin very long, with a stout spine which is serrate behind; anal short with a similar spine; ventrals well forward. Large fishes of the fresh waters of Asia.

Carassius auratus (Linnæus). GOLD-FISH.

Dorsal II, 18; A. II, 7; scales 26; teeth 4-4. Body rather robust, much compressed; lateral line complete.

Color olivaceous, orange, or variegated in domestication. Length about 18 inches.

The streams of China and Japan are the native homes of this species. Owing to its bright coloration it has been introduced everywhere as an aquarium fish, where it has taken on numerous and strange variations. In the lakes in the Valley of Mexico it has become quite an important food fish.

	PAGE
bb. Air bladder not surrounded by alimentary canal.	
c. Intestinal canal elongate, usually more than twice the length of the body, and with several convolutions; peritoneum usually black.	
d. Scales small, more than 55 in the lateral series; lateral line complete.	
e. Gill rakers long and slender, more than 60 on the first gill arch.....	<i>Xystrosus</i> 43
ee. Gill rakers short, less than 60 on the first gill arch.....	<i>Algansea</i> 44
dd. Scales large, 35 to 45 in the lateral series.	
f. First (rudimentary) ray of dorsal fin slender, and attached firmly to the first developed ray.....	<i>Hybognathus</i> 48
ff. First (rudimentary) ray of dorsal fin blunt, enlarged and connected to first dorsal ray by a membrane	<i>Pimelocephalus</i> 50
cc. Intestinal canal short, less than twice length of the body, and with usually one convolution; peritoneum usually pale.	
g. Teeth in the main row 5-5 or 4-5 (3-3 in <i>Stypodon</i>); usually 2 teeth in the lesser row.	
h. Abdomen behind ventral fins transversely rounded, the scales passing over it, the edge not forming a scaleless ridge; base of anal fin generally short; body little compressed; lateral line but slightly below axis of the body.	
i. Teeth subconical, scarcely hooked, sharp edged, wide apart; the long limb of the pharyngeal bone elongate; body elongate; mouth large.	
j. Teeth 3-3, scales 35.....	<i>Stypodon</i> 51
jj. Teeth 2, 4-5, 2; scales 80 to 90.....	<i>Ptychocheilus</i> 52
ii. Teeth compressed, strongly hooked; the pharyngeal bones of the usual form.	
k. Caudal peduncle slender and elongate; the caudal fin forked, its basal rudiments much developed; scales very small, 83 to 87 in lateral series; head	

depressed in the adult; anal rays 9 or 10	<i>Gila</i>	PAGE 53
kk. Caudal peduncle stout, basal rudiments but little developed; scales 60 to 75; anal rays 8	<i>Leuciscus</i>	55
hh. Abdomen behind ventral fins compressed to a sharp edge over which the scales do not pass; abdomen in front of ventrals rounded; anal basis elongate, its ray 12 to 14; dorsal fin posterior; teeth 5-5; body much compressed; the lateral line much below axis of body	<i>Abramis</i>	56
gg. Teeth in the main row 4-4, usually absent in the lesser row, rarely one or two being present.		
1. Maxillary without barbels.		
m. Scales large, 30 to 60 in the lateral series.		
n. Jaws each with a hardened sheath; the first dorsal ray spine-like, connected by a membrane to the first developed ray; teeth 4-4	<i>Cochlognathus</i>	57
nn. Jaws without bony sheath, being normally formed.		
o. Lower jaw with the lip thin, not developed as a fleshy lobe on each side at base.		
p. Fins high; longest dorsal ray as long as head; tips of pectorals reaching middle of base of ventrals; scales 50 in the lateral series; teeth 4-4; origin of dorsal much nearer snout than base of caudal	<i>Falcula</i>	58
pp. Fins moderate; longest dorsal ray less than the length of the head; tips of pectorals not reaching base of ventrals; origin of dorsal fin about in middle of body.		
q. Scales small, 47 to 60 in the lateral series; body robust; teeth 4-4; about 23 to 30 scales in a series between dorsal fin and nape	<i>Aztecula</i>	59

	PAGE
qq. Scales larger, 30 to 45 in the lateral series; less than 20 scales between nape and dorsal fin; teeth 4-4 in the main row, occasionally one or two in smaller row.....	<i>Nototropis</i> 62
oo. Lower jaw with the lip developed as a fleshy lobe on each side; teeth 4-4; scales 43 to 45	<i>Phenacobius</i> 76
mm. Scales small, 80 to 100 in the lateral series; body long and slender, subterete; mouth small, the upper jaw little protractile; teeth 4-4	<i>Evarra</i> 77
11. Maxillary with a small barbel at or near its extremity.	
r. Premaxillaries not protractile, the frenum very broad; teeth 2, 4-4, 2 or 1; scales small, 60 in the lateral series	<i>Rhinichthys</i> 79
rr. Premaxillaries protractile, rarely joined to the forehead by a narrow frenum.	
s. Scales very small, 60 to 90 in the lateral series; lateral line often incomplete; dorsal fin posterior.....	<i>Agosia</i> 79
ss. Scales large, 35 to 55 in the lateral series; dorsal median; lateral line complete.	
t. Teeth 4-4, or 1, 4-4, 1 or 0; the lesser row with never more than one; scales 35 to 45	<i>Hybopsis</i> 80
tt. Teeth 2, 4-4, 2 or 1; scales more than 50 in the lateral series.....	<i>Couesius</i> 82
aa. Dorsal fin short, posterior, with a strong spine; body without scales; teeth 2, 4-4, 2; maxillary with a barbel.....	<i>Plagopterus</i> 83

Subfamily **Campostomatinae**.

14. Campostoma Agassiz.

Campostoma Agassiz, Amer. Jour. Sci. Arts, 1855, 218. (Type, *Rutilus anomalus* Rafinesque.)

Body moderately elongate, little compressed; mouth rather small, the jaws with thick lips and the rudiment of a hard sheath; premaxillaries protractile; no barbel; pharyngeal teeth 4-4, or 1, 4-4, 0, with oblique grinding surface, and a slight hook on one or two teeth; air

bladder suspended in the abdominal cavity, and entirely surrounded by many convolutions of the long alimentary canal, which is 6 to 9 times the length of the body; ovaries similarly inclosed by the alimentary canal; peritoneum black; pseudobranchiæ present; lateral line present; anal fin short; dorsal nearly over ventrals.

The surrounding of the air bladder by many convolutions of the alimentary canal is peculiar to this group of fishes. During the breeding season, which occurs in the spring, the males are covered with large tubercles, those on the head being the largest.

KEY TO THE SPECIES OF CAMPOSTOMA.

	PAGE
a. Scales small, about 70 to 75 in the lateral series. <i>ornatum</i>	41
aa. Scales larger, about 40 to 55 in the lateral series.	
b. Scales in the lateral series, about 53 <i>anomalum</i>	42
bb. Scales in the lateral series, about 46 <i>formosulum</i>	42

32. *Campostoma ornatum* Girard.

Campostoma ornatum Girard, Proc. Acad. Nat. Sci. Phila., 1856, 176; Rio Chihuahua, Mexico: Girard, Mex. Bd. Sur., 4, pl. xiv, figs. 1-4, 1858; Rio Chihuahua, Mexico: Günther, Cat., vii, 183, 1868: Woolman, Bull. U. S. Fish Comm., 1894, 57; Rio Chihuahua, Chihuahua: Woolman, Ibid., 1894, 61; Rio Lerma, Salamanca, Guanajuato (there is some mistake in regard to this reference, for it is quite evident that this species does not occur in the Lerma Basin): Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 205; Rutter, Proc. Cal. Acad. Sci., 1896, 259; Rucker Cañon, trib. Rio Yaqui, Chiricahua Mts., Arizona: Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 146; Colonia Garcia, Chihuahua: Meek, Field Col. Mus. Pub. 65, 1902, 77; Colonia Juarez; Chihuahua; San Andres; Santa Rosalia; Jimenez.

Campostoma pricei Jordan & Thoburn, Bull. 47, U. S. Nat. Mus., 1896, 205; Rucker Cañon, tributary of Rio Yaqui, Chiricahua Mts., southern Arizona.

Rivers of northern Mexico in the headwaters of the Atlantic and Pacific coast streams, its southern range being the headwaters of the Rio Nazas. (Santiago Papasquiaro.)

Head $3\frac{1}{2}$ to $3\frac{3}{4}$; depth 4 to $4\frac{1}{2}$; D. 8; A. 8; scales 10-72 to 75-9. Body rather stout, not much compressed; head rather large, the snout projecting and somewhat acute; mouth small, the maxillary not reaching to vertical from anterior margin of orbit; length of snout $2\frac{2}{3}$ in head; diameter of eye $4\frac{3}{4}$ in head; origin of dorsal fin midway between base of caudal and anterior margin of eye; 35 to 40 scales in a

series between nape and dorsal fin; longest dorsal ray $1\frac{2}{3}$ in head; pectoral $1\frac{1}{2}$ in head; ventrals $1\frac{1}{3}$ in head; caudal forked; lateral line nearly complete, usually absent on about last 10 scales; males in the spring with large tubercles on head and body.

Color brownish with a brassy luster above; the scales more or less mottled with dark; sides much and irregularly mottled with darker; small specimens with a fairly well developed lateral band, and an indistinct caudal spot; a broad black band across the base of the dorsal fin; all other fins plain. Length about $4\frac{1}{2}$ inches.

Ovaries in females, taken the latter part of May, not enough developed to give a definite idea as to the time of spawning. One specimen taken at Santiago Papasquiaro.

33. *Campostoma anomalum* (Rafinesque). STONE-ROLLER.

Rutilus anomalus Rafinesque, Ichth. Ohiensis, 52, 1820; Licking River, Kentucky.

Campostoma nasutum Girard, Proc. Acad. Nat. Sci. Phila., 1856, 176; Cadereita and Acapulco, Nuevo Leon.

Campostoma dubium Günther, Cat., VII, 183, 1868.

Campostoma anomalum Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 205.

Rivers of the Mississippi Valley south to the Rio San Juan in northeastern Mexico. (San Juan; Montemorelos.)

Head 4 to $4\frac{1}{5}$; depth $4\frac{2}{5}$; D. 8; A. 7 or 8; scales 7-53-8. Body stoutish, moderately compressed, the antedorsal region becoming swollen and prominent in large specimens; head moderate; the snout moderately decurved and pointed, its length $2\frac{1}{3}$ in head; diameter of eye $4\frac{1}{5}$ in head; maxillary not reaching vertical from anterior margin of orbit; 22 to 25 scales in a series between nape and dorsal fin; longest dorsal ray $1\frac{1}{2}$ in head; length of pectoral $1\frac{1}{3}$ in head; ventral $1\frac{1}{3}$ in head; caudal fin forked; lateral line complete; males in the spring with tubercles on snout and body.

Color brownish, much mottled with darker; a broad black band across the base of the dorsal fin; other fins plain; small specimens have a well-defined lateral band and a small black caudal spot. Length 6 to 8 inches.

34. *Campostoma formosulum* Girard.

Campostoma formosulum Girard, Proc. Acad. Nat. Sci. Phila., 1856, 176; Rio Sabinal, near San Antonio, Texas: Jordan, Bull. U. S. Geol. Sur., 1878, 401; Rio Grande, Brownsville, Texas: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 206.

Rio Grande to the Rio Sabinal in Texas.

Head 4; depth $4\frac{1}{2}$; D. 8; A. 7; scales 46. Head short and blunt, with broad, projecting snout.

Color grayish above, whitish below; sides more or less marmorate; a black patch at base of caudal fin and one on the dorsal.

A little-known species.

Subfamily **Chondrostomatinæ.**

15. Xystrosus Jordan & Snyder.

EL POPOCHE.

Xystrosus Jordan & Snyder, Bull. U. S. Fish Com., 1889, 123.

(Type, *Xystrosus popoche* Jordan & Snyder.)

Body elongate, compressed; interorbital space low and flat; mouth terminal, very oblique, jaws about equal; premaxillary protractile; no barbels; no pseudobranchiæ; gill rakers very long and slender, about 66 on first gill arch; teeth 4-4, hooked, with developed grinding surface; alimentary canal about twice as long as body, peritoneum dusky.

35. Xystrosus popoche Jordan & Snyder. POPOCHE.

Xystrosus popoche Jordan & Snyder, Bull. U. S. Nat. Mus., 1900,

123; Lago de Chapala, Ocotlan, Jalisco: Jordan & Evermann,

Bull. 47, U. S. Nat. Mus., 1902, 3142; Meek, Field Col. Mus.

Pub. 65, 1902, 85; Ocotlan; La Palma.

Basin of the Rio Lerma.

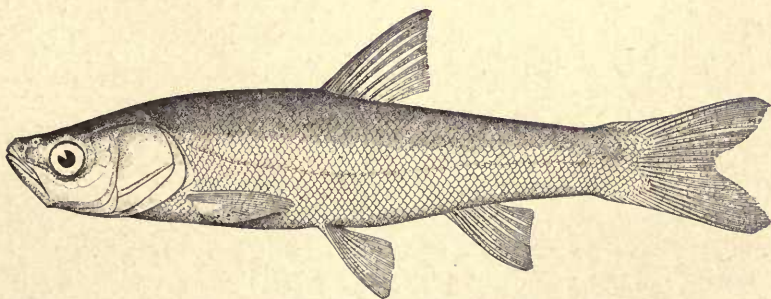


FIG. 7. *XYSTROSUS POPOCHE* Jordan & Snyder.
No. 6151, Leland Stanford Jr. University.

Head $3\frac{1}{2}$; depth $4\frac{1}{3}$; D. 8; A. 7; scales 15-61-7. Body rather robust, compressed; head large, flattish above, interorbital width $2\frac{2}{3}$ in head; snout pointed, 4 in head; mouth large, very oblique, end of maxillary reaching vertical from anterior margin of orbit; diameter of eye 4 to $4\frac{1}{3}$ in head; origin of dorsal midway between

tip of snout and base of caudal; base of dorsal $2\frac{2}{3}$ in head; longest dorsal ray $1\frac{2}{3}$ in head; pectoral $1\frac{1}{3}$ in head; ventral $1\frac{1}{4}$ in head; caudal fin rather short, forked; caudal peduncle robust, its least depth $2\frac{1}{3}$ in head; lateral line decurved anteriorly, complete; gill rakers long, longest about $\frac{2}{3}$ diameter of eye, about 66 on first gill arch; alimentary canal elongate, with about 5 convolutions; peritoneum black.

Color light brownish, lighter below; no distinct lateral band; on smaller specimens (less than 4 inches) a dark caudal spot; fins all plain. Length about 12 inches.

This species is so far known only from Lago de Chapala, where it is quite abundant and is much used for food. Ovaries of females taken the last week of May are quite mature. The spawning season is probably in June.

16. *Algansea* Girard.

Algansea Girard, Proc. Acad. Nat. Sci. Phila., 1856, 182. (Type, *Leuciscus tincella* Cuv. & Val.)

Body robust, not much compressed; mouth moderate, terminal, oblique; no barbels; caudal peduncle strong; fins very small; eyes small; scales small, 60 to 110 in the lateral series; gill rakers short, from 15 to 23 on first gill arch; intestinal canal moderate, $\frac{1}{2}$ to 2 times the length of the body, folded on the right side; peritoneum black; teeth 4-4; vertebrae 20+17 = 37-

KEY TO THE SPECIES OF ALGANSEA.

a. Scales large, 57 to 70 in the lateral series.	PAGE
b. Gill rakers short and blunt, 15 to 19.	
c. Gill rakers 3+12; dorsal fin inserted over ventrals.	<i>tincella</i> 44
cc. Gill rakers 4+15; dorsal fin inserted slightly before ventrals	<i>dugesi</i> 45
bb. Gill rakers long and slender, 22 or 23 on the first gill arch; scales 65 in the lateral series.	<i>rubescens</i> 46
aa. Scales small, 85 to 95 in the lateral series.	<i>lacustris</i> 47

36. *Algansea tincella* (Cuvier & Valenciennes). JUILIS.

Leuciscus tincella Cuvier & Valenciennes, Hist. Nat. Poiss., 323, 1844; City of Mexico.

Algansea tincella Girard, Proc. Acad. Nat. Sci. Phila., 1856, 183; City of Mexico: Girard, Mex. Bd. Sur., 46, pl. xxvii, figs. 1-4, 1858; City of Mexico: Woolman, Bull. U. S. Fish Comm., 1894, 61; Rio Lerma, Salamanca, Guanajuato: Jordan &

Evermann, Bull. 47, U. S. Nat. Mus., 1896, 211: Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 120; Lago de Chalco, Valley of Mexico; Rio Verde, Aguas Calientes: Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Estado de Jalisco: Meek, Field Col. Mus. Pub. 65, 1902, 77; Aguas Calientes; Lagos; Celaya; Acambaro; San Juan del Rio; Lago de Chalco; Texcoco.

*Ceratichthys sallæi** Günther, Cat., VII, 1868, 484; Cuernavaca, Mexico.

Algansea sallæi Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 212.

Basin of the Rio Lerma, the Valley of Mexico and the headwaters of the Rio San Juan to tributary of the Rio Panuco. (Chalco; Viga Canal.)

Head $3\frac{1}{2}$ to 4; depth $3\frac{1}{2}$ to 4; D. 8; A. 8; scales 17-65 to 70-13. Body very stout, moderately compressed; head moderate; snout rather pointed; mouth terminal, oblique; teeth 4-4; maxillary scarcely reaching vertical from anterior margin of orbit; maxillary $3\frac{3}{4}$ in head; snout $3\frac{1}{2}$ in head; eye small, 6 in head; interorbital area very convex, $2\frac{3}{4}$ in head; origin of dorsal fin in advance of ventrals and midway between tip of snout and base of caudal fin; about 35 scales between nape and dorsal fin; longest dorsal ray $1\frac{3}{4}$ in head; base of dorsal $2\frac{3}{8}$ in head; pectoral very short, rounded, $1\frac{3}{4}$ in head; ventrals $2\frac{1}{4}$ in head; caudal fin forked, its length $1\frac{1}{3}$ in head; caudal fin of specimens from lakes about the City of Mexico slightly shorter, and the fish slightly more robust than those from the Lerma Basin; gill rakers very short, 15 on gill arch; lateral line somewhat decurved, complete; vertebrae $20+17=37$.

Color dark reddish brown, gradually becoming lighter below; smaller specimens have a faint lateral band which usually ends in a black caudal spot. This caudal spot is not very evident on specimens 6 or more inches in length. Length about 10 inches.

37. *Algansea dugesi* Bean.

Algansea dugesi Bean, Proc. U. S. Nat. Mus., 1892, 283, pl. XLIV, fig. 1; Lago de Yuriria, Guanajuato: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 212.

*This is the only record of a species of this genus occurring in the basin of the Rio Balsas. I did not find it south or east of Cuernavaca. I am inclined to believe that the specimen on which the description of *Ceratichthys sallæi* was based was secured in the markets of the City of Mexico. It is quite probable that the pond in the famous Borda Garden was partially stocked with fishes from the lakes near the City of Mexico, and the specimen now in the British Museum was taken from it. This pond is said by Dr. W. L. Tower, who saw it last summer, to be about 400 feet long, 200 feet wide, and the water in it to be 6 to 10 feet deep. It contains a large number of fishes from 4 to 8 inches in length. The scales on the type are given by Dr. Boulenger as 57 to 60.

Basin of the Rio Lerma.

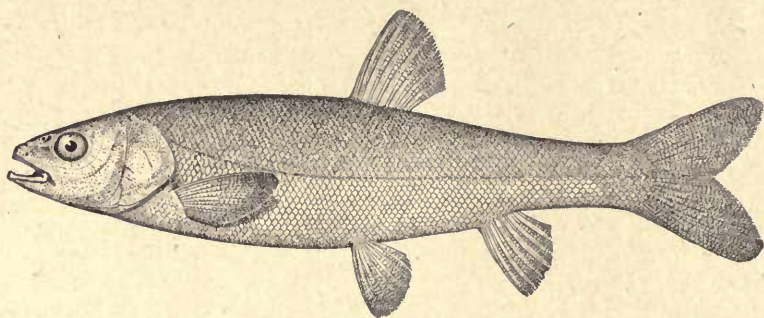


FIG. 8. *ALGANSEA DUGESI* Bean.
No. 41818, U. S. National Museum.

Head 4; depth 4; D. 7; A. 6; scales 18-69 to 72-13. Body robust; snout rather pointed, its length $3\frac{1}{2}$ in head; mouth rather large, maxillary reaching to vertical from anterior margin of orbit; lower jaw slightly included; teeth 4-4; dorsal fin inserted somewhat before ventrals; midway between tip of snout and base of caudal; longest dorsal ray $1\frac{1}{2}$ in head; about 30 scales in a series between nape and dorsal fin; length of pectoral fin $1\frac{1}{2}$ in head; ventral $1\frac{1}{3}$; lateral line decurved, complete; gill rakers 4+15 on first gill arch.

Color dusky brown; sides of head silvery; a faint dusky spot at base of caudal; upper fins dusky, unmarked. (Bean.) Length about 6 inches. Known only from the type locality.

38. *Algansea rubescens* Meek.

Algansea rubescens Meek, Field Col. Mus. Pub. 65, 1902, 78;
Ocotlan.

Lago de Chapala and neighboring region.

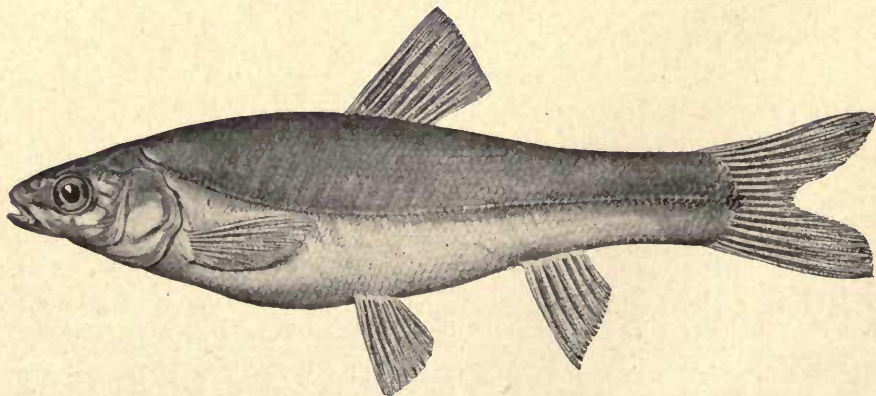


FIG. 9. *ALGANSEA RUBESCENS* Meek.
No. 3653, Field Columbian Museum.

Head 4; depth 4 to $4\frac{1}{5}$; D. 8; A. 7; scales 16-65-10. Body elongate, rather robust; snout rather blunt, 4 in head; mouth oblique; lower jaw short included; maxillary scarcely reaching vertical from anterior of eye, its length $3\frac{1}{4}$ in head; interorbital convex, $2\frac{2}{3}$ in head; eye 5 in head; origin of dorsal midway between tip of snout and base of caudal; longest dorsal ray $1\frac{1}{2}$ in head; base of dorsal $2\frac{1}{4}$ in head; 33 scales in a series between nape and dorsal fin; pectoral $1\frac{2}{3}$ in head; ventral $1\frac{2}{3}$ in head; caudal fin forked, its length about $1\frac{1}{10}$ in head; gill rakers long and rather slender, 22 or 23 on the first gill arch; lateral line complete, decurved.

Color reddish, becoming lighter below, not much silvery; a very faint lateral band on posterior half of body; a black caudal spot, which is rather faint in specimens over 6 inches long. Length 6 to 10 inches.

Spawning time about the middle or last of June.

39. *Algansea lacustris* Steindachner.

Algansea lacustris Steindachner, Einige Fisharten, Mexico, 1895, 10, pl. III, figs. 1-1b; Lago de Patzcuaro: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3140: Meek, Field Col. Mus. Pub. 65, 1902, 78; Patzcuaro.

Algansea tarascorum Steindachner, ibid., figs. 2-2c; Lago de Patzcuaro, Michoacan: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2796.

Basin of the Rio Lerma; very abundant in Lago de Patzcuaro.

Head $3\frac{2}{3}$ to 4; depth $3\frac{2}{3}$ to 4; D. 8; A. 7 or 8; scales 24-85 to 100-15. Body rather stout, head moderate; snout rather pointed; mouth oblique, terminal, maxillary scarcely reaching vertical from anterior margin of orbit; snout rather pointed, $3\frac{1}{2}$ in head; eye small, 5 to 6 in head; interorbital area moderately convex, $2\frac{2}{3}$ in head; origin of dorsal fin in advance of ventrals, midway between base of caudal and nostril; longest dorsal ray $1\frac{3}{4}$ in head; base of dorsal fin $2\frac{2}{3}$ in head; pectoral $1\frac{1}{2}$ in head; ventral $2\frac{1}{3}$ in head; caudal fin forked, its length $1\frac{1}{3}$ in head; gill rakers moderately long and slender, about 22 on first gill arch; lateral line complete, somewhat decurved.

Color light reddish above, lighter with a silvery tinge below. The young have a very faint lateral band which ends in a caudal spot. This spot is very obscure in specimens of 6 inches or over. Length about 8 inches.

This species is easily distinguished from the others of the genus by its very small scales. Spawning time the last of May or early in June.

17. Hybognathus Agassiz.

THE SILVERY MINNOWS.

Hybognathus Agassiz, Amer. Jour. Sci. Arts, 1855, 223. (Type, *Hybognathus nuchalis* Agassiz.)*

Dionda Girard, Proc. Acad. Nat. Sci. Phila., 1856, 177. (Type, *Dionda episcopa* Girard.)

Algoma Girard, l. c., 180. (Type, *Algoma amara* Girard.)

Body elongate, somewhat compressed; mouth small, horizontal or oblique; the jaws normal, sharp-edged; lower jaw with a slight, hard protuberance on anterior margin; no barbel; upper jaw protractile; teeth 4-4, with grinding surface, little if any hooked; alimentary canal elongate, three or more times length of body; peritoneum black; scales large, about 40 in lateral series; dorsal fin in advance of ventrals; anal fin short. Small fishes usually inhabiting streams with considerable current.

KEY TO THE SPECIES OF HYBOGNATHUS.

- | | | | |
|-----|--|------------------|---------|
| a. | Body robust, depth less than 4 in body; no well defined lateral band; eye small, $3\frac{1}{4}$ in head | <i>episcopus</i> | PAGE 48 |
| aa. | Body rather slender, depth 4 in body; a well defined lateral band and a distinct caudal spot; eye large, $2\frac{2}{3}$ to 3 in head | <i>rasconis</i> | 50 |

40. Hybognathus episcopus (Girard). SILVERY MINNOW.

Dionda episcopa Girard, Proc. Acad. Nat. Sci. Phila., 1856, 177; Comanche Spring, a tributary of the Rio Grande.

Dionda melanops Girard, Proc. Acad. Nat. Sci. Phila., 1856, 178; Buena Vista, Coahuila: Girard, Mex. Bd. Sur., 44, pl. xxvi, figs. 17-20, 1859; Buena Vista, Coahuila.

Dionda couchi Girard, Proc. Acad. Nat. Sci. Phila., 1856, 178; Guajuco, Monterey, and Cadereita, Nuevo Leon: Girard, Mex. Bd. Sur., 44, pl. xxvi, figs. 1-4, 1859; Guajuco, Monterey and Cadereita, Nuevo Leon.

Algoma amara Girard, Proc. Acad. Nat. Sci. Phila., 1856, 180; Lagoon near Ft. Brown, Texas: Girard, Mex. Bd. Sur., 45, pl. xxvii, figs. 17-20, 1859; Ft. Brown, Texas.

Algoma fluviatilis Girard, Proc. Acad. Nat. Sci. Phila., 1856, 181; near Monterey, Nuevo Leon: Girard, Mex. Bd. Sur., 45, pl. xxvii, figs. 17-20, 1859; Monterey, Nuevo Leon.

Dionda amara Jordan, Bull. U. S. Geol. Sur., 1876, 401; Brownsville, Texas.

Hybognathus serenus Jordan, Bull. Geol. Sur., 1878, 401; Brownsville, Texas: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 214.

Hybognathus melanops Jordan, Bull. U. S. Geol. Sur., 1878, 402; Brownsville, Texas: Woolman, Bull. U. S. Fish Comm., 1894, 59; Rio Conchos, Chihuahua: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 217; Meek, Field Col. Mus. Pub. 65, 1902, 77; Chihuahua, Jimenez.

Hybognathus punctifer Garman, Bull. Mus. Comp. Zool., 1881, 89; Parras, and Spring near Saltillo, Coahuila, Mexico.

Hybognathus civilis Cope, Trans. Amer. Phila. Soc., 1884, 167; Monterey, Nuevo Leon.

Hybognathus episcopa Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 214.

Hybognathus amara Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 215.

Southern Texas and northern Mexico south to the Rio Mezquital in Durango, and the Rio San Juan, in Nuevo Leon. (Labor; Durango; Monterey; Montemorelos.)

— Head 4; depth $3\frac{5}{8}$; D. 8; A. 7; scales 7-38 to 45-5. Body rather stout, moderately compressed; head moderate, flattish above; snout bluntish, $3\frac{1}{4}$; interorbital width 2 in head; eye $3\frac{1}{4}$; mouth small, oblique; maxillary reaching about half-way to vertical of front of eye; margin of upper lip on a level with lower margin of pupil; pharyngeal teeth 4-4, grinding surface not hooked, sometimes the distal portion blackish; origin of dorsal midway between base of caudal and nostril; longest dorsal ray $1\frac{1}{2}$ in head; base of dorsal 2 in head; length of pectoral $1\frac{1}{3}$ in head; ventral $1\frac{3}{4}$ in head; lateral line slightly decurved, occasionally missing on a few scales; caudal peduncle rather strong, its least width about 2 in head (caudal peduncle in Durango specimen is about $2\frac{1}{2}$ in head and in Chihuahua specimens about 2 in head); alimentary canal about three times the length of the body; peritoneum black.

Color dark to light brownish (specimens from Montemorelos considerably paler), lighter below; edges of scales darker, forming dark lines along their rows; in darker specimens a dark lateral band ending in a dark caudal spot; in paler specimens this band and spot very faint; fins all plain. Length about 3 inches. Southern Texas and northern Mexico, south to the Rio Mezquital, Durango, and the Rio San Juan, Montemorelos.

This species is very variable. I have compared many specimens from various localities in Mexico and regard all as belonging to the same species. The specimens taken at Durango and Monterey are much darker than those from Montemorelos; the color of specimens from other localities represent various shades between these extremes. Spawning time the last of May and first part of June.

41. *Hybognathus rasconis* (Jordan & Snyder).

Notropis rasconis Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 121; Rio Verde, near Rascon, San Luis Potosi: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3141.

Basin of the Rio Panuco. (Forlon; Valles; Rascon; Rio Verde, Dr. W. L. Tower.)

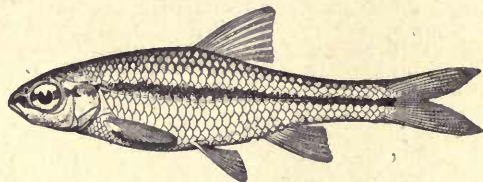


FIG. 10. *HYBOGNATHUS RASCONIS* (Jordan & Snyder).
No. 6153 (*Notropis rasconis* Jordan & Snyder), Leland Stanford Jr. University.

Head 4; depth 4; D. 8; A. 8; scales 7-36 to 42-5. Body rather elongate, aspect of *Nototropis heterodon*; head small, convex above, interorbital width $2\frac{1}{2}$ to 3; eye $2\frac{2}{3}$ to 3; snout $3\frac{1}{2}$; teeth 4-4; mouth moderate, the maxillary nearly reaching vertical from anterior margin of orbit; mouth oblique, more so than in preceding species; origin of dorsal fin midway between base of caudal and tip of snout; longest dorsal ray $1\frac{1}{2}$ in head; base of dorsal $2\frac{1}{8}$ in head; pectorals $1\frac{1}{8}$ in head; ventrals $1\frac{1}{2}$ in head; lateral line decurved, occasionally missing on a few scales.

Color dark olivaceous above, lighter below; sides with a well-defined lateral band ending in a black caudal spot. Length about $2\frac{3}{4}$ inches.

18. *Pimelocephales* Rafinesque.

FLAT-HEAD MINNOWS.

Pimephales Rafinesque, Ichth. Ohiensis, 52, 1820. (*Pimephales promelas* Rafinesque).

Body rather robust, little compressed; head short and rounded; mouth small, inferior; upper jaw protractile; no barbels; teeth 4-4, with oblique grinding surface, usually but one of the teeth hooked; dorsal fin opposite ventrals, its first (rudimentary) ray separated from the rest by a membrane, and not adnate to the first developed ray, as is usual in minnows (most distinct in adult males, in which the skin of the first ray is thickened); anal base short; alimentary canal elongate, about $2\frac{1}{2}$ times the length of the body; peritoneum black; lateral line complete or missing on some scales. A small group of minnows inhabiting streams east of the Rocky Mountains and south to Chihuahua.

42. Pimelocephales confertus (Girard).

Hyborhynchus confertus Girard, Proc. Acad. Nat. Sci. Phila., 1856, 179; Hurrah Creek, tributary of the Rio Pecos, Texas.

Pimephales promelas Jordan, Bull. U. S. Geol. Sur., 1878, 402; Brownsville, Texas.

Pimephales confertus Woolman, Bull. U. S. Fish Comm., 1894, 57; Rio Chihuahua, Chihuahua: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 217; Meek, Field Col. Mus. Pub. 65, 1902, 79; Colonia Juarez; Guzman; Santa Maria; Chihuahua; San Andres; Santa Rosalia; Jimenez; Miñaca.

Tributaries of the Rio Grande and the Rio Yaqui in northern Mexico and southwestern Texas.

Head 4; depth $3\frac{3}{4}$; D. 7; A. 7; scales 12-52 to 55-8. Body robust, head flat above; interorbital width $2\frac{1}{2}$ in head; snout blunt, 4 in head; diameter of eye $3\frac{1}{4}$ in the head; teeth 4-4; origin of dorsal midway between base of caudal fin and nostril; longest dorsal ray $1\frac{1}{4}$ in head; pectoral $1\frac{1}{2}$ in head; ventral $1\frac{1}{3}$; scales on anterior and upper part of body very small, about 35 in a series between nape and dorsal fin; lateral line decurved, complete; caudal fin forked; intestinal canal $2\frac{1}{2}$ times length of body.

Color light olivaceous to nearly black; the very black males have a light vertical bar from base of pectoral to back; a second light bar from first dorsal rays to base of ventrals; pectoral fins black; middle portion of ventral and anal fins very dark; caudal with a dark bar across its middle; all of the fins in the light colored specimens pale. Length about $2\frac{3}{4}$ inches.

Subfamily **Mylopharodontinæ**.**19. Stypodon** Garman.

Stypodon Garman, Bull. Mus. Comp. Zoöl., VIII, 1881, 90. (Type, *Stypodon signifer* Garman.)

Body oblong, compressed, covered with large deciduous scales; mouth small, terminal; premaxillaries protractile; fold of lower lip not crossing the symphysis; lower jaw trenchant, without horny covering; no barbels; pharyngeals strong; teeth 3-3, more or less cylindrical, with rounded grinding surface, the posterior more slender and subconical; lateral line complete, decurved; gill rakers short; dorsal and anal fins short.

43. Stypodon signifer Garman.

Stypodon signifer Garman, Bull. Comp. Zoöl., 1881, 90; Lago de Parras, Coahuila: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 220.

Head $3\frac{2}{3}$; depth $3\frac{2}{3}$; D. 8; A. 8; scales 6-35-20. Body oblong, compressed; dorsal and ventral outlines similar; snout short, less than diameter of eye; mouth oblique, the maxillary not reaching vertical from front of eye; lower jaw the longer; pectorals not reaching ventrals; the latter to anal.

Color brown, silvery below; a broad brown lateral band bordered above by a narrow silvery line. (Garman.)

A small fish, known only from the above account.

Subfamily Leuciscinæ.

20. *Ptychocheilus* Agassiz.

Ptychocheilus Agassiz, Amer. Journ. Sci. Arts, 1855, 229. (Type, *Ptychocheilus gracilis* Agassiz.)

Body elongate, little elevated, the caudal peduncle not contracted; head long and slender, pike-like; mouth nearly horizontal, widely cleft, the maxillary extending below the eye; the margin of the upper lip rather lower than the inferior margin of the eye; lower jaw included; no barbels; lips thick; scales small; mostly longer than deep; lateral line decurved; gill rakers very short; dorsal fin somewhat behind ventrals; anal base short; caudal fin strong; intestinal canal short; teeth 2, 5-4, 2; the straight limb of the pharyngeal bone extremely long and slender, its teeth wide apart; teeth subconical, scarcely compressed and but slightly curved at the tip; no grinding surface. Minnows of very large size.

44. *Ptychocheilus lucius* Girard. WHITE SALMON OF THE COLORADO RIVER.

Ptychocheilus lucius Girard, Proc. Acad. Nat. Sci. Phila., 1856, 209; Rio Colorado: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 225; Bean, Bull. Amer. Mus. Nat. Hist., 1898, 165; Northern Sonora: Gilbert & Scofield, Proc. U. S. Nat. Mus., 1898, 492; Colorado River at Yuma and Horseshoe Bend, near its mouth.

Sonora and the Colorado River Basin, north to the Uncompagre River at Delta, Colorado.

Head $3\frac{1}{2}$; depth $5\frac{1}{2}$; D. 9; A. 9; scales 83 to 87. Body slender, elongate, with long, slender, depressed head; eye small, $2\frac{1}{4}$ in the snout, 7 in head; mouth large; maxillary $2\frac{3}{8}$ in head, its tip reaching past vertical from anterior margin of eye; teeth 2, 4-5, 2; lateral line strongly decurved; fins moderate.

Color plain, darker above; the young always with a caudal spot and a faint pale lateral line below a darker one. Length about 4 feet.

This is the largest member of the American *Cyprinidæ*, reaching a weight of 80 pounds. It has been taken in northern (probably in the Rio Sonora or Rio Yaqui) Sonora; otherwise known only from the Colorado Basin.

21. *Gila* Baird & Girard.

Gila Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1853, 368.
(Type, *Gila robusta* Baird & Girard.)

Body elongate, little compressed; the back arched, especially in the adult; the caudal peduncle extremely long, slender, contracted, much narrower than the base of the caudal fin which is widely forked, with its basal fulcra very much developed; head broad, more or less depressed, its profile concave; mouth large, horizontal and overlapped by the broad snout; dorsal fin behind the middle of the body, slightly behind ventrals; anal base short; intestinal canal short; peritoneum dusky; scales very small, longer than deep, especially posteriorly; no barbels; teeth 2, 5-4, 2, closely set, compressed and hooked, without grinding surface; vertebræ 42 to 46. Minnows of large size, known only from the Colorado, Gila, and Yaqui rivers. These fishes are easily distinguished from others of the family by the long, slender caudal peduncle.

KEY TO THE SPECIES OF GILA.

- | | | | |
|-----|--|----------------|----|
| a. | Head short, 5 in the length; anal rays 10;
caudal peduncle long and slender, as broad as
deep; tips of pectorals reaching $\frac{2}{3}$ distance to
base of ventrals..... | <i>elegans</i> | 53 |
| aa. | Head longer, $3\frac{1}{2}$ in the length; anal rays 8;
caudal peduncle more robust; tips of pectorals
reaching to base of ventrals..... | <i>minacæ</i> | 54 |

45. *Gila elegans* Baird & Girard. BONY-TAIL; GILA TROUT.

Gila elegans Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1853, 369; Zuñi, Colorado, and Gila rivers: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 226; Gilbert & Scofield, Proc. U. S. Nat. Mus., 1898, 492; Colorado and Gila rivers, at Yuma and Horseshoe Bend.

Channels of the Colorado and Gila rivers.

Head 5; depth 5; D. 9; A. 10; scales 23-85-10. Body elongate, somewhat compressed, the region before the dorsal elevated, forming a sort of hump; head short, broad; the snout depressed and broadly rounded; the anterior part of the head from behind the eyes broad and depressed, the posterior part high, so that the profile forms a

concave arch; mouth rather large, nearly horizontal, the upper lip on the level of the inferior margin of eye; lower jaw included; skin of the lower jaw hard; teeth 2, 4-5, 2; eye small, 5 in head; gill rakers rather weak; fins all long and falcate; pectorals reaching ventrals; caudal deeply forked.

Color bluish above, pale below. Length about 12 inches.

46. *Gila minacæ* Meek. BONY-TAIL.

Gila minacæ Meek, Field Col. Mus. Pub. 65, 1902, 80; Miñaca. Headwaters of the Rio Yaqui.

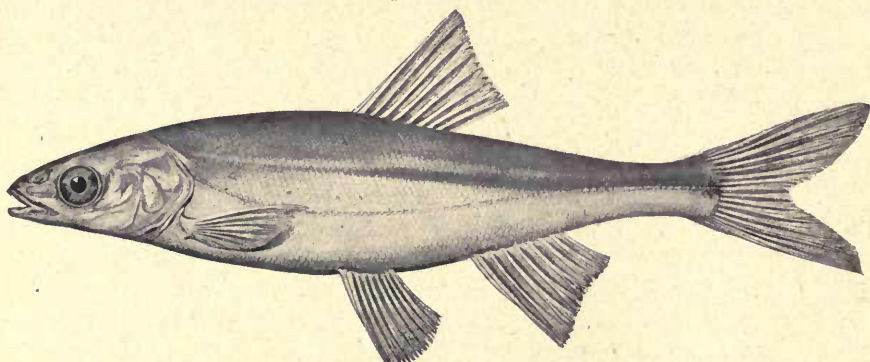


FIG. 11. *GILA MINACÆ* Meek.
No. 3573, Field Columbian Museum.

Head $3\frac{4}{5}$; depth $4\frac{2}{5}$; D. 9; A. 8; scales 24-90-11. Body elongate, back not arched; snout bluntish; mouth terminal, rather large; maxillary not reaching anterior margin of pupil, its length $3\frac{1}{8}$ in head; snout $3\frac{1}{2}$; diameter of eye $4\frac{1}{4}$; body completely scaled; origin of dorsal fin slightly behind base of ventrals, midway between base of caudal and anterior margin of orbit; base of dorsal 2 in head, its longest ray $1\frac{1}{4}$ in head; the tips of the dorsal rays fall together when the fin is deflexed and fall opposite to the middle of the base of the anal fin; ventrals $1\frac{2}{3}$ in head, their tips reaching vent; caudal fin forked, its upper lobe the larger; lateral line complete, decurved, its lowest portion over space between tip of pectorals and ventrals, reaching axis of the body on posterior half of caudal peduncle; a row of pores from nostril to nape; a second row on sides of head under eye to near upper angle of opercle; caudal peduncle very slender, nearly terete, its least depth $3\frac{1}{2}$ in the head.

Color light olivaceous; a faint dark band from base of caudal to opposite first dorsal rays; fins all plain; a faint caudal spot. Length of type 4.46 inches.

22. *Leuciscus* Cuvier.

DACE.

Leuciscus (Klein) Cuvier, Regne Animal, Ed. 1, 194, 1817. (No type mentioned, *Cyprinus leuciscus* Linnæus, understood.)

Body oblong, robust, compressed or nearly terete, caudal peduncle rather strong; mouth usually large, terminal and oblique; no barbels; scales large or small, 36 to 100 in the lateral series; dorsal fin usually behind the ventrals; intestinal canal short; teeth (in American species) 2, 5-4, 2, to 1, 4-4, 1, hooked, with a narrow grinding surface or none; lateral line decurved, complete or not; anal fin composed of from 7 to 22 rays. A very large genus of very variable fishes, of which only two species are known from Mexico.

KEY TO THE SPECIES OF LEUCISCUS.

- | | | |
|-----|---|---------------------------|
| a. | Body rather slender; head $4\frac{1}{2}$ in length of | PAGE |
| | body; depth $4\frac{3}{4}$ | <i>nigrescens</i> 55 |
| aa. | Body elongate, heavy forward; head $3\frac{3}{4}$; | |
| | depth 4..... | [<i>intermedius</i>] 56 |

47. *Leuciscus nigrescens* (Girard). PESCADITO; CHUB OF THE RIO GRANDE.

Tigoma nigrescens Girard, Proc. Acad. Nat. Sci. Phila., 1856, 207; Boca Grande and Rio Janos, Chihuahua: Girard, Mex. Bd. Sur., 64, pl. xxxii, figs. 1-4, 1859; Boca Grande and Rio Janos, Chihuahua.

Tigoma pulchella Girard, Proc. Acad. Nat. Sci. Phila., 1856, 206; Rio Mimbres, tributary of Lago de Guzman, Chihuahua: Girard, Mex. Bd. Sur., 62, pl. xxxiv, figs. 5-8, 1859; Rio Mimbres, Chihuahua.

Tigoma pulchra Girard, Proc. Acad. Nat. Sci. Phila., 1856, 207; Rio Chihuahua, Chihuahua.

Gila conspersa Garman, Bull. Mus. Comp. Zool., 1881, 91; Rio Nazas.

Cheonda modesta Garman, Bull. Mus. Comp. Zool., 1881, 92; Rio Salinas, Saltillo, Coahuila.

Cheonda nigrescens Garman, Bull. Mus. Comp. Zool., 1881, 92; Parras, Coahuila.

Leuciscus nigrescens Woolman, Bull. U. S. Fish Comm., 1894, 57; Rio Chihuahua, Chihuahua: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 233; Meek, Field Col. Mus. Pub. 65, 1902, 80; Colonia Juarez; Santa Maria; Chihuahua; Bustillos; San Andres; Miñaca; Ahumada.

Tigoma conspersa Garman, Bull. Mus. Comp. Zool., 1896, 234; Rio Nazas, Coahuila.

Leuciscus purpureus Rutter, Proc. Cal. Acad. Sci., 1896, 260; Morse Cañon and the Rio Yaqui east of Opsura.

Leuciscus niger Bean, Bull. Amer. Mus., 1898, 166; San Diego, Chihuahua.

Northern Mexico, headwaters of the Rio Yaqui, to the headwaters of the Rio Mezquital, the Rio Nazas, and east to Saltillo, Coahuila. (Lerdo; Santiago Papasquiaro; Durango.)

Head $3\frac{1}{2}$ to $4\frac{1}{2}$; depth 4 to $4\frac{2}{3}$; D. 8; A. 8; scales 15 to 18-60 to 75-8 to 10. Body rather slender, little compressed; head rather long and pointed; snout $3\frac{2}{3}$ in head; mouth moderate, oblique, terminal; the jaws equal, the maxillary about reaching front of eye; eye rather small, 5 to 6 in head; origin of dorsal fin midway between base of dorsal and nostril, its longest ray $1\frac{1}{3}$ in head; base of dorsal fin 2 in head; pectorals reaching about $\frac{2}{3}$ distance to ventrals, $1\frac{1}{3}$ in head; ventrals $1\frac{2}{3}$ in head; lateral line decurved, complete; caudal fin forked; least depth of caudal peduncle $2\frac{1}{8}$ in head; teeth 2, 4-5, 1, hooked, and with narrow grinding surface.

Color dusky above, silvery below; some larger specimens with a reddish tinge; young specimens usually have a dark lateral band and a black caudal spot; the band and caudal spot disappearing with age, being quite absent on specimens over 8 inches in length. Length about 12 inches. A very abundant and variable species.

***Leuciscus intermedius* (Girard).**

Tigoma intermedia Girard, Proc. Acad. Nat. Sci. Phila., 1856, 206; Rio San Pedro, tributary of the Gila, Arizona.

Leuciscus intermedius Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 235; Gilbert & Scofield, Proc. U. S. Nat. Mus., 1898, 493 (see this reference for synonymy).

Leuciscus niger Jordan & Evermann, *ibid.*, 235.

This species has been taken in Arizona, near the Mexican border. It may occur in northern Sonora.

Head $3\frac{3}{4}$; depth $3\frac{3}{4}$ to 4; D. 8; A. 8 or 9; scales 15-65 to 80-9. Body elongate, heavy forward; head long, rather pointed, broad above, depressed over the eye; interorbital $4\frac{1}{3}$ in head; mouth large, oblique, the jaws equal, the maxillary just reaching vertical from the eye; dorsal fin slightly behind origin of ventrals; pectorals long, nearly reaching ventrals, $1\frac{2}{3}$ in head; ventrals 2 in head; lateral line decurved; teeth 2, 5-4, 2.

Color dusky, paler below; small specimens with a dark lateral band; fins all dusky. Southwestern Arizona in basin of the Gila River.

In size and appearance this species is very much like the preceding.

23. *Abramis* Cuvier.

BREAMS.

Abramis Cuvier, Regne Animal, Ed. I, III, 1817. (Type, *Cyprinus brama* Linnæus.)

Notemigonus Rafinesque, Jour. Phys. Chem. et Hist. Nat. Paris, 1819, 421. (Type, *Notemigonus auratus* Rafinesque = *Cyprinus crysoleucas* Mitchill.)

Body sub-elliptical, strongly compressed; dorsal and ventral outlines similar; belly behind ventral fins forming a keel over which the scales do not pass; head small, conic; mouth small, oblique; no barbels; dorsal fin inserted behind ventrals; anal fin long, its rays (American species) 9 to 18; lateral line complete, much decurved, concurrent with ventral outline; alimentary canal short, a little longer than the body; teeth 5-5, edges crenate.

48. *Abramis chrysoleucus* (Mitchill). GOLDEN SHINER; BREEM.

Cyprinus crysoleucas Mitchill, Rept. Fish. N. Y., 23, 1814; New York.

Notemigonus chrysoleucus Jordan, Bull. U. S. Geol. Sur., 1878, 404; Brownsville, Texas.

Abramis americanus Günther, Cat., VII, 305, 1868.

Abramis crysoleucas Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 250.

Mouth of the Rio Grande north to the Dakotas and Nova Scotia.

Head $4\frac{1}{2}$; depth 3; D. 8; A. 12 to 14; scales 10-46 to 55-3. Body moderately elongate, strongly compressed; head short, sub-conic, compressed, the profile somewhat concave; mouth small, oblique, the upper lip on a level of upper part of pupil; the maxillary not reaching vertical from anterior margin of the orbit.

Color greenish above; sides silvery with golden reflections; fins yellowish, the tips of the lower fins sometimes slightly orange in spring males. Length about 12 inches.

The most southern known locality of this species is the mouth of the Rio Grande at Brownsville, Texas; from here it ranges north to Dakota and Nova Scotia. It lives mostly in bayous and ponds where there is much vegetation.

24. *Cochlognathus* Baird & Girard.

Cochlognathus Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854, 158. (Type, *Cochlognathus ornatus* Baird & Girard.)

Body elongate; head rather large; jaws each provided with a hard cutting plate, the sharp, bony edge being surrounded by the usual lip; teeth 4-4, with grinding surface, the tips slightly hooked; first dorsal ray spine-like and separate from the next ray by a membrane; alimentary canal short; anal fin small.

49. *Cochlognathus ornatus* Baird & Girard. HARD-JAW MINNOW.

Cochlognathus ornatus Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854, 158; Brownsville, Texas: Girard, Proc. Acad. Sci. Phila., 1856, 181; Brownsville, Texas: Girard, Mex. Bd. Sur., 46, pl. xxv, figs. 12-17, 1859; Brownsville, Texas: Günther, Cat., VII, 187, 1868: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 252.

Head 4; depth $4\frac{1}{2}$; D. 8; A. 6; scales 40. Body moderately elongate; head long; dorsal fin over ventrals, rather high; caudal fin short.

Color dusky, yellowish; a dusky lateral band; dorsal fin with a black spot near the base in front and a dusky blotch behind; caudal fin with a dusky median band, preceded and followed by a pale area; snout tuberculate in the spring during the breeding season. Length about three inches. Known only from the type locality.

25. *Falcula* Jordan & Snyder.

Falcula Jordan & Snyder, Bull. U. S. Fish Comm., 1899, 124.
(Type, *Falcula chapalæ* Jordan & Snyder.)

Body elongate, compressed; caudal peduncle slender; mouth large; lips thin, premaxillary protractile; no barbels; teeth 4-4, hooked, with grinding surface; gill rakers few, short, far apart; alimentary canal short; peritoneum light; fins high.

50. *Falcula chapalæ* Jordan & Snyder. SARDINA.

Falcula chapala Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 125, fig. 6; Lago de Chapala, Jalisco: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3143: Meek, Field Col. Mus. Pub. 65, 1902, 85; Ocotlan; La Palma; La Barca Basin of the Rio Lerma.

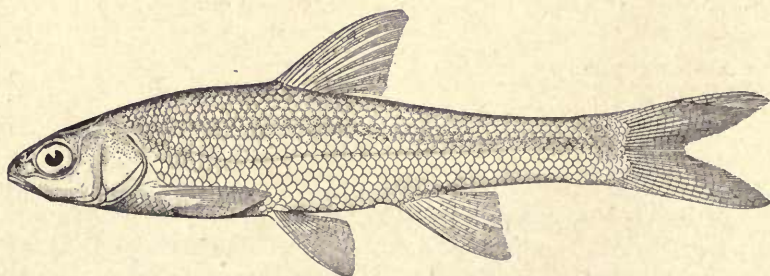


FIG. 12. *FALCULA CHAPALÆ* Jordan & Snyder.
No. 6152, Leland Stanford Jr. University.

Head $3\frac{3}{4}$ to 4; depth 4 to $4\frac{1}{4}$; D. 8; A. 8; scales 8-50-5. Body elongate, compressed, back little arched; head long, narrowed for-

wards; interorbital broad, convex, 3 in head; snout very slightly bluntish, $3\frac{1}{4}$ in head; eye $3\frac{1}{2}$ to $4\frac{1}{3}$ in head; mouth large, oblique; maxillary reaching vertical from anterior margin of orbit; origin $3\frac{1}{2}$ dorsal nearer tip of snout than base of caudal; base of dorsal $2\frac{1}{4}$ in head; its longest ray $1\frac{1}{3}$ in head; pectoral long and slender, its length $1\frac{1}{3}$ in head; ventral $1\frac{1}{2}$ in head; base of anal $2\frac{2}{3}$ in head; caudal fin long and pointed; caudal peduncle rather slender, its least depth $2\frac{2}{3}$ in head; lateral line decurved, complete.

Color light brownish; a faint plumbeous band on side; no caudal spot; the fins all plain. Length about 10 inches.

This species is known only from the region about the lake whose name it bears, and where it is abundant. Spawning time the middle or the latter part of June. This fish is much used for food.

26. *Aztecula* Jordan & Evermann.

Azteca Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 258. (Type, *Notropis aztecus* Woolman = *Codoma vittata* Girard.)

Aztecula Jordan & Evermann, *ibid.*, 1898, 2799; substitute for *Azteca*, which is preoccupied in Entomology.

Body very robust; moderately compressed; head rather large; snout decurved; mouth terminal, oblique, rather small; fins small; scales small; origin of dorsal slightly behind ventrals; teeth 4-4, no grinding surface, tips slightly hooked; intestinal canal short, about equal to the length of the fish; gill rakers very short, about 9 on first gill arch; vertebrae $18+16=34$.

KEY TO THE SPECIES OF AZTECULA.

- | | |
|--|--------------------|
| a. Scales large, about 50 in the lateral line; about 23 scales between nape and dorsal fin. | PAGE |
| b. Eye large, its diameter $3\frac{3}{4}$ in the head; caudal peduncle robust, its least depth 2 in head. | <i>vittata</i> 59 |
| bb. Eye smaller, its diameter 5 in the head; caudal peduncle slender, its least depth $2\frac{1}{4}$ in head | <i>lermae</i> 60 |
| aa. Scales small, about 59 in the lateral line; about 30 scales between nape and dorsal fin | <i>mexicana</i> 61 |

51. *Aztecula vittata* (Girard).

Codoma vittata Girard, Proc. Acad. Nat. Sci. Phila., 1856, 195; Valley of Mexico: Girard, Mex. Bd. Sur., 53, pl. xxix, figs. 18-21, 1859; Valley of Mexico.

Notropis aztecus Woolman, Bull. U. S. Fish Comm., 1894, 63; Canals about the City of Mexico: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 258; City of Mexico.

Aztecula azteca Meek, Field Col. Mus. Pub. 65, 1902, 81; Texcoco; Chalco

Mexico and headwaters of the Rio Balsas at Puebla (Agua Canal; Chalco; Puebla. Xochimilco.)

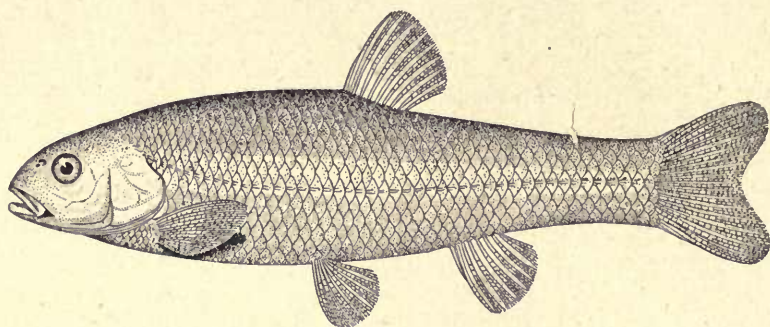


FIG. 13. *AZTECULA VITTATA* (Girard).
No. 45569 (*Notropis aztecus* Woolman), U. S. National Museum.

Head 4; depth $3\frac{1}{2}$ to 4; D. 8; A. 8; scales 7-50-5. Body robust, back moderately arched, the highest point over pectorals; snout bluntish, $4\frac{1}{2}$ in head; mouth small, oblique; maxillary scarcely reaching vertical from front of eye, $3\frac{3}{4}$ in head; teeth 4-4; eye small, $4\frac{1}{2}$ in head; origin of dorsal midway between base of caudal and eye; about 23 scales in a series between nape and dorsal fin; pectoral fin short, $1\frac{2}{3}$ in head; ventral $1\frac{4}{5}$; caudal fin forked; caudal peduncle rather stout, its least depth 2 in head; lateral line decurved, wavy, complete.

Color dark brown above, lighter below; a dark lateral band more distinct on posterior half of body; the band more prominent in young examples; caudal spot very indistinct.

This species is very abundant in the lakes and canals about the City of Mexico. I also took six specimens of this species from the river at Puebla and a number of small ones from a pond near by. Its appearance in the Balsas basin was rather unexpected. There is a quite deep artificial pond at Santa Maria, near Puebla, in which are fishes of this species which were probably brought from the lakes near the City of Mexico, and have escaped into the river near by.

52. *Aztecula lermæ* (Evermann & Goldsborough).

Notropis lermæ Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 147, fig. 3; Lago de Lerma, Mexico.

Basin of the Rio Lerma. (Lerma.)

Head $3\frac{2}{3}$; depth $3\frac{2}{3}$; D. 9; A. 8; scales 7-47-5. Body stout, deep, not much compressed, the dorsal region gently elevated; head

rather heavy; snout short and rather blunt; mouth small, oblique, the lower jaw included; the maxillary scarcely reaching vertical from anterior margin of the eye, $3\frac{1}{3}$ in head; eye 5 in head; snout $3\frac{1}{4}$; teeth 4-4; hooked, and with crenate edges; origin of dorsal fin midway

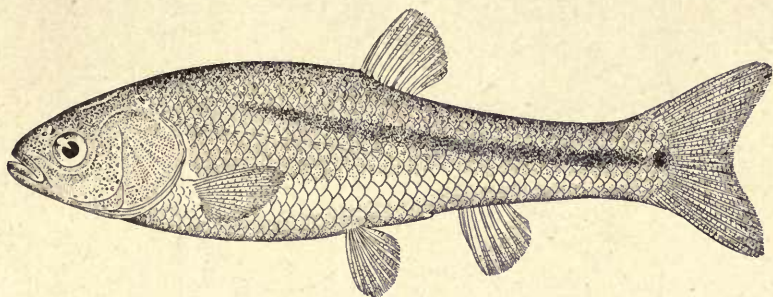


FIG. 14. *AZTECULA LERMÆ* (Evermann & Goldsborough).
No. 50003, U. S. National Museum.

between base of caudal and nostril; about 23 scales in a series between nape and dorsal fin; pectoral $1\frac{1}{2}$ in head; ventral 2; lateral line decurved, not wholly complete, an occasional scale without any pore; least depth of caudal peduncle $2\frac{1}{4}$ in head.

Color grayish olivaceous on back and upper part of side, the scales profusely covered with dark punctulations; a broad dark plumbeous lateral band ending in an indistinct black spot at base of caudal; pectoral, caudal, and dorsal fins dusky; the ventrals and anal pale. Length about $2\frac{1}{2}$ inches.

This species is closely related to the preceding, from which it differs chiefly in the more slender peduncle, the larger eye, less rounded snout and coloration. Spawns late in summer. At present this species is known only from Lerma, from which place a few specimens were taken by me.

53. *Aztecula mexicana* Meek.

Aztecula mexicana Meek, Field Col. Mus. Pub. 65, 1902, 81; San Juan del Rio.

Basin of Rio San Juan on the Mexican Plateau.

Head 4; depth $3\frac{1}{2}$ to 4; D. 8; A. 7; scales 9-59-7. Body robust, back slightly elevated, its highest point over pectoral fin and somewhat in advance of the dorsal; snout bluntish; mouth small, oblique, terminal, lower jaw the shorter; snout 4 in head; teeth 4-4, hooked, no grinding surface; interorbital area 3 in head; eye small, $4\frac{1}{2}$ in head; origin of dorsal fin midway between base of caudal and the eye; about 30 scales in a series between nape and dorsal fin; pectoral fins short, $1\frac{1}{2}$ in head; ventrals 2 in head; caudal fin rather short, forked;

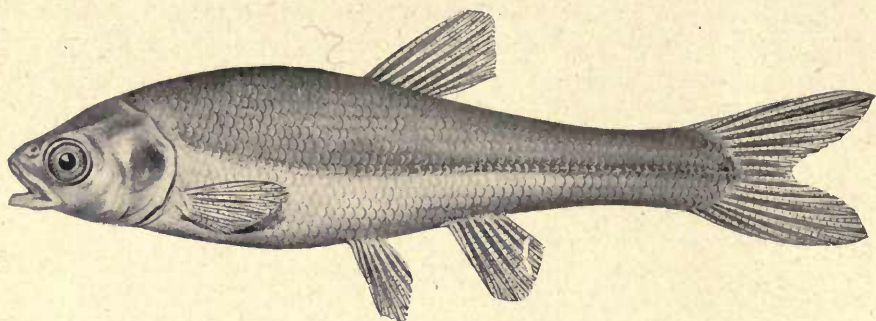


FIG. 15. AZTECULA MEXICANA Meek.
No. 3606, Field Columbian Museum.

caudal peduncle slender, its least depth $2\frac{1}{4}$ in head; lateral line decurved and wavy, complete or missing on a few scales.

Color dark brownish above, lighter below; a faint lateral band, most conspicuous on last half of the body; the faint caudal spot more prominent in the young.

This species differs from the preceding in having smaller scales. Length about 3 inches.

27. *Nototropis* Rafinesque.

THE SHINERS.

Notropis Rafinesque, Amer. Monthly Mag., II, 1818, 204. (Type, *Notropis atherinoides* Rafinesque.)

Codoma Girard, Proc. Acad. Nat. Sci. Phila., 1856, 194. (Type, *Codoma ornata* Girard.)

Alburnops Girard, l. c., 194. (Type, *Alburnops blennioides* Girard.)

Moniana Girard, l. c., 199. (Type, *Leuciscus lutrensis* Baird & Girard.)

Graodius Günther, Cat., VII, 485, 1868. (Type, *Graodius nigrotæniatus* Günther = *Leuciscus boucardi* Günther.)

Orcella Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 289. (Type, *Notropis orca* Woolman.)

Body elongate, more or less compressed; mouth normal, mostly terminal and oblique, or subinferior; no barbels; teeth 4-4, or 0, 1 or 2, 4-4, 1 or 2, sharp-edged or with narrow grinding surface; scales usually large, 30 to 55 in the lateral series; lateral line complete or not, in some species not extending beyond base of ventrals; coloration more or less silvery; males usually in the breeding season with much red on body and fins, and with tubercles on head and body. The fishes belonging to this group are all small, most of them less than 3

inches in length, seldom do any of them exceed 5 inches; in color and form most of the species are very variable.

This genus contains a large number of species of small fishes inhabiting the streams of the United States east of the Rocky Mountains, ranging south into Mexico to the Rio Panuco and west to the headwaters of the Rio Yaqui, and south on the Pacific side to the Rio Balsas. They are among the most feeble of our fresh-water fishes. None of them are of any value as food for man, but are of great importance as food for larger fishes. Very few of the species inhabit river channels, nearly all being confined to the smaller streams and ponds, from which they probably migrate only very short distances. So far as known, the species all spawn in the spring, at which time the males are more or less highly colored, some being red, or with red fins, while others are white or entirely black, and the head and often the entire body is covered with tubercles, an outgrowth of the epidermis.

All of the species of this group are quite variable, many being difficult to determine. Their food consists largely of small crustaceans and insect larvæ.

KEY TO THE SPECIES OF NOTOTROPIS.

- | | PAGE |
|--|---------------------|
| a. Body subterete, not much compressed; snout bluntish. | |
| b. Scales large, less than 40 in the lateral series. | |
| c. Sides of body without dark vertical bars; depth of body $3\frac{1}{2}$ to 4; least depth of caudal peduncle 2 to $2\frac{1}{2}$ in head. | |
| d. Lateral line incomplete, usually on from 3 to 10 scales, not extending beyond base of ventrals | <i>calientis</i> 65 |
| dd. Lateral line complete or very nearly so. | |
| e. Head large, $3\frac{1}{2}$ to $3\frac{2}{3}$ in body; about 14 or 15 scales before dorsal fin. | |
| f. Eye large, 3 in head; dorsal rays 8; anal rays 7; origin of dorsal fin midway between tip of snout and base of caudal fin | <i>braytoni</i> 65 |
| ff. Eye smaller, $3\frac{1}{2}$ in head; dorsal rays 9; anal rays 8; origin of dorsal fin midway between base of caudal and nostril | <i>robustus</i> 66 |
| ee. Head shorter, 4 in body; about 16 scales before dorsal fin. | |
| g. Caudal peduncle slender, its least depth $2\frac{2}{3}$ in head; a narrow dark lateral band; upper half of body with many spots, each about the size of pupil | <i>chihuahua</i> 67 |

	PAGE
gg. Caudal peduncle strong, its least depth 2 in head; a broad, dark lateral band; no spots on upper half of body <i>boucardi</i>	67
cc. Sides of body with 8 to 10 dark vertical bars; body very robust; caudal peduncle strong, $1\frac{3}{4}$ in body; depth of body 3 in its length <i>ornatus</i>	68
bb. Scales small, more than 40 in the lateral series.	
h. Origin of dorsal fin nearer snout than base of caudal; scales 8-42-4; depth 5 <i>orca</i>	69
hh. Origin of dorsal fin midway between posterior half of eye and base of caudal fin; depth $4\frac{1}{4}$ <i>nazas</i>	70
aa. Body much compressed, snout pointed.	
i. Scales deeper than long; body usually deep, its depth 3 to 4 in its length.	
j. Lateral line decurved, below the middle of the body; 6 to 9 rows of scales above (including lateral line) lateral line, 2 or 3 rows below it.	
k. Scales large, less than 40 in the lateral series; less than 20 scales in a series before dorsal fin.	
l. Lateral line complete, or nearly so.	
m. Origin of dorsal fin midway between base of caudal and nostril; anal fin long, its base $1\frac{3}{4}$ to 2 in head.	
n. Eye large, 3 in head; anal rays 9 <i>forlonensis</i>	70
nn. Eye small, $3\frac{1}{2}$ to $3\frac{3}{4}$ in head; anal rays 8.	
o. Lateral band on the posterior portion of the body only <i>lutrensis</i>	71
oo. Lateral band extending from eye to base of caudal <i>macrostomus</i>	72
mm. Origin of dorsal fin midway between base of caudal and pupil; anal base long, $1\frac{1}{4}$ in head; caudal peduncle slender, its least depth $2\frac{1}{4}$ in body <i>garmani</i>	73
ll. Lateral line incomplete, on 11 to 13 scales; anal rays 9; lateral line much decurved; scales 9-38-2 <i>santamariæ</i>	74
kk. Scales small, more than 40 in the lateral series; about 24 scales before dorsal fin <i>formosus</i>	74
jj. Lateral line on or above the middle of the body; scales 5-35-6; head 4; depth $4\frac{1}{2}$ <i>frigidus</i>	75
ii. Scales not deeper than long; body slender, its depth $4\frac{1}{3}$ in head; anal rays 10 <i>santarosaliæ</i>	75

Subgenus *Alburnops* Girard.**54. *Nototropis calientis* Jordan & Snyder.**

Notropis calientis Jordan & Snyder, Bull. U. S. Fish Comm., 1900, Rio Verde, Aguas Calientes: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3197: Meek, Field Col. Mus. Pub. 65, 1902, 83; Aguas Calientes; Ocotlan; Acambaro. Basin of the Rio Lerma.



FIG. 16. *NOTOTROPIS CALIENTIS* Jordan & Snyder.
No. 6193, Leland Stanford, Jr. University.

Head $3\frac{3}{4}$ to 4; depth $3\frac{1}{3}$ to $3\frac{2}{3}$; D. 8; A. 7; scales 6-33 to 35-3. Body oblong, rather stout, not much compressed, back little elevated; snout bluntish, 4 in head; mouth small, maxillary scarcely reaching vertical from anterior margin of orbit; eye small, 4 in head; teeth 4-4, hooked, with narrow grinding surface; origin of dorsal fin midway between tip of snout and base of caudal, base of dorsal 2 in head; longest dorsal ray $1\frac{1}{4}$ in head; pectoral $1\frac{1}{3}$ in head; ventral $1\frac{1}{2}$ in head; base of anal fin $2\frac{1}{3}$ in head; caudal fin forked, its lobes rather rounded; caudal peduncle moderate, $2\frac{1}{3}$ in head; lateral line decurved, incomplete, usually only on the first three to ten scales, seldom reaching as far as opposite origin of ventrals; vertebrae $20 + 18 = 38$.

Color rather dark brownish, lighter below; an indefinite dark band on middle of sides; no black caudal spot. Length $2\frac{1}{4}$ inches.

This species spawns during the first half of June.

55. *Nototropis braytoni* (Jordan & Evermann).

Moniana nitida Girard, Proc. Acad. Nat. Sci. Phila., 1856, 20; Cadereita, Nuevo Leon: Girard, Mex. Bd. Sur., 58, 1858; Cadereita, Nuevo Leon, Mexico.

Notropis braytoni Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896; name a substitute for *Moniana nitida*, preoccupied.

Streams in northeastern Mexico between the Rio Panuco and the Rio Grande. (San Juan; Montemorelos; Garza Valdez; La Cruz; Santa Engracia; Victoria.)

Head $3\frac{2}{3}$; depth 4; D. 8; A. 7; scales 6-36-3. Body elongate, robust, not much compressed; head stout, rather broad; snout blunt;

mouth rather large, little oblique, tip of maxillary reaching vertical from front of eye; snout $3\frac{1}{2}$; interorbital width $2\frac{2}{3}$ in head; eye large, its diameter 3 in head; origin of dorsal fin midway between tip of snout and base of caudal fin; about 15 scales in a series between nape and dorsal fin; longest dorsal ray $1\frac{1}{4}$ in head; base of dorsal 2 in head; pectorals $1\frac{1}{2}$ in head; ventrals $1\frac{1}{2}$; base of anal $2\frac{1}{3}$ in head; lateral line decurved, complete; caudal fin forked; caudal peduncle stout, its least depth nearly half head.

Color straw, lighter below; a faint lateral band on posterior half of body, ending usually in a black caudal spot. Length about 3 inches.

56. *Nototropis robustus* Meek.

Notropis robustus Meek, Field Col. Mus. Pub. '65, 1902, 82; Santa Rosalia; Jimenez.

Upper tributaries of the Rio Conchos in Chihuahua.

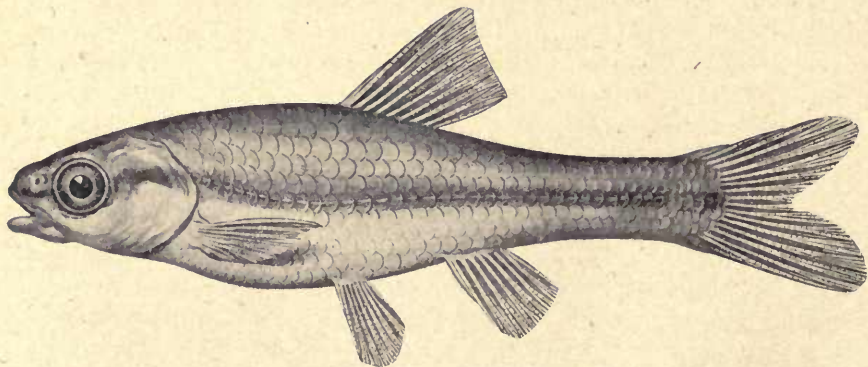


FIG. 17. *NOTOTROPIS ROBUSTUS* Meek.
No. 3548, Field Columbian Museum.

Head $3\frac{1}{2}$; depth 4; D. 9; A. 8; scales 6-37-4. Body robust, back little arched, its highest point being just in front of dorsal fin; snout blunt, its length $3\frac{2}{3}$ in head; mouth large, nearly terminal, slightly oblique; maxillary $3\frac{1}{4}$ in head, its tip reaching vertical from pupil; teeth 4-4, the tips slightly hooked; eye large, its diameter $3\frac{1}{2}$ in head; interorbital space 3 in head; origin of dorsal midway between base of caudal and nostril; 15 scales in a series between nape and origin of dorsal fin; pectoral fins long, nearly reaching ventrals, $1\frac{1}{2}$ in head; ventrals 2 in head.

Color olivaceous, a dark lateral band from snout to base of caudal fin, ending in a small caudal spot; chin white. Spawning time the latter part of June.

57. *Nototropis chihuahua* Woolman.

Nototropis chihuahua Woolman, Amer. Nat., March, 1892, 260; Rio Conchos, Chihuahua: Woolman, Bull. U. S. Fish Comm., 1894, 58; Rio Conchos, Chihuahua: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 265; Meek, Field Col. Mus. Pub., 65, 1902, 83; Chihuahua; San Andres; Santa Rosalia; Jimenez.

Headwaters of the Rio Conchos in Chihuahua, where it is very abundant.

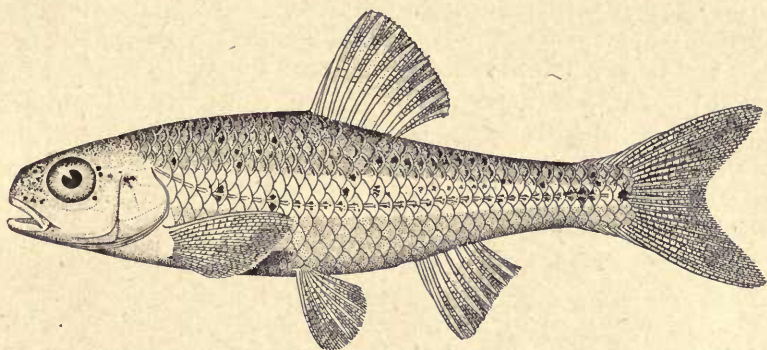


FIG. 18. *NOTOTROPIS CHIHUAHUA* Woolman.
No. 44151, U. S. National Museum.

Head 4; depth 4; D. 8; A. 7; scales 6-33 to 37-3. Body rather robust, little compressed, the back little elevated; head large; snout blunt, its length $3\frac{1}{2}$ in-head; mouth slightly oblique, the maxillary scarcely reaching vertical from anterior margin of the eye; eye $3\frac{2}{3}$ in head; origin of the dorsal midway between tip of snout and base of caudal; about 16 scales in a series between nape and dorsal fin; base of dorsal fin 2 in head, its longest ray $1\frac{1}{3}$ in head; base of anal $2\frac{2}{3}$ in head; caudal fin forked; caudal peduncle slender, its least depth $2\frac{2}{3}$ in head; lateral line nearly straight, complete.

Color light brown; scales above dark edged; numerous round dark dots on upper half of the body, the largest sometimes nearly the size of pupil; the spots unequal and irregularly placed; a plumbeous lateral band from eye through snout, ending in a black caudal spot; fins plain. Length about $2\frac{1}{2}$ inches.

One of the most conspicuously marked species in the genus. Spawning season the last of June and the early part of July.

58. *Nototropis boucardi* (Günther). SALMICH.

Leuciscus boucardi Günther, Cat., VII, 485, 1868; Cuernavaca.

Rutilus boucardi Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 247.

Graodus nigrotæniatus Günther, Cat., VII, 485, 1868; Atlitico, Mexico.

Notropis nigrotæniatus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 264; Jordan & Snyder, Bull. U. S. Fish Comm. 1900, 121; Rio Ixtla, Puente de Ixtla, Morelos: Meek, Field Col. Mus. Pub. 65, 1902; Balsas; Puente de Ixtla.

Basin of the Rio Balsas. (Cuautla; Yautepec; Jojutla; Atlitico; Matamoras; Chietla.)

Head 4; depth 4; D. 8; A. 8; scales 7-36 to 38-4. Body elongate, very robust, not much compressed, back little elevated; head large; snout blunt, $3\frac{1}{2}$ in head; mouth moderate, maxillary reaching to vertical from anterior margin of orbit; teeth 4-4; eye $3\frac{3}{8}$ to 4 in head; origin of dorsal slightly nearer tip of snout than base of caudal; base of dorsal 2 in head; longest dorsal ray $1\frac{1}{2}$ in head; about 16 scales in a series between the nape and dorsal fin; pectorals $1\frac{1}{3}$ in head; ventrals $1\frac{1}{2}$; base of anal $2\frac{1}{4}$; caudal forked; caudal peduncle rather robust its least depth 2 in head; lateral line complete, slightly de-curved.

Color dark brownish above, much lighter below; sides with a dark lateral band, more prominent on smaller specimens and on posterior half of body, ending in a black caudal spot; fins plain. Length about $3\frac{3}{4}$ inches.

Mr. C. Tate Regan, of the British Museum, London, has kindly examined the types of *Leuciscus boucardi* and *Graodus nigrotæniatus*, and he considers both to be the same species. This decision agrees with the result of my study of the minnows of the Balsas Basin. This species is in North America the most southern member of the family to which it belongs. Specimens taken at Yautepec on March 26th have the ovaries well developed, indicating the spawning season to be in April.

Subgenus *Codoma* Girard.

59. *Nototropis ornatus* (Girard).

Codoma ornata Girard, Proc. Acad. Nat. Sci. Phila., 1856, 195; Rio Chihuahua: Girard, Mex. Bd. Sur., 59, pl. xxix, figs. 22-25, 1859; Rio Chihuahua and its tributaries.

Notropis ornatus Woolman, Bull. U. S. Fish Comm., 1894, 58, Rio Conchos, Chihuahua: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 27; Meek, Field Col. Mus. Pub. 65, 1902, 83; Chihuahua; San Andres; Jimenez; Miñaca.

Headwaters of the Rio Mezquital and the Rio Nazas, in Durango, to the upper tributaries of the Rio Yaqui and the Rio Conchos, in Chihuahua. (Santiago Papasquiaro; Durango.)

Head $3\frac{3}{4}$ to 4; depth 3; D. 8; A. 7; scales 8-40-4. Body very stout and moderately compressed, the back arched; the head very blunt, thick, and rounded; mouth small, somewhat oblique; the cleft mostly anterior; the jaws equal; teeth 4-4; snout $3\frac{2}{3}$ in head; eye small, $3\frac{3}{4}$ to 4 in the head; origin of dorsal midway between tip of snout and base of caudal; base of dorsal 2 in head, its longest ray $1\frac{1}{2}$ in head; 18 scales in a series between nape and dorsal fin; pectorals $1\frac{1}{2}$ in head; ventrals $1\frac{3}{8}$ in head; base of anal $2\frac{1}{2}$ in head; caudal fin forked; caudal peduncle very stout, its least depth $1\frac{3}{4}$ in head; males in breeding season with prickles on head and body; lateral line complete.

Color dark, lighter below; sides with about 8 to 10 more or less conspicuous cross-bars; fins with the middle parts dusky or black. The smaller specimens do not have as prominent bars as the larger ones, but they have a more prominent caudal spot. A few males are black with a white vertical band on preopercle behind eye; all of the fins are black with light margins. Length about $2\frac{3}{4}$ inches. Spawning time apparently the first part of June

Subgenus *Orcella* Jordan & Evermann.

60. *Nototropis orca* Woolman.

Notropis orca Woolman, Bull. U. S. Fish Comm., 1894, 56; Rio Grande, El Paso, Texas: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 289.

Rio Grande at El Paso, Texas.

Head $4\frac{1}{2}$; depth 5; D. 7; A. 8; scales 8-42-4. Body robust, little compressed, with broad back; dorsal outline somewhat elevated; head heavy; snout blunt, decurved; mouth subinferior, little oblique; lower jaw slightly included; maxillary scarcely reaching vertical from pupil; top of head transversely rounded so that the eye is as near the lower as the upper profile of the head; interorbital space very wide and very convex, equals distance from tip of snout to pupil; origin of dorsal fin a little nearer snout than base of caudal; longest dorsal ray $1\frac{1}{8}$ in head; pectorals slightly falcate, about reaching ventrals, $1\frac{1}{2}$ in head; ventrals 2 in head; caudal deeply forked; scales rather large, thin; lateral line somewhat decurved.

Color pale; side with a broad distinct silvery band as broad as length of snout, bordered above by a narrow plumbeous line; back sparsely covered with fine dark punctulations; median line of back with a faint plumbeous band; top of head darkish; fins pale. Length about $3\frac{1}{2}$ inches. (Jordan & Evermann.)

61. *Nototropis nazas* sp. nov.

Type, No. 4375, F. C. M., $2\frac{1}{2}$ inches in length; Santiago Papasquiari, Durango.

Headwaters of the Rio Nazas in Durango.

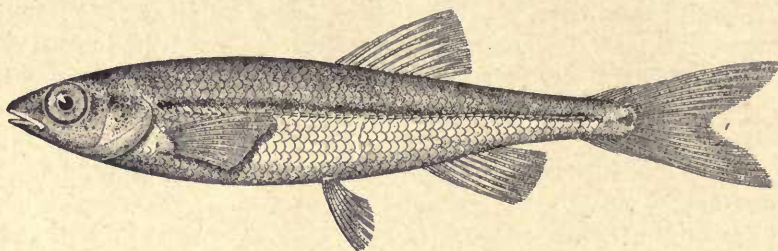


FIG. 19. NOTOTROPIS NAZAS Meek.

Head $4\frac{1}{6}$; depth $4\frac{1}{4}$ to $4\frac{3}{8}$; D. 8; A. 8; scales 10-49 to 54-5. Body elongate, not much compressed; top of head flattish, the eye being much nearer the upper than the lower profile of the head; snout rather pointed, slightly overhanging the mouth, $3\frac{1}{2}$ in head; mouth large, maxillary about reaching vertical from anterior margin of pupil; maxillary 3 in head; teeth 4-4, hooked and with grinding surface quite well developed; pharyngeal bones and teeth very small; eye $3\frac{1}{3}$ in snout; origin of dorsal fin about midway between base of caudal and anterior margin of eye; about 30 scales in a series between nape and dorsal fin; base of dorsal $1\frac{3}{4}$ in head; its longest ray $1\frac{1}{3}$ in head; pectoral $1\frac{1}{2}$ in head, its tips reaching about $\frac{2}{3}$ distance from its base to base of ventrals; ventrals nearly reaching anal, $1\frac{2}{3}$ in head; base of anal 2 in head; caudal fin deeply forked; caudal peduncle slender, its least depth $3\frac{1}{3}$ in head; scales small, smaller on upper anterior part of the body; lateral line complete.

Color light brownish, lighter below; a narrow dark lateral band, which ends in a faint caudal spot, on base of caudal rays; back finely punctulate with dark dots, many being grouped to form larger dots. Length about $2\frac{3}{4}$ inches. Spawning time the latter part of May. (Nazas,—name of the river from which the type was taken.)

Subgenus *Moniana* Girard.

62. *Nototropis forlonensis* sp. nov.

Type, No. 4478, F. C. M., 2 inches in length; Forlon, Tamaulipas. Basin of the Rio Panuco. (Forlon; Valles.)

Head $3\frac{3}{4}$ to 4; depth $3\frac{1}{8}$; D. 8; A. 9; scales 6-35-3. Body elongate, considerably compressed; dorsal and ventral outlines about equal; snout pointed, 4 in head; mouth terminal, oblique; end of

maxillary reaching vertical from anterior margin of orbit; eye large, 3 in head; teeth 4-4, hooked, with narrow grinding surface; origin of dorsal fin midway between base of caudal and nostril; base of dorsal $2\frac{1}{5}$ in head; its longest ray $1\frac{2}{5}$ in head; pectoral pointed,

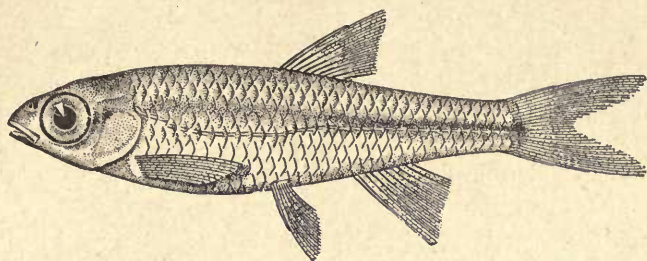


FIG. 20. NOTOTROPIS FORLONENSIS Meek.

$1\frac{1}{5}$ in head; ventral $1\frac{1}{2}$ in head; base of anal $1\frac{3}{4}$ in head; caudal peduncle rather slender, its least depth $2\frac{1}{4}$ in head; scales rather deeper than long; lateral line decurved, complete.

Color rather light brownish, with a lateral plumbeous band, ending in a very faint caudal spot. Length about 2 inches.

This species resembles *Nototropis lutrensis*, differing, however, from it in having a better developed lateral band, a faint caudal spot, and a larger eye. Spawning time the latter part of May. (Forlon,—name of the river from which the type was taken.)

63. *Nototropis lutrensis* (Baird & Girard).

Leuciscus lutrensis Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1853, 391; Otter Creek, tributary of the North Fork of Red River, Arkansas.

Moniana couchi Girard, Proc. Acad. Nat. Sci. Phila., 1856, 201; China, Nuevo Leon: Girard, Mex. Bd. Sur., 57, pl. xxx, figs. 21-24, 1859; China, Nuevo Leon.

Moniana rutila Girard, Proc. Acad. Nat. Sci. Phila., 201, 1856; Cadereita, Nuevo Leon: Girard, Mex. Bd. Sur., 57, pl. xxx, figs. 1-4, 1859; Cadereita, Nuevo Leon.

Moniana gracilis Girard, Proc. Acad. Nat. Sci. Phila., 201, 1856; Monterey, Nuevo Leon: Girard, Mex. Bd. Sur., 59, 1859; Acapulco, near Monterey, Nuevo Leon.

Moniana gibbosa Girard, Mex. Bd. Sur., 1859, 59; Brownsville, Texas.

Cyprinella bubalina Jordan, Bull. U. S. Geol. Sur., 1878, 403; Brownsville, Texas.

Chiola montiregis Cope, Proc. Amer. Philos. Soc., 1884, 168; Monterey, Nuevo Leon.

Notropis lutrensis Woolman, Bull. U. S. Fish Comm., 1894, 58; Rio Chihuahua, Chihuahua: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 271; Meek, Field Col. Mus. Pub. 65, 1902; Santa Maria; Ahumada; Chihuahua; Santa Rosalia; Jimenez; San Andres; Miñaca.

Small streams from the Rio Conchos in Chihuahua, north and east to South Dakota. (Sauz; Linares.)

Head $3\frac{2}{3}$ to 4; depth 3 to 4; D. 7 or 8; A. 8; scales 6 or 7, 36-3. Body elongate, compressed; head rather large; snout slightly bluntish; mouth moderate, oblique; end of maxillary reaching vertical from anterior margin of orbit; teeth 4-4, or 1, 4-4, 0, 1 or 2; eye small, about equal to snout, $3\frac{3}{4}$ to 4 in head; origin of dorsal fin midway between base of caudal and nostril; about 14 to 19 scales in a series between nape and dorsal fin; base of dorsal $1\frac{3}{4}$ in head, its longest ray $1\frac{1}{4}$ in head; pectorals $1\frac{1}{2}$ in head; ventrals $1\frac{2}{3}$ in head; base of anal 2 in head; caudal fin forked; caudal peduncle moderate, its least depth 2 in head; scales deeper than long; lateral line considerably decurved.

Color bluish above, lighter below; on darker specimens a dark vertical bar behind gill opening followed by a pale vertical bar which in life is red; in males, which have the body entirely covered with tubercles, the body in life is tinged with red, the pectorals, ventrals, and anals a bright red; small specimens with a very faint lateral band on posterior half of body; no caudal spot. Length about 3 inches.

A very variable and widely distributed species. Spawning time the last half of May.

64. *Nototropis macrostomus* (Girard).

Cyprinella macrostoma Girard, Proc. Acad. Nat. Sci. Phila., 1856, 198; Devil's River, Texas; China, Nuevo Leon: Girard, Mex. Bd. Sur., 54, pl. xxxi, figs. 5-8, 1859; China, Nuevo Leon. *Notropis macrostomus* Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 274.

Streams tributary to the Rio Grande, in northeastern Mexico. (San Juan; Montemorelos.)

Head $3\frac{2}{3}$; depth $3\frac{1}{3}$; D. 8; A. 8; scales 7-35-2. Body rather elongate, moderately compressed; head conical; snout bluntish; mouth rather large, terminal, the maxillary reaching vertical from front of orbit; eye equal to length of snout, $3\frac{1}{2}$ in head; origin of dorsal fin midway between tip of snout and base of caudal; dorsal fin short, its base 2 in head; pectoral $1\frac{1}{4}$ in head; ventrals reaching vent, $1\frac{1}{2}$ in head; base of anal $2\frac{1}{4}$ in head; least depth of caudal

peduncle $2\frac{1}{5}$ in head; lateral line above pectoral considerably decurved.

Color olivaceous; a silvery band from eye to base of caudal, with a narrow light line above it. Length about 2.25 inches.

The males of this species are much the darker, with the lateral band very faint; tubercles on head and nape. Females with well-developed eggs. This species resembles *Nototropis lutrensis*, but is more slender than that species, and the lateral band is more prominent on anterior half of the body; the mouth is also larger.

65. *Nototropis garmani* (Jordan).

Cyprinella rubripinna Garman, Mus. Comp. Zool., 1881, 91; Lago del Muerte, near Parras, Coahuila.

Notropis garmani Jordan, Cat. Fishes N. Amer., 1885, 813; name a substitute for *rubripinna*, preoccupied: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 281.

Basin of the Rio Nazas. (Lerdo; Santiago Papasquiario.)

Head $3\frac{3}{4}$ to 4; depth $2\frac{3}{4}$ to 4; D. 9; A. 10 to 12; scales 7-36-3. Body elongate to very deep, much compressed, the back somewhat arched; head rather small; snout bluntish, 4 in head; mouth small, oblique, terminal, the lower jaw included when mouth is closed; the tip of maxillary reaching vertical from anterior margin of the orbit; teeth 4-4, narrow grinding surface, tips hooked; eye $3\frac{1}{2}$ in the head; origin of dorsal fin midway between base of caudal and pupil; about 18 scales between nape and dorsal fin; base of dorsal $1\frac{1}{4}$ in head, slightly less than length of longest ray; fins all large, the tips of the pectorals, in the deeper specimens, reaching base of ventrals; pectorals $1\frac{1}{5}$ in head; ventrals $1\frac{1}{2}$ in head; base of anal equals length of longest anal ray, $1\frac{1}{4}$ in head; scales rather large, deeper than long, especially on deepest specimens; caudal fin forked; caudal peduncle very slender, its least depth $2\frac{1}{4}$ in head; vertebræ 16+17=33.

Color bluish above, lighter below; a dark band on middle of the body on posterior half; no caudal spot; fins plain; males in breeding season with much red on body and fins, and tubercles on body; old males with tubercles over the entire body. Length about 3 inches.

This species is very variable in form and color; it differs chiefly from *Nototropis lutrensis*, which it most resembles, in having larger fins and a much more slender caudal peduncle. The specimens from Lerdo are very much compressed, appearing much like half-starved fish; dark olivaceous, not much silvery. The large males are very red in life, with a dark bar followed by a lighter one just back of head.

This species may possibly prove to be a variety of *Nototropis lutrensis*. Spawning time the latter part of May and in June.

66. *Nototropis santamariæ* Evermann & Goldsborough.

Nototropis santamariæ Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 147; Lago de Santa Maria, Chihuahua. Basin of the Rio Santa Maria.

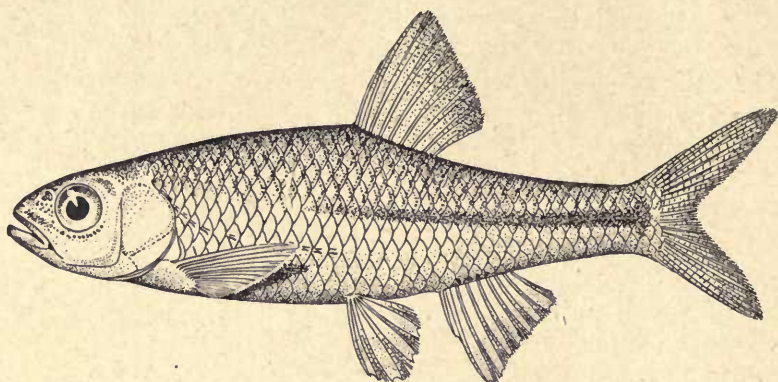


FIG. 21. *NOTOTROPIS SANTAMARIÆ* Evermann & Goldsborough.
No. 50003, U. S. National Museum.

Head 4; depth $3\frac{1}{2}$; D. 8; A. 9; scales 9–38–2. Body short, deep, and compressed; head short, obtuse; mouth rather small, oblique; jaws subequal, the lower slightly included; maxillary scarcely reaching eye; its length 6 in head; interorbital 6 in head; eye large, $3\frac{2}{3}$ in head; origin of dorsal fin over ventrals, midway between base of caudal and anterior margin of the orbit; scales large, loose, and closely imbricated, the exposed portions of the anterior ones deeper than long; about 15 scales between nape and dorsal fin; longest dorsal ray $1\frac{2}{3}$ in head; pectorals short, pointed, $1\frac{1}{4}$ in head, not reaching base of ventrals; ventrals barely reaching origin of anal; lateral line greatly decurved and incomplete, only 11 to 13 pores; fins all small; teeth 4–4, slightly hooked; caudal peduncle moderate, its least depth $2\frac{3}{8}$ in head.

Color olivaceous, paler below; back and upper part of side with numerous small dark specks; the edges of the scales dark; an obscure dark lateral band, plainest on caudal peduncle; median line of back dark; top of head dark; snout somewhat dusky; dorsal and caudal fins dusky, other fins pale. Length about 2 inches. Known only from the type locality.

67. *Nototropis formosus* (Girard).

Moniana formosa Girard, Proc. Acad. Nat. Sci. Phila., 1856, 201; Rio Mimbres, Chihuahua: Girard, Mex. Bd. Sur., 58, pl. xxx, figs. 5–8, 1859; Rio Mimbres, Chihuahua.

Notropis formosus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 271; Meek, Field Col. Mus. Pub. 65, 1902, 84; Colonia Juarez.

Basin of the Rio Casas Grandes.

Head $3\frac{2}{3}$; depth $3\frac{1}{4}$ to $3\frac{3}{4}$; D. 9; A. 8; scales 10-42 or 48-5. Body elongate, much compressed; head large; snout pointed, 4 in head; mouth moderate, end of maxillary reaching to vertical from anterior margin of eye; teeth 4-4, narrow grinding surface, tips little hooked; eye small, $3\frac{1}{4}$ in head; origin of dorsal fin midway between base of caudal and nostril; about 24 scales in a series between nape and dorsal fin; base of dorsal $1\frac{2}{3}$ in head; longest ray $1\frac{1}{3}$ in head; pectoral $1\frac{1}{3}$ in head; ventral $1\frac{1}{2}$ in head; caudal fin forked; caudal peduncle 2 in head; lateral line decurved, complete or absent on a few scales.

Color dark bluish, much lighter below; a dark band on middle of posterior part of body; no caudal spot; vertical fins darkish; outer margin of first pectoral ray dark. Length 2 inches.

This species is abundant in the basin of the Rio Casas Grandes. It has not been taken elsewhere.

68. *Nototropis frigidus* (Girard).

Moniana frigida Girard, Proc. Acad. Nat. Sci. Phila., 1856, 200; Rio Frio, Texas: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 271.

Notropis frigidus Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 148; Lago de Santa Maria, Chihuahua.

Northern Chihuahua to Texas.

Head 4; depth $4\frac{1}{4}$; D. 7; A. 9; scales 5-35-6. Body slender, compressed; head small; mouth small, oblique, lower jaw slightly included; scales thin, deciduous; fins small; origin of dorsal slightly behind base of ventrals.

Color pale yellowish or straw color; a few dark punctulations along the median line of back. Length about 2 inches.

A single specimen 2 inches long from a pool near Lake Santa Maria, Chihuahua, seems to be this species, though too badly mutilated to enable us to identify it with certainty. (Evermann & Goldsborough.)

Subgenus *Nototropis* Rafinesque.

69. *Nototropis santarosaliæ* Meek.

Notropis santarosaliæ Meek, Field Col. Mus. Pub. 65, 1902, 85; Santa Rosalia.

Basin of the Rio Conchos in Chihuahua.

Head 4; depth $4\frac{1}{3}$; D. 8; A. 10; scales 6-37-3. Body elongate, rather slender; snout pointed, short; 4 in head; mouth large, terminal, oblique; jaws about equal; end of maxillary reaching to middle of the pupil; margin of upper lip on level with center of eye; eye large,

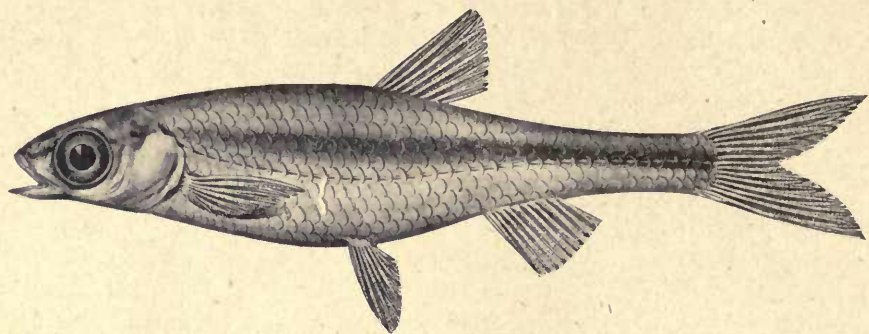


FIG. 22. NOTOTROPIS SANTAROSALIAE Meek.
No. 3535, Field Columbian Museum.

3 in head; origin of dorsal fin midway between base of caudal and anterior margin of the orbit; 18 scales in a series before dorsal fin; base of dorsal fin $2\frac{1}{2}$ in head, its longest ray $1\frac{1}{2}$ in head; pectorals $1\frac{1}{2}$ in head; ventrals $1\frac{1}{3}$; lateral line decurved, complete; the lateral line about one scale-width below the lateral band.

Color light olivaceous, with a broad dark lateral band from snout through eye to base of caudal, more prominent on the posterior half of the body, not ending in a black caudal spot; fins all plain. Length about 2 inches.

28. *Phenacobius* Cope.

Phenacobius Cope, Proc. Acad. Nat. Sci. Phila., 1867, 96. (Type, *Phenacobius teretulus* Cope.)

Sarcidium Cope, Hayden's Geol. Sur. Wyom., 1870 (1871), 440. (Type, *Sarcidium scopiferum* Cope.)

Body elongate, little compressed; head moderate, subterete; mouth inferior, the lower lip thin mesially, but enlarged into a fleshy lobe on each side toward the angle of the mouth, resembling a cut lip; upper lip with a callous covering within; dentary bones distinct, except at the symphysis; no barbel; upper jaw protractile; teeth 4-4, without grinding surface; scales small; lateral line present; isthmus wide; alimentary canal short; peritoneum white.

70. *Phenacobius scopifer* (Cope).

Sarcidium scopiferum Cope, Hayden's Geol. Surv. Wyo., 1870 (1871), 440; Missouri River near St. Joseph, Missouri.

Phenacobius scopifer Jordan, Bull. U. S. Geol. Sur., 1878, 666; Brownsville, Texas: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 302.

Mouth of the Rio Grande north to St. Joseph, Missouri.

Head 4 to $4\frac{1}{4}$; depth $4\frac{1}{4}$; D. 8; A. 7; scales 6-43-5. Body moderately slender; head short; snout rather blunt; mouth small; dorsal fin in front of ventrals.

Color olivaceous, a silvery lateral band, and a black caudal spot; edges of scales with dark edgings, which sharply define their outlines. Length about 3 inches.

29. *Evarra* Woolman.

Evarra Woolman, Bull. U. S. Fish Comm., 1894, 64. (Type, *Evarra eigenmanni* Woolman.)

Body very elongate, slender, subterete; head small; snout bluntish; mouth small, terminal, oblique; no barbels; the lips thickish; upper jaw protractile; lateral line complete; dorsal fin low; teeth small 4-4; alimentary canal about as long as body.

To this genus belong 2 species which are known only from the lakes and canals near the City of Mexico.

KEY TO THE SPECIES OF EVARRA.

	PAGE
a. Anal fin short, with about 7 rays; scales about 88 in the lateral series <i>eigenmanni</i>	77
aa. Anal fin long, with 14 rays; scales 95 in lateral series <i>tlahuacensis</i>	78

71. *Evarra eigenmanni* Woolman.

Evarra eigenmanni Woolman, Bull. U. S. Fish Comm., 1894, 64; City of Mexico: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 304; Meek, Field Col. Mus. Pub. 65, 1902, 86; Tlahuac.

Valley of Mexico.

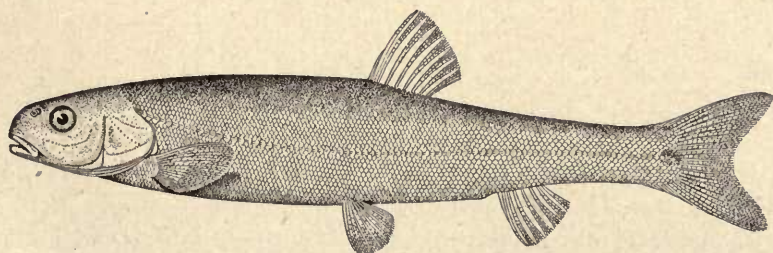


FIG. 23. *EVARRA EIGENMANNI* Woolman.
No. 45571, U. S. National Museum.

Head $4\frac{1}{4}$; depth $5\frac{1}{3}$; D. 8; A. 7; scales 17-88-10. Body elongate, subterete; head small; the snout bluntish, $\frac{3}{4}$ in head; inter-orbital area broad and flattish; mouth small, the maxillary not reaching vertical from eye; lips somewhat thickened; lateral line decurved anteriorly, complete; fins all very small; dorsal inserted slightly behind origin of ventrals.

Color olivaceous, silvery below; sides with a faint plumbeous lateral band, ending in a small caudal spot; a dark dorsal stripe; fins all plain. Length about 3 inches.

72. *Evarra tlahuacensis* Meek.

Evarra tlahuacensis Meek, Field Col. Mus. Pub. 65, 1902, 85;
Tlahuac.
Valley of Mexico.

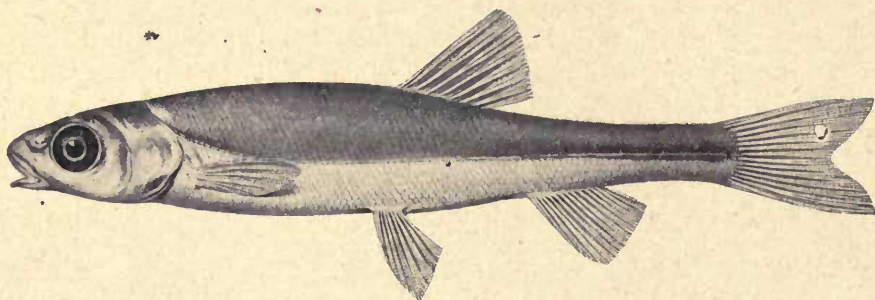


FIG. 24. *EVARRA TLAHUACENSIS* Meek.
No. 3681, Field Columbian Museum.

Head 4; depth $5\frac{1}{2}$; D. 8; A. 14; scales 95. Body elongate, rather slender; snout blunt, its length $3\frac{2}{3}$ in head; upper jaw protractile; teeth 4-4, tips hooked, grinding surface fairly developed; mouth little, oblique, tip of maxillary reaching margin of orbit; diameter of eye $3\frac{2}{3}$ in head; origin of dorsal fin midway between base of caudal and posterior margin of eye; about 38 scales in a series before dorsal fin; first dorsal ray reaching beyond tip of the last ray, when the fin is deflexed; lateral line complete, decurved above the pectorals; gill membranes connected to isthmus; peritoneum black; the length of the alimentary canal equals distance from eye to tip of caudal fin.

Color dark olive, white below, the line between the colors very distinct and extending from below eye to one-quarter distance from ventral surface of caudal peduncle; a dark vertebral and a dark lateral band. Length about $2\frac{1}{2}$ inches.

30. *Rhinichthys* Agassiz.

BLACK-NOSED DACE.

Rhinichthys Agassiz, Lake Superior, 353, 1850. (Type, *Cyprinus atronasmus* Mitchell.)

Body elongate, not much compressed; mouth small, subinferior; the upper jaw not protractile; the upper lip continuous with the skin of the forehead, forming a very broad frenum; a small barbel on end of maxillary; scales very small; lateral line complete; teeth 2, 4-4, 2 or 1, hooked, and without grinding surface; intestinal canal short. Species few, inhabiting springs and running water.

73. *Rhinichthys simus* Garman. SOUTHERN DACE.

Rhinichthys simus Garman, Science Observer, 1881, 61; Coahuila: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 307; Meek, Field Col. Mus., Pub., 65, 1902, 86; Santa Rosalia.

Tributaries of the Rio Grande in northern Mexico. (Monte-morelos.)

Head $3\frac{1}{2}$; depth $4\frac{2}{3}$; D. 8; A. 8; scales 12-62-8. Body elongate, little compressed; head depressed; snout blunt, its length $2\frac{3}{4}$ in head; mouth inferior; lips thick; eye small, $5\frac{1}{3}$ in head; interorbital area $3\frac{1}{2}$ in head; origin of dorsal fin midway between base of caudal and nostril; pectoral fin large, nearly reaching ventrals, its length $1\frac{1}{4}$ in head; ventrals $1\frac{1}{2}$ in head; caudal fin forked; caudal peduncle strong, its least depth $2\frac{1}{6}$ in head; lateral line complete, nearly straight.

Color light brownish; young with a dark lateral band and small caudal spot, disappearing in the largest specimens. Length about 3 inches. Spawning time the last of May and early in June.

31. *Agosia* Girard.

Agosia Girard, Proc. Acad. Nat. Sci. Phila., 1856, 186. (Type, *Agosia chrysogaster* Girard.)

Apocope Cope, Hayden's Geol. Sur. Mont., 1871-4, 472. (Type, *Apocope carringtoni* Cope.)

Body elongate, not much compressed; head long; snout blunt; maxillary with a terminal barbel; premaxillaries protractile; scales small, 60 to 90 in the lateral series; teeth 4-4, 1, or 2, 4-4, 1 or 2; intestinal canal short. A genus which much resembles *Rhinichthys*.

KEY TO THE SPECIES OF AGOSIA.

- | | |
|---|------------------------|
| a. Teeth 1, 4-4, 1; body elongate, its depth $4\frac{3}{4}$ | PAGE |
| in the body..... | <i>oscula</i> 80 |
| aa. Teeth 4-4, body rather deep, its depth 4 in body..... | <i>chrysogaster</i> 80 |

74. *Agosia oscula* (Girard).

Argyreus osculus Girard, Proc. Acad. Nat. Sci. Phila., 1856, 186;

Babocomori Creek, a tributary of the Rio San Pedro, Arizona.

Argyreus notabilis Girard, Proc. Acad. Nat. Sci. Phila., 1856, 186;

Rio Santa Cruz, a tributary of the Gila, Sonora: Girard, Mex.

Bd. Sur., 47, pl. xxvii, figs. 5-8, 1859; Rio Santa Cruz, Sonora.

Agosia oscula Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 309.

Tributaries of the Gila River in Arizona and Sonora.

Head 4; depth $4\frac{3}{4}$; D. 8; A. 7; scales 18-89-15. Body rather elongate, the caudal peduncle stout; snout obtuse, but narrowed anteriorly, not overhanging the mouth; maxillary barbels small; eye small, 4 in head.

Color dusky olive above; a blackish lateral band; male with axils of pectorals and ventrals scarlet; a scarlet patch above gill openings and one on side of snout. Length about 3 inches.

75. *Agosia chrysogaster* Girard.

Agosia chrysogaster Girard, Proc. Acad. Nat. Sci. Phila., 1856,

187; Rio Santa Cruz, Sonora (Gila Basin): Girard, Mex. Bd.

Sur., 49, pl. xxviii, figs. 5-8, 1859; Rio Santa Cruz, Sonora:

Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 313:

Rutter, Proc. Cal. Acad. Sci., 1896, 260; Morse Cañon; Rucker

Cañon, Yaqui Basin; Hermosillo: Evermann & Goldsborough,

Bull. U. S. Fish Comm., 1902, 148; near summit of Sierra

Madre. Chihuahua.

Northern Sonora and Chihuahua.

Head 4; depth 4; D. 8; A. 7; scales 88. Body fusiform; head rather heavy; snout conical; maxillary barbel small; mouth terminal, the upper jaw the longer; maxillary reaching about vertical from outer margin of orbit; eye small, 4 in head; fins long.

Color dark iron gray above, sometimes spotted; a darker band of same along the side above lateral line, extending from end of snout to middle of caudal; males with the belly yellow or orange. Length about 3 inches.

32. *Hybopsis* Agassiz.**HORNY HEADS.**

Hybopsis Agassiz, Amer. Jour. Sci. Arts, 1854, 358. (Type,

Hybopsis gracilis Agassiz = *Rutilus amblops* Rafinesque.)

Yuriria Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 321.

(Type. *Hudsonius altus* Jordan.)

Body robust or elongate; mouth terminal or inferior, with a barbel present and terminal on maxillary; a second barbel sometimes present on each side; premaxillaries protractile; teeth 4-4 or 1, 4-4, 1 or 0, hooked, with narrow grinding surface; scales rather large, 35 to 60 in the lateral line; lateral line complete; males usually with tubercles on snout in breeding season, and sometimes flushed with red. A small group of fishes usually inhabiting river channels.

KEY TO THE SPECIES OF HYBOPSIS.

- | | | | |
|-----|---|------------------|----|
| a. | Body slender, $5\frac{1}{3}$ in. in length; scales 36 in the lateral series; mouth moderate, inferior; the snout projecting and rather pointed; color silvery, everywhere sprinkled with dark dots. | <i>æstivalis</i> | 81 |
| aa. | Body more robust, $3\frac{3}{4}$ to $4\frac{1}{5}$; mouth large oblique, terminal, the lower jaw slightly included; scales 45 in the lateral line; color silvery without dark dots. | <i>altus</i> | 81 |

76. *Hybopsis æstivalis* (Girard).

Gobio æstivalis Girard, Proc. Acad. Nat. Sci. Phila., 1856, 189; Rio San Juan, near Cadereita, Nuevo Leon: Girard, Mex. Bd. Sur., 49, pl. LVII, figs. 17-29, 1859; Rio San Juan near Cadereita, Nuevo Leon.

Hybopsis æstivalis Woolman, Bull. U. S. Fish. Comm., 1894, 56; Rio Grande, El Paso, Texas: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 316.

Northeastern Mexico north to the upper tributaries of the Rio Grande in New Mexico, and to the Arkansas River in Arkansas. (San Juan; Linares.)

Head $3\frac{3}{4}$; depth $5\frac{1}{3}$; D. 8; A. 8; scales 6-36-4. Body slender, with long caudal peduncle, the back scarcely elevated; head long and slender; the snout much projecting and rather pointed; mouth moderate, inferior, the maxillary reaching posterior nostril; barbels long, nearly as long as snout, about 3 in head; each maxillary with single barbel; eye small 4 to $4\frac{1}{2}$ in head; fins rather long, the caudal deeply forked, its lobes subequal; origin of dorsal over ventrals nearer tip of snout than base of caudal.

Color silvery, everywhere sprinkled with small black dots; fins plain. Length about 3 inches. This species spawns during the latter part of June.

77. *Hybopsis altus* (Jordan). PESCADA BLANCA.

Hudsonius altus Jordan, Proc. U. S. Nat. Mus., 1879, 301; Lago de Tupatara, Guanajuato: Bean, Proc. U. S. Nat. Mus. 1896, 322.

Hybopsis altus Woolman, Bull. U. S. Fish Comm., 1894, 61; Rio Lerma, Salamanca, Queretaro: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 322; Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 125; Rio Verde; Aguas Calientes: Pellegrin, Bull. Mus. Nat. Hist. Paris, 1901, 205; Estado de Jalisco: Meek, Field Col. Mus. Pub. 65, 1902, 86; Acambaro; Celaya; Aguas Calientes; Lagos.

Notropis altus B. A. Bean, Proc. U. S. Nat. Mus., 1898, 539; Rio Cuitzeo, Michoacan.

Basin of the Rio Lerma.

Head $3\frac{2}{3}$ to 4; depth $3\frac{3}{4}$ to 4; scales 9-46-4. Body rather elongate, compressed, back elevated; head low, rather long; snout bluntish; mouth terminal, large; end of maxillary reaching slightly beyond vertical from anterior margin of orbit, its length $3\frac{1}{3}$ in head; snout $3\frac{2}{3}$ in head; jaws equal; teeth 4-4, with grinding surface and tips slightly hooked; maxillary barbel rather small; eye $4\frac{3}{4}$ in head; origin of dorsal fin slightly nearer tip of snout than base of caudal; pectoral fins pointed, $1\frac{1}{2}$ in head; ventrals $1\frac{1}{2}$ in head; caudal fin forked; caudal peduncle strong, its least depth $2\frac{1}{4}$ in head; lateral line complete, slightly decurved.

Color light olivaceous, lighter below; sides above lateral line with a more or less plumbeous lateral band; no caudal spot. Length about 10 inches.

This species is usually found in clear running water. It is quite abundant in the upper tributaries of the Rio Lerma, from which streams only it is known. Sexual organs of specimens taken the third week of May not developed. Evidently it spawns late in the summer.

33. *Couesius* Jordan.

Couesius Jordan, Bull. Hayden's Geol. Sur. Terr., iv, 785, 1878.
(Type, *Nocomis milneri* Jordan.)

Body elongate; head normal, not depressed; the profile convex; mouth terminal, normal; a well-developed barbel on the anterior side of the maxillary, just above its tip; teeth 2, 4-4, 2, hooked, without grinding surface; scales rather small; lateral line complete.

78. *Couesius adustus* Woolman.

Couesius adustus Woolman, Bull. U. S. Fish Comm., 1894, 57; Rio Conchos, Chihuahua: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 325.

Rio Conchos in Chihuahua.

Head $4\frac{1}{4}$; depth $4\frac{2}{3}$; D. 8; A. 7; scales 13-58-8. Body moderately compressed, the back little elevated, the anterior profile rather

convex; snout rather long, slightly pointed; its length $3\frac{2}{3}$ in head; mouth low, terminal, oblique; the jaws subequal, the maxillary opposite posterior nostril; barbel evident in young, inconspicuous in the adult, its position not quite terminal; interorbital space broad, flattish; eye $3\frac{2}{3}$ in head; preorbital broad; origin of dorsal inserted over or a little behind ventrals, the latter reaching to vent.

Color olivaceous, dusky above; sides silvery; a narrow plumbeous lateral band ending in a small caudal spot in young individuals; fins all plain. Length about 4 inches.

This species is known only from the type locality.

Subfamily **Plagopterinæ.**

34. **Plagopterus** Cope.

Plagopterus Cope, Proc. Amer. Phil. Soc. Phila., 1874, 301. (Type, *Plagopterus argentissimus* Cope.)

Body slender; mouth terminal; a barbel at the extremity of the maxillary; teeth 2, 5-4, 2, hooked, without grinding surface; body without scales; dorsal fin short, posterior, with a strong spine composed of 2 spines, the posterior one being received into a longitudinal groove of the anterior; inner border of ventral fins adherent to the body.

79. **Plagopterus argentissimus** Cope.

Plagopterus argentissimus Cope, Proc. Amer. Phil. Soc. Phila., 1874, 130; San Luis Valley, Colorado: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 329; Gilbert & Scofield, Proc. U. S. Nat. Mus., 1898, 496; mouth of Rio Gila at Yuma.

Colorado River Basin in Colorado to Ft. Yuma, Arizona.

Head 4; depth 6; D. 11, 7; A. 10. Body slender; head rather broad, the muzzle slightly depressed, overhanging the rather small, horizontal mouth; lips thin; maxillary reaching front of eye; eye moderate, $4\frac{1}{2}$ in head; dorsal fin entirely behind ventrals, the first spine curved, longer than the second; soft rays of dorsal thickened, ossified at base; lateral line complete, slightly deflexed.

Color silvery; back dusky, with minute black dots. Length about $2\frac{1}{2}$ inches. A singular little fish.

Family VI. **Characinidæ.**

THE CHARACINS.

Body usually rather elongate, compressed and covered with cycloid scales; head naked; margin of the upper jaw formed mesially by the premaxillaries and laterally by the maxillaries; no barbels; pre-

maxillaries protractile; teeth various, often incisor-like, often wanting; branchiostegals usually 3; gill membranes united to the isthmus or not; no pseudobranchiæ; gills 4, a slit behind the fourth; lower pharyngeals more or less curved, armed with small, sometimes villiform, teeth; adipose fin present (occasionally wanting); air bladder transversely divided into two portions; anterior vertebræ coalesced and modified.

A large family of fishes inhabiting the fresh waters of South America and Africa. A few species inhabit the streams of southern Mexico, ranging as far north as the United States. All of the members of this family in Mexico are small, none reaching a length of over six inches.

KEY TO THE GENERA OF CHARACINIDÆ.

	PAGE
a. Scales large, less than 50 in the lateral series; anal fin short, with less than 35 rays.	
b. Anterior teeth strong, incisor-like; premaxillary teeth in a double series, those on mandible in a single series; less than 40 scales in the lateral series; lateral line complete. <i>Tetragonopterus</i>	84
bb. Anterior teeth weaker, more or less conical and with lateral cusps; more than 40 scales in the lateral series; lateral line incomplete. <i>Hemigrammus</i>	87
aa. Scales small, more than 60 in the lateral series; anal fin long, with more than 40 rays <i>Ræboides</i>	88

Subfamily **Tetragonopterinae**.

35. **Tetragonopterus** Cuvier.

Tetragonopterus Cuvier, Regne Animal, Ed. 1, Vol. II, 166, 1817.

(Type, *Tetragonopterus argenteus* Cuvier.)

Astyanax Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854, 26.

(Type, *Astyanax argentatus* Baird & Girard.)

Body oblong or elevated, compressed, covered with moderate scales; belly rounded; mouth rather small; anterior teeth strong, incisor-like; lateral teeth small; premaxillary and mandibular teeth about equal in size, with a compressed, notched crown, the former in a double, the latter in a single series; nostrils of each side close together, separated by a valve only; lower pharyngeals very slender, curved, armed with a single series of slender, hooked teeth; gill openings wide; gill membranes not connected, free from the isthmus; origin of the dorsal fin about midway between tip of snout and base of caudal.

The species of this genus, which inhabit the streams of Mexico, are extremely variable. In the collections studied by me, I am unable to recognize more than two species.

KEY TO THE SPECIES OF TETRAGONOPTERUS.

	PAGE
a. Anal fin short, its rays 18 to 23.....	<i>mexicanus</i> 85
aa. Anal fin longer, its rays 24 to 27.....	<i>æneus</i> 86

80. *Tetragonopterus mexicanus* Filippi.

Tetragonopterus mexicanus Filippi, Guerins Rev. Mag. Zoöl., 1853, 166; Mexico: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 335; Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 125; Rio Ixtla, Puente de Ixtla, Morelos: Meek, Field Col. Mus. Pub. 65, 1902, 86; Puente de Ixtla; Balsas; Cuicatlan; Venta Salada.

Astyanax argentatus Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854, 27; Comanche Spring and Brownsville, Texas: Girard, Mex. Bd. Sur., 74, pl. VIII, figs. 5-9, 1859; mouth of the Rio Grande: Günther, Cat., v, 380, 1864; Garman, Bull. Mus. Comp. Zoöl., 1881, 92; tributaries of Lago del Muerto and spring near Monclova.

Tetragonopterus fulgens Bocourt, Ann. Sci. Nat. Zoöl., ix, 1868, 62; Province of Cuernavaca: Vaillant & Pellegrin, Bull. Mus. Hist. Nat. Paris, 1904, 325; Cuernavaca.

Tetragonopterus argentatus Woolman, Bull. U. S. Fish Comm., 1894, 60; Rio Chihuahua, Chihuahua: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896: Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 125; Rio Verde, near Rascon, San Luis Potosi; Rio Tamesin, Tampico: Meek, Field Col. Mus. Pub. 65, 1902, 86; Chihuahua; Santa Rosalia; Jimenez.

Tetragonopterus nitidus Vaillant & Pellegrin, Bull. Mus. Hist. Nat. Paris, 1904, 324; Cuernavaca.

Rio Balsas and Rio Tehuacan to the Rio Grande. (Lerdo; Santiago Papasquiaro; Monterey; San Juan; Montemorelos; Linares; Garza Valdez; La Cruz; Santa Engracia; Victoria; Rio Verde; Forlon; Valles Rascon; Cuautla; Yautepec; Jojutla; Atlixco; Matamoras; Chietla.)

Head $3\frac{1}{2}$ to 4; depth $2\frac{2}{3}$ to 3; D. 9 or 10; A. 20 to 23; scales 8-34 to 37-6. Body elongate, compressed, the dorsal and ventral outlines similar; head rather small; snout bluntish; mouth terminal, small; the free straight portion of the maxillary $3\frac{1}{4}$ in head; snout 3 to $3\frac{1}{4}$; eye 3 to $3\frac{1}{4}$; origin of dorsal fin about midway between tip of snout and base of caudal fin (in most specimens nearer tip of snout); base of dorsal $1\frac{1}{2}$ in its longest ray, 2 in head; pectorals

nearly or quite reaching ventrals, $1\frac{1}{3}$ in head; ventrals to vent, $1\frac{3}{4}$ in head; base of anal equals the length of the head; origin of adipose fin over the last ray of the anal; caudal fin forked, the lobes equal; least depth of caudal peduncle $2\frac{1}{6}$ in head; lateral line complete, nearly straight; gill rakers short, rather slender, about 17 on the first gill arch; vertebræ $16+17=33$.

Color light olivaceous above, silvery below; a broad bluish silvery band becoming darker posteriorly from upper edge of gill opening to base of caudal fin; an oblong black caudal spot extending on the middle rays of caudal fin; a dark humeral blotch. Length about 4 inches.

This species is very abundant and variable. Specimens from the Rio Nazas, the upper waters of the Rio Conchos and from the Rio Panuco average a little deeper than those from the other localities. Those found in streams where vegetation is the most abundant are the darker in color. The females are full of eggs, indicating that the spawning season is the latter part of May and early in June. Eggs small, the diameter of each .035 inch.

81. *Tetragonopterus æneus* Günther.

Tetragonopterus æneus Günther, Proc. Zool. Soc. London, 1860, 319; Oaxaca, Mexico: Günther Cat., v, 326, 1864; Oaxaca: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 333.

Tetragonopterus oaxacanensis Bocourt, Ann. Sci. Nat. Zool., ix, 1868, 62; Oaxaca.

Lowland streams south of the city of Vera Cruz and of the Rio Balsas. (Otopa; Cordoba; Motzorongo; Refugio; El Hule; Obispo; Perez; Sanborn; San Juan Evangelista; San Geronimo; Tehuantepec.)

Head $3\frac{1}{2}$ to 4; depth $2\frac{1}{3}$ to 3; D. 10; A. 24 to 27; scales 8 or 9, 35 to 38-6. Body elongate, or rather deep, compressed; head short; mouth small; in some of the larger specimens the outer cusps of the upper teeth protrude through the skin of the upper lip; snout short, blunt, 4 in head; eye $2\frac{3}{8}$; maxillary rather slender, its posterior portion nearly vertical and about $\frac{3}{4}$ diameter of the eye; no teeth on maxillary; origin of the dorsal fin midway between tip of snout and base of caudal, or slightly near the snout; longest dorsal ray slightly longer than the head; tip of pectorals reaching ventrals; pectoral $1\frac{1}{2}$ in head; tips of ventrals not quite reaching anal; lateral line complete, slightly decurved; caudal fin deeply forked.

Color light olivaceous, a silvery band on sides, ending in an oblong caudal spot extending on middle rays of the caudal fin; this band is darker in dark colored specimens; a black humeral spot with trace of a second one behind it. Length about 4 inches. Streams south of Cordoba and south of the Rio Balsas.

In form this species is very variable, usually the deeper specimens are more compressed than the more elongate ones. The darker specimens are from Refugio and Motzorongo, the lighter from San Juan Evangelista. The former were taken in a shady stream, the latter on the edge of a sand-bar. This species is very abundant in the lower portions of all streams examined by me south of Vera Cruz.

36. *Hemigrammus* Gill.

Hemigrammus Gill, Ann. N. Y. Lyc. Nat. Hist., 1858, 420. (Type, *Hemigrammus unilineatus* Gill.)

Body elongate, much compressed; belly before ventrals rounded; head moderate; snout pointed; teeth in both jaws uniserial, pointed, with one to three cusps; teeth on maxillary 0-5; gill membranes not connected, free from the isthmus; gill rakers long and slender, numerous; lateral line incomplete.

82. *Hemigrammus compressus* sp. nov.

Type, No. 4641, F. C. M., 1½ inches in length; El Hule, Oaxaca. Basin of the Rio Papaloapam. (El Hule; Obispo.)

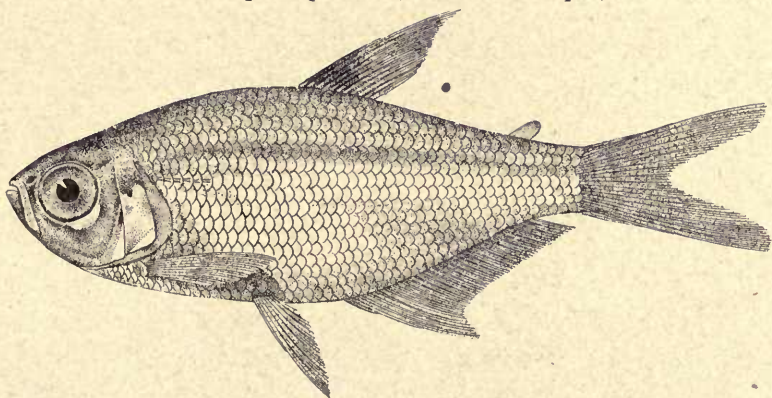


FIG. 25. *HEMIGRAMMUS COMPRESSUS* Meek.

Head $3\frac{1}{2}$; depth $2\frac{1}{2}$; D. 11; A. 25 or 27; scales 45 to 48. Body deep, much compressed; ventral region rounded before and behind ventrals; mouth moderate; maxillary slender, its tip reaching vertical from pupil, its length $2\frac{1}{4}$ in head; teeth in jaws in one series, conical; snout short, its length slightly more than $\frac{1}{2}$ diameter of eye; dorsal fin high, its longest ray slightly more than length of head, its base $1\frac{3}{4}$ in head; origin of dorsal fin midway between base of caudal fin and anterior margin of eye; pectorals $1\frac{1}{2}$ in the head, their tips reaching slightly past base of ventrals; ventral fins slightly shorter than pectorals; caudal peduncle very slender, its least depth

3 in base of anal fin; base of anal fin $3\frac{1}{2}$ in body; anal fin falcate, its longest rays equaling the length of the head; the lateral line incomplete, on 4 to 10 anterior scales; caudal fin widely forked.

Color light olivaceous, body and fins sprinkled with black dots, being more numerous on dorsal region and region near anal fin; basal half of anterior dorsal rays black; anal fin with many dark dots. The largest specimen obtained is 1.75 inches in length.

Subfamily Characinæ.

37. *Ræboides* Günther.

Ræboides Günther, Cat., v, 347, 1864. (Type, *Epicyrthus microlepis* Rheinhardt.)

Body oblong, rather elevated, covered with small scales; belly rounded in front of ventrals; pectoral and ventral fins near each other; humerus dilated or produced into a process before pectoral fin; mouth wide, with conical teeth in the premaxillary, maxillary, and mandible; those on the mandible uniserial, on the upper jaw uniserial or biserial; front of jaws with short, conical, tooth-like processes directed forward; no teeth on palate; nostrils close together, separated by a membrane only; gill openings wide, the membranes separate and free from the isthmus; gill rakers slender, lanceolate; adipose fin present; vertebræ $12 + 22 = 34$.

83. *Ræboides guatemalensis* (Günther).

Anacyrtus guatemalensis Günther, Cat., v, 347, 1864; Rio Chagres; Huamuchal: Günther, Fishes Cent. Amer., 479, pl. 82, fig. 4, 1869; Huamuchal.

Ræboides guatemalensis Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 338.

Rivers of the Pacific slope of the Isthmus of Tehuantepec and Central America. (San Geronimo.)

Head $3\frac{3}{4}$; depth 3; D. 9; A. 50; scales 86. Body elongate, profile rather gibbous at the nape; head small, subconical; mouth large; maxillary long and slender, its tips reaching vertical from posterior margin of the pupil, its length $2\frac{1}{2}$ in head; snout equaling diameter of eye, $3\frac{1}{2}$ in head; origin of dorsal fin slightly nearer tip of snout than base of caudal fin; ventrals long and slender, $1\frac{1}{2}$ in head, their tips reaching anal; ventrals $1\frac{1}{2}$ in head; caudal fin deeply forked; lateral line straight, complete.

Color olivaceous; sides with a silvery band; a faint dark blotch above lateral line over middle of pectoral; a larger blotch below lateral line above origin of anal; a faint caudal blotch; no markings on the fins. Length about 3 inches.

One specimen 3 inches in length was taken by me at San Geronimo.

Order V. **Symbranchia.**

THE SYMBRANCHOID EELS.

Body eel-shaped; premaxillary, maxillary, and palatine bones well developed and distinct from each other; no paired fins; vertical fins rudimentary, reduced to folds of the skin; gill openings confluent in a single slit; no air bladder; vertebræ numerous, the anterior ones not modified.

Family VII. **Symbranchidæ.**

THE SYMBRANCHOID EELS.

Body eel-shaped, naked, the abdomen very long, longer than the tail; snout short; eyes small, anterior; teeth small; palatine teeth in a band; gill openings confluent in a narrow slit; 4 gill arches; gills well developed; gill membranes free from the isthmus; no accessory breathing sac; shoulder girdle attached to the skull by a well-developed bifurcate post-temporal.

38. **Symbranchus** Bloch.

Symbranchus Bloch, Ichthyologia, ix, 87, 1795. (Type, *Symbranchus marmoratus* Bloch.)

The description of the genus is included in that of the family.

84. **Symbranchus marmoratus** Bloch.

Symbranchus marmoratus Bloch. Ichth., ix, 87, pl. 418, 1795; Tropical America: Günther, Cat., viii, 15, 1870; Mexico; Vera Cruz: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 342; B. A. Bean, Proc. U. S. Nat. Mus., 1898, 539; Santa Maria.

Tropical streams from Vera Cruz to the Amazon.

Body elongate; snout short, rounded or pointed; eyes small, rather close to the end of the snout; gill opening narrow, not extending to the edge of the ventral surface, generally transverse, arched, frequently appearing as a longitudinal slit unless drawn out; vertebræ $79 + 57 = 136$.

Color brownish, variously marbled, sometimes immaculate. Length 3 to 5 feet.

Order VI. **Apodes.**

THE EELS.

Body eel-shaped; premaxillaries atrophied or lost, the maxillaries lateral; vertebræ numerous, 110 to 250, the anterior ones not modified; no ventral fins; tail isocercal; gill openings comparatively small, lateral. To this order belong the larger number of our eel-like fishes.

Family VIII. **Anguillidæ.**

Body elongate, eel-shaped; skin covered with rudimentary embedded scales, usually linear in form, arranged in small groups, and placed obliquely at right angles to those of neighboring groups; pectoral and vertical fins well developed, the latter confluent around the tail; gill openings lateral and vertical; teeth in cardiform bands on jaws and vomer.

39. Anguilla Shaw.

COMMON EEL; ANGUILLA.

Anguilla Shaw, General Zoölogy, IV, 15, 1804. (Type, *Muræna anguilla* Linnæus.)

Body elongate, compressed posteriorly; head long, conical, moderately pointed, the rather small eye well forward and over the angle of the mouth; teeth small, subequal in bands on each jaw and a long patch on the vomer; lower jaw the longer; gill openings rather small, slit-like, and partly below pectorals; lateral line well developed; nostrils well separated, the anterior with a slight tube; dorsal fin confluent with anal around tail; pectorals well developed.

85. Anguilla chrysypa Rafinesque. COMMON EEL; ANGUILLA; FRESH-WATER EEL.

Anguilla chrysypa Rafinesque, Amer. Mon. Mag. & Crit. Rev., 1817, 120; Lake George; Hudson River; Lake Champlain: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 348.

Anguilla tyrannus Girard, Mex. Bd. Sur., 75, pl. XL, 1859; Matamoros; mouth of the Rio Grande.

This species is quite abundant in all streams east of the Rocky Mountains from Canada to Tampico; it is also common in salt and brackish water along the adjacent coasts, and in the West Indies. (San Juan.)

Head 2 to $2\frac{1}{2}$ in trunk; the fin rays and scales very numerous. Body elongate, rather robust; distance from origin of dorsal to vent $1\frac{1}{6}$ to 2 in head.

Color brown above, nearly plain, often tinged with yellowish, paler below, the color very variable. Length 4 to 5 feet.

This species is apparently abundant in the streams of Mexico north of Tampico. Two specimens were taken by me in the river at San Juan.

Order VII. **Isospondyli.**

THE ISOSPONDYLOUS FISHES.

Anterior vertebræ simple; opercular bones distinct; pharyngeal bones not falciform; jaws well developed, the maxillary broad, always distinct from premaxillary, and forming part of margin of upper jaw; no barbels; gills 4; ventral fins abdominal.

KEY TO THE FAMILIES OF ISOSPONDYLI.

	PAGE
a. Adipose fin none; no lateral line; ventral surface compressed to an edge which is armed with bony serratures; stomach short, muscular, like the gizzard of a fowl; last ray of dorsal fin produced into a filament..... <i>Dorosomatidæ</i>	92
aa. Adipose fin present; lateral line present; ventral surface rounded; stomach siphonal, not gizzard-like; last ray of dorsal fin not produced into a filament..... <i>Salmonidæ</i>	95

Family IX. **Dorosomatidæ.**

THE GIZZARD SHADS.

Body short and deep, strongly compressed, covered with thin deciduous cycloid scales; belly compressed to an edge which is armed with bony serratures; head rather small, without scales; no lateral line; gill membranes not united, free from the isthmus; pseudo-branchia large; dorsal fin short, its last ray produced into a long filament; anal fin long and low; stomach short, muscular, like the gizzard of a fowl. Mud-eating fishes of warm regions.

KEY TO THE GENERA OF DOROSOMATIDÆ.

	PAGE
a. Maxillary short, in two pieces, with a notch on outer margin..... <i>Dorosoma</i>	92
aa. Maxillary long, curved, in three pieces, and without a notch on its outer margin..... <i>Signalosa</i>	94

40. **Dorosoma** Rafinesque.

THE GIZZARD SHADS.

Dorosoma Rafinesque, Ichth. Ohiensis, 39, 1820. (Type, *Dorosoma notata* Rafinesque = *Megalops cepedianum* Le Sueur.)

Body short, deep, and strongly compressed; dorsal and ventral outlines similar; head rather small; snout blunt, overlapping the small

inferior oblique mouth; maxillary narrow and short, with a single supplemental bone, not extending to opposite middle of the eye; maxillary with a notch on outer margin; caudal peduncle slender. Mud-eating fishes, having no value as food.

KEY TO THE SPECIES OF DOROSOMA.

a.	Scales small, 69 to 73 in lateral series; anal rays 36 to 38	<i>anale</i>	PAGE 93
aa.	Scales larger, 56 to 60 in lateral series; anal rays 30 to 34	<i>exile</i>	94

86. *Dorosoma anale* sp. nov.

Type, No. 4637, F. C. M., $7\frac{1}{4}$ inches in length; El Hule, Oaxaca.

Atlantic streams of Mexico south of the city of Vera Cruz. (Otopa; El Hule; Perez; San Juan Evangelista.)

Head $3\frac{1}{2}$ to $4\frac{1}{4}$; depth $2\frac{3}{4}$ to 3; D. 12; A. 36 to 38; scales 25-69

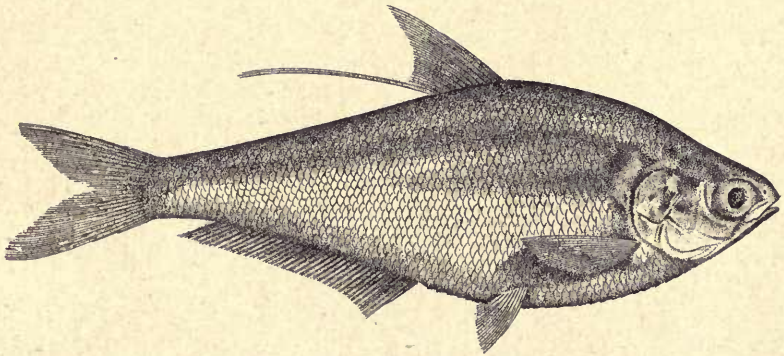


FIG. 26. *DOROSOMA ANALE* Meek.

to 73. Body much compressed, deep, profile with a slight angle at nape; dorsal region elevated; eye large with a well-developed adipose eyelid, its diameter $3\frac{1}{2}$ in head; snout very short, its length about one-half diameter of eye; origin of dorsal slightly nearer tip of snout than base of caudal; ventral scutes 18+10; least depth of caudal peduncle $2\frac{3}{4}$.

Color brownish on upper third of body, light silvery below; a black spot on shoulder; fins all plain. Length about 12 inches.

All of the specimens collected by me have a long anal fin. The specimen recorded from Montecristo by Evermann & Goldsborough Dr. Evermann informs me has 32 rays in the anal fin. The smaller scales of this species readily distinguishes it from the next one.

87. *Dorosoma exile* Jordan & Gilbert. GIZZARD SHAD; HICKORY SHAD.

Dorosoma cepedianum exile Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 585; Galveston, Texas: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 416.

Dorosoma mexicanum B. A. Bean, Proc. U. S. Nat. Mus., 1899, 539; Lago de Cademaco, south of Vera Cruz: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 416; Meek, Field Col. Mus. Pub. 65, 1902, 87; La Antigua.

Lowland streams which flow into the Gulf of Mexico north of the city of Vera Cruz. (San Juan; Forlon; Valles.)

Head $4\frac{1}{6}$; depth $2\frac{2}{3}$ to 3; D. 12; A. 30 to 34; scales 29-56 to 60. Body deep, compressed, the back elevated; ventral scutes 18+11; origin of dorsal fin midway between tip of snout and opposite tips of last anal ray; dorsal fin slightly behind ventrals, its filamentous ray about as long as head; least depth of caudal peduncle $2\frac{2}{3}$ in head.

Color bluish brown above, silvery below; a black spot on the shoulder. Length about 12 inches.

41. *Signalosa* Evermann & Kendall.

Signalosa Evermann & Kendall, Bull. U. S. Fish Comm., 1897 (Feb. 9, 1898) 127. (Type, *Signalosa atchafalayæ* Evermann & Kendall=*Chatoessus mexicanus* Günther.)

Body short, deep and compressed, the form somewhat elliptical; ventral outline more strongly curved than the dorsal; mouth small. terminal, oblique, the lower jaw scarcely included; maxillary in three pieces, broad and curved and without notch in outer margin; branchiostegals 5; pseudobranchiæ large; gill rakers short and very numerous, about 340 in number; no teeth; adipose eyelid present; last ray of dorsal filamentous.

88. *Signalosa mexicana* (Günther).

Chatoessus mexicanus Günther, Cat., VII, 409, 1868; Mexico and Central America.

Dorosoma mexicanum Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 416.

Signalosa atchafalayæ Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2809.

Louisiana to Central America, in lowland streams which empty into the Gulf of Mexico. (Valles; Obispo; El Hule; Perez.)

Head $3\frac{1}{4}$ to 4; depth $2\frac{2}{3}$ to 3; D. 11 or 12; A. 24 to 26; scales 15-42. Body rather deep, compressed; mouth terminal, rather large; no teeth; maxillary reaching vertical from anterior margin of pupil,

its length $3\frac{1}{2}$ to $3\frac{3}{4}$ in head; origin of dorsal fin midway between tip of snout and tip of last anal ray; last ray of dorsal 3 in body; pectoral $1\frac{1}{3}$ in head, reaching base of ventrals; ventrals $2\frac{1}{4}$; base of anal fin equaling length of head; scutes well developed, 15 or 16+9; scales large, thin, deciduous; caudal fin forked; least depth of caudal peduncle $2\frac{1}{2}$ in head.

Color brownish above, light silvery below, the opercles and adjoining region with considerable yellowish; a black humeral spot; fins all plain. Length about 6 inches.

Mr. C. Tate Regan, of the British Museum, has kindly reexamined the types of *Chatoessus mexicanus* Günther, and he informs me that *Signalosa atchafalaye* Evermann & Kendall is the same species.

Family X. **Salmonidæ.**

THE SALMON FAMILY.

Body elongate, covered with cycloid scales; head naked; mouth terminal, large or small, the maxillary forming its lateral margin; maxillary with a supplemental bone; premaxillaries not protractile; teeth various, sometimes wanting; pseudobranchiæ present; gill membranes not connected, free from the isthmus; branchiostegals 10 to 20; no barbels; dorsal fin small, placed near the middle of the body, its rays 9 to 15; adipose fin present; caudal fin forked; lateral line present; abdomen rounded in outline; air bladder large; stomach siphonal; pyloric cœca numerous; ova large, falling into cavity of the body before exclusion.

The fishes which belong to this family are confined to the northern regions, one species ranging as far south as Durango.

Subfamily **Salmoninæ.**

42. **Salmo** (Artedi) Linnæus.

SALMON AND TROUT.

Salmo (Artedi, Genera Piscium) Linnæus, Syst. Nat., Ed. x, 302, 1758. (Type, *Salmo salar* Linnæus.)

Body elongate, somewhat compressed; mouth large; jaws, palatines, and tongue toothed; vomer flat, its shaft not depressed, a few teeth on chevron of the vomer, behind which is a somewhat irregular single or double series of teeth (in migratory forms deciduous with age); scales small, more than 100 in the lateral series; dorsal and anal fins short, of 10 to 12 rays each; sides and median fins black spotted.

The species of this genus are confined to the colder portions of the northern hemisphere. Of the three species on the Atlantic side of

North America, one *Salmo salar* Linnæus is anadromous, while the other two, *Salmo sebago* Girard and *Salmo ouananiche* McCarthy, are land-locked; those in the Rocky Mountains and western streams with few exceptions remain in fresh water, the exceptions comprise a few species which usually inhabit the streams near the sea, and which spend a portion of their time in salt water. All of the species are very variable and difficult to distinguish. 'The almost infinite variations of these fishes are dependent on age, sex, sexual development, food, and the properties of the water.' The young are barred. The size of these fishes seems to depend largely on the extent of water and the abundance of food. The water also has a marked influence on colors. Trout found in shaded streams with clear rapid water are brightly colored, and profusely spotted with black; those which spend considerable time in brackish or salt water are silvery and with few or no spots.

89. *Salmo irideus* Gibbons. RAINBOW TROUT.

Salmo irideus Gibbons, Proc. Cal. Acad. Sci., 1855, 36; San Leandro Creek, Alameda Co., California: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 500.

Headwaters of Pacific coast streams of Durango north to Washington.

Head 4; depth $3\frac{2}{3}$; D. 10; A. 9; scales 135. Body rather robust; head moderate; mouth large; maxillary reaching posterior margin of eye, its length $2\frac{1}{6}$ in head; diameter of eye $3\frac{3}{8}$; length of mandible $1\frac{5}{8}$; origin of dorsal fin slightly nearer tip of snout than base of caudal; length of pectoral $1\frac{1}{3}$ in head; ventral $1\frac{5}{8}$; least depth of caudal peduncle $2\frac{1}{3}$ in head; branchiostegals 10.

Color olive brown, darker above; sides with a few scattered dark blotches; a few small black spots on upper and posterior part of caudal peduncle; dorsal fin with black spots, none on other fins; basal $\frac{2}{3}$ of anal dark; ventrals with a dark shade; specimens 3 inches in length with 9 or 10 pale marks on the side, the dorsal fin black spotted, but no spots on other fins.

Four specimens collected June, 1902, by Mr. E. Heller at San Antonio, Lower California, the longest specimen 5.80 inches in length. This species reaches a weight from $\frac{1}{2}$ (in small mountain brooks) to 6 pounds.

There is a species of trout found in the streams on the Pacific slope of the Sierra Madre Mountains in Chihuahua and Durango. I have not seen any specimens of this trout and so, provisionally at least, regard it as this species. Mr. John Ramsey, General Manager of the R.-G., S.-M. & P. R. R., informs me that a trout is quite abundant

in the upper tributaries of the Rio Yaqui. Mr. A. V. Temple also told me trout were found in the Pacific coast streams west of the city of Durango. In the American Naturalist, 1886, 735, I quote the following from Prof. E. D. Cope: "The most southern salmon.—I owe to my friend, Professor Lupton, two specimens of a black-spotted trout from a locality far south of any which has hitherto yielded Salmonidæ. They are from streams of the Sierra Madre, of Mexico, at an elevation of between 7,000 and 8,000 feet, in the southern part of the State of Chihuahua, near the boundaries of Durango and Sinaloa. The specimens are young, and have teeth on the basihyal bones, as in *Salmo purpuratus*, which they otherwise resemble."

Order VIII. **Haplomi.**

THE PIKE-LIKE FISHES.

Anterior vertebræ simple; mesocoracoid wanting; the coracoids normally developed; opercular bones well developed; ventral fins abdominal; pectoral fins placed low; dorsal fin more or less posterior, the first ray sometimes stiffened and spine-like; no adipose fin; head usually covered with cycloid scales like those on the body; mouth with teeth. Fishes chiefly inhabiting fresh water.

Family XI. **Pœciliidæ.**

THE KILLIFISHES.

Body elongate, or deep and compressed behind, depressed forward, and covered by rather large cycloid scales; head scaly, at least so above; mouth terminal, small, lower jaw usually the longer; premaxillaries extremely protractile; teeth conical, or incisor-like, usually confined to the jaws, sometimes on vomer; lower pharyngeals separate, with cardiform, rarely molar teeth; gill membranes somewhat connected, free from the isthmus; gill rakers very short and thick; branchiostegals 4 to 6; pseudobranchiæ none; dorsal fin single, behind the middle of the body; caudal fin not forked; ventral fins abdominal, rarely absent; air bladder, if present, simple.

The species of this family are usually of small size, some are oviparous, others viviparous. In the oviparous forms, the males and females are more nearly alike in size and color, and the anal fin of both sexes is similar in form and position. In many of the viviparous species the anal fin of the male is placed well forward and modified into an intromittent organ, and the male is about half the length of the female. In other viviparous forms the anal fin of the male has the same position as that in the female, but differs from it in having the first five or six rays short and stiff, and separated from the rest of the fin by a shallow notch; the sexes differ in color, but are of about the same size. In some species the alimentary canal is about as long as the fish; in others it is several times as long.

KEY TO THE GENERA OF PŒCILIIDÆ.

- a. Intestinal canal comparatively short, little convoluted, usually less than one and one-half times the total length of the body (2 in *Chap-
alichthys*); teeth little movable; dentary bones firmly united; species chiefly carnivorous.

- | | PAGE |
|---|----------------------------|
| b. A few of the anterior teeth in each jaw much enlarged, canine-like | <i>Cynodonichthys</i> 101 |
| bb. Anterior teeth in each jaw subequal, none canine-like. | |
| c. Outer series of teeth enlarged, pointed, or a few of the anterior ones compressed, incisor-like, none of them notched, bicuspid or tricuspid. | |
| d. Anal fin of the male similar to that of the female; pharyngeal bones and teeth not enlarged; species oviparous. | |
| e. Teeth in more than one series, usually a larger outer series, behind which is a band of smaller teeth; no caudal ocellus; body oblong; dorsal fin variable in size and insertion | <i>Fundulus</i> 102 |
| ee. Teeth arranged in a single series; dorsal fin inserted in advance of anal, its rays 9 to 13 | <i>Lucania</i> 109 |
| dd. Anal fin of the male with its first five or six rays short and stiff, and slightly separated from the rest of the fin by a shallow notch; species viviparous, the young usually of large size at birth. | |
| f. Dorsal and anal fin each of less than 18 rays; body elongate, not much compressed | <i>Zoogoneticus</i> 109 |
| ff. Dorsal and anal fins each of 19 or more rays; body compressed | <i>Girardinichthys</i> 115 |
| cc. Outer series of teeth incisor-like, bicuspid or tricuspid. | |
| g. Outer series of teeth bicuspid with a band of villiform teeth behind them. | |
| h. Intestinal canal about $1\frac{1}{2}$ in total length of body; the teeth very firmly attached .. | <i>Characodon</i> 118 |
| hh. Intestinal canal about 2 in total length of body; teeth less firmly attached | <i>Chapalichthys</i> 123 |
| gg. Outer series of teeth tricuspid, no villiform teeth behind them; dorsal fin short, of 10 to 12 rays, the first ray slender and rudimentary | <i>Cyprinodon</i> 124 |
| ddd. Anal fin of the males placed well forward and modified into a sword-shaped intro- | |

	mittent organ; teeth all pointed, arranged in bands; species viviparous, the young of moderate or large size at birth.		PAGE
i.	Eye normal, the pupil not divided by a partition; dorsal fin inserted more or less behind the front of the anal.		
j.	Jaws not produced into a beak; lower jaw prominent, longer than the upper; the males much smaller than the females.		
k.	Dorsal fin long, of 14 to 16 rays; anal short	<i>Pseudoxiphophorous</i>	127
kk.	Dorsal fin short, of 6 to 10 rays; anal fin short.		
l.	Alimentary canal less than twice length of body.		
m.	Anal fin not falcate, its first three rays not produced, the longest being less than the length of head	<i>Gambusia</i>	128
mm.	Anal fin falcate, its first three rays much produced, the longest longer than the head	<i>Paragambusia</i>	133
ll.	Alimentary canal more than twice the length of the body	<i>Glaridichthys</i>	134
jj.	Jaws produced into a moderate beak; dorsal and anal short, each of 9 to 11 rays ..	<i>Belonesox</i>	135
ii.	Eye divided into two portions by a horizontal cross partition; vertical fins short, of 9 to 11 rays	<i>Anableps</i>	135
aa.	Intestinal canal elongate, usually coiled on ventral and right side, with numerous convolutions; dentary bones loosely joined; teeth movable; species chiefly mud-eating.		
n.	Outer series of teeth bicuspid, with villiform teeth behind them; anal fin of the male with first five or six rays of anal fin short and stiff and separated from the rest of the fin by a notch; species viviparous, the young of large size when born.		
o.	Body robust, oblong, depth 3 to 4 in length of body; gill rakers long and slender, 35 to 40 on the first gill arch; vertebræ 19+17 = 36	<i>Goodea</i>	136

oo. Body deep, compressed, depth $2\frac{2}{3}$ to $3\frac{1}{4}$ in length; gill rakers rather short, stiff, about 20 on the first gill arch; vertebræ $16+18=34$	<i>Skiffia</i>	141
nn. Outer series of teeth pointed: anal fin of the male placed well forward and modified into an intromittent organ; species viviparous.		
p. Teeth in a single series.		
q. Dorsal fin inserted in advance of the anal . . .	<i>Platypæcilus</i>	144
qq. Dorsal fin inserted more or less behind the front of the anal	<i>Heterandria</i>	147
pp. Teeth in more than one series; dorsal fin inserted over or in advance of anal, its rays much elevated in the male.		
r. Dorsal fin short, of less than 7 to 11 rays; teeth of the inner series in both jaws entire	<i>Pæcilia</i>	149
rr. Dorsal fin long, of 12 to 16 rays.		
s. Caudal fin normal, alike in both sexes, or with the lower angle merely sharp in the male	<i>Mollienesia</i>	154
ss. Caudal fin in the males with its lower lobe much produced and sword-shaped	<i>Xiphophorus</i>	156

Subfamily Fundulinæ.

43. *Cynodonichthys* gen. nov.

Type, *Cynodonichthys tenuis* Meek.

Body elongate, depressed anteriorly, compressed posteriorly; head broad and flat; lower jaw the longer; teeth in villiform bands, a large canine-like tooth on each side in front of upper jaw; a few smaller and similar teeth in front of lower jaw; dorsal fin posterior, its origin over posterior third of anal; margins of caudal fins formed by tips of short basal rays; head entirely scaled. A very peculiar fish, quite unlike any other member of the family. *κύνας* dog, *ὀδόν* tooth, *ἰχθὺς* fish.

90. *Cynodonichthys tenuis* sp. nov.

Type, No. 4643, F. C. M., 1.6 inches in length; El Hule, Oaxaca.

Head $3\frac{1}{2}$; depth $4\frac{1}{2}$; D. 8; A. 11; scales 10-38. Body elongate, depressed anteriorly, compressed posteriorly; head broad, much depressed; interorbital flat, 2 in head; snout short, 4 in head; upper jaw the longer; teeth in jaws in villiform bands, upper jaw with a well-developed canine-like tooth on each side; some of anterior teeth of lower jaw canine-like; eye small, $3\frac{2}{3}$ in head; premaxillary pro-

tractile, its exposed part very small, with a short, fleshy, blunt-like protuberance on each side; gill membranes not connected, free from the isthmus; head entirely covered with scales; 30 scales in a series from snout to origin of dorsal fin; dorsal fin posterior; its origin

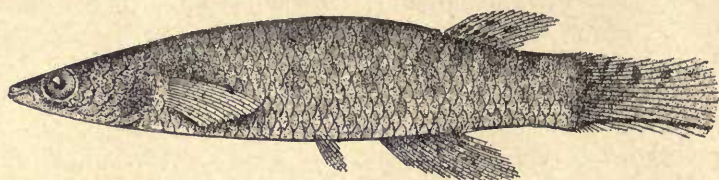


FIG. 27. *CYNODONICHTHYS TENUIS* Meek.

over posterior third of anal; origin of dorsal fin slightly nearer tip of caudal than origin of pectoral fin; base of dorsal 3 in head; base of anal 2; pectoral $1\frac{1}{2}$; ventrals very short, $3\frac{1}{2}$ in head, their tips nearly reaching anal fin; caudal fin rounded, its first outer rays short, and gradually increasing in length, forming the margins of the fins.

Color dark brownish, pectoral fins dark; dorsal fin with about 3 narrow cross-bars made up of small faint dark spots; lower margin of caudal fin light.

One specimen only of this species was taken.

While collecting at El Hule this specimen was taken in one of the early hauls of the seine. I saw it was quite different from any other fish I had collected in Mexico and made an extra effort to secure more of them, but was unable to do so. I also spent one day afterwards collecting at Perez and one at Obispo, but was unable to secure more specimens of this fish. A short siege of fever, and the hard rains made it impossible for me to do further collecting then in that region.

44. *Fundulus* Lacépède.

KILLIFISHES.

Fundulus Lacépède, Hist. Nat. Poiss., v, 37, 1803. (Type, *Fundulus mudfish* Lacépède.)

Fontinus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 633. (Type, *Fundulus seminolis* Girard.)

Body rather elongate, compressed behind; mouth moderate, the lower jaw projecting; jaws each with two or more series of pointed teeth, usually forming a narrow band; bones of the mandible firmly united; scales moderate; gill opening not restricted above; preopercle preorbital and mandible with mucous pores; dorsal and anal fins similar, small; origin of the dorsal fin either in front of, above, or

behind that of the anal; ventrals well developed; air bladder present; intestinal canal short, 1 to $1\frac{1}{2}$ times the length of the body; anal fin of male not modified, it being similar in size and position to that in the female; oviparous.

KEY TO THE SPECIES OF FUNDULUS.

- | | PAGE |
|---|------------------|
| a. Scales large, 31 to 38 in the lateral series. | |
| b. Body without cross-bars; anal rays 13 to 16. | |
| c. Body rather slender; depth 4 to $4\frac{1}{2}$; dorsal rays 12 or 13; scales 34 or 35. | |
| d. Anal rays 14 to 16; depth 4.....[<i>guatemalensis</i>] | 103 |
| dd. Anal rays 13; depth $4\frac{1}{2}$[<i>punctatus</i>] | 104 |
| cc. Body rather robust, head $3\frac{1}{2}$; depth $3\frac{3}{4}$; dorsal rays 14; anal rays 15; scales 11-30; origin of dorsal midway between tip of caudal and orbit..... | oaxacæ 104 |
| bb. Body with cross-bars; anal rays 9 to 11; scales large, 30 to 33 in the lateral series. | |
| f. Body with about 23 narrow undulating silvery bars, narrower than the interspaces; fins nearly plain; scales 10-31..... | vinctus 105 |
| ff. Body with 7 to 15 narrow, dark, vertical bars $\frac{1}{3}$ to $\frac{2}{3}$ as wide as interspaces, and not very dark; scales 11-33..... | similis 105 |
| aa. Scales small, 35 to 48 in the lateral series. | |
| g. Dorsal rays 10 to 11; anal rays 9 to 11; depth $3\frac{3}{8}$ to $4\frac{1}{3}$. | |
| h. Scales 35 to 38 in the lateral series; depth $3\frac{3}{8}$ to $3\frac{5}{8}$ | heteroclitus 106 |
| hh. Scales 41 to 46; depth 4 to $4\frac{1}{3}$ | grandis 107 |
| gg. Dorsal rays 13 to 15; anal rays 13 to 17; depth $4\frac{1}{2}$ to $5\frac{2}{3}$. | |
| i. Scales in lateral series 37 to 39; dorsal rays 13 or 14; anal rays 16 or 17..... | [labialis] 107 |
| ii. Scales in lateral series 47 to 60. | |
| j. Scales in the lateral series 47; depth $5\frac{2}{3}$ | extensus 108 |
| jj. Scales in the lateral series 60; depth $4\frac{1}{2}$ to $4\frac{3}{4}$ | zebrinus 108 |

Subgenus *Fundulus* Lacépède.***Fundulus guatemalensis* Günther.**

Fundulus guatemalensis Günther, Cat., vi, 321, 1866; Lago de Duenas; Lago de Amatitlan; Rio Gujalote (all in Guatemala): Günther, Fishes Cent. Amer., 483, pl. 86, figs. 3 and 4, 1869; Lago de Dueñas; Lago de Amatitlan; Rio Guacalate (all in Guatemala).

Adimia guatemalensis Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 660.
Zoogoneticus guatemalensis Meek, Field Col. Mus. Pub. 65, 1902, 94.

Guatemala.

Head 4; depth 4; D. 12 or 13; A. 14 to 16; scales 12-32 to 35. Body moderately elongate; head thick and broad; interorbital area broad, slightly convex, its width being a little less than half its length; snout broad, obtuse, lower jaw slightly projecting beyond the upper; mandible longer than eye; diameter of eye about equaling length of snout, 4 in head; origin of dorsal fin midway between tip of caudal and posterior margin of orbit, slightly in advance of anal; dorsal fin of male higher than that of female; basal half of caudal fin scaly.

Color brown above and on sides; pale below; females with a very indistinct dark band along the side; fins plain; anal with a light margin. (Günther.) Length about $3\frac{1}{2}$ inches.

Two years ago I suggested that this species and also *Fundulus labialis* Günther, probably belonged to *Zoogoneticus*. Mr. C. Tate Regan* has since reexamined the types and finds that both species belong to *Fundulus*.

Fundulus punctatus Günther.

Fundulus punctatus Günther, Cat., vi, 230, 1866, Chiapas: Günther, Fishes Cent. Amer., 482, pl. 86, fig. 5, 1869; Chiapas: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 637.

Guatemala and southern Mexico.

Head 4; depth $4\frac{1}{2}$; D. 12; A. 13; scales 12-34. Body little elongate; head broad, interorbital area slightly convex, its width 2 in head; snout broad, obtuse, much depressed, the lower jaw scarcely projecting beyond the upper; mandible longer than eye; upper lip of moderate breadth; eye small, $4\frac{1}{2}$ in head; origin of dorsal fin slightly nearer extremity of caudal than orbit, over the 19th scale in the lateral series; dorsal fin slightly in advance of anal; pectoral fins not reaching base of ventrals, shorter than head (without snout); caudal fin subtruncate, scaly on its basal half.

Color brownish olive, paler below; each scale, especially those on the tail, with a vertical dark purplish violet spot on the center; dorsal with 3 or 4 series of blackish dots, anal with a whitish margin. Length about $3\frac{1}{2}$ inches.

Through the courtesy of Dr. B. W. Evermann, of the Bureau of Fisheries, I have been permitted to examine a number of specimens of this species, which were collected by Dr. Gustav Eisen in July, 1902, in Lake Atitlan, Guatemala, at an altitude of about 4,500 feet. These specimens agree very well with the description given by Dr. Günther, except in the absence of spots on the dorsal fin.

91. Fundulus oaxacæ Meek.

Fundulus oaxacæ Meek, Field Col. Mus. Pub. 65, 1902, 90; Oaxaca.

Basin of the Rio Verde in Oaxaca.

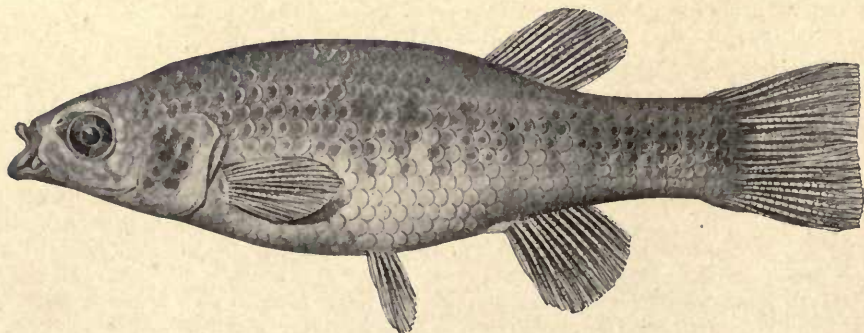


FIG. 28. *FUNDULUS OAXACÆ* Meek.
No. 3721, Field Columbian Museum.

*Ann. & Mag. Nat. Hist., 1904, 257.

Head $3\frac{1}{2}$; depth $3\frac{3}{4}$; D. 14; A. 15; scales 11-30. Body robust, profile from nape slightly concave; top of head broad, slightly convex; snout not much depressed, $3\frac{2}{3}$ in head; lower jaw slightly the longer; teeth pointed, in a band in both jaws, the outer series the larger; eye small, $4\frac{1}{2}$ in head; interorbital space $2\frac{1}{3}$ in head; origin of the dorsal fin slightly in advance of the anal, midway between tip of caudal fin and posterior margin of the eye; base of dorsal $2\frac{1}{3}$ in head, its height slightly more than half the head; pectoral $1\frac{5}{8}$ in head; ventral $2\frac{1}{2}$ in head; caudal fin subtruncate; peritoneum black; alimentary canal shorter than the total length of the fish.

Color brownish olive, a dark spot in the middle of each scale; these spots more prominent on the posterior half of the body of males from $1\frac{1}{2}$ to $1\frac{3}{4}$ inches in length; males usually with a row of spots on base of the dorsal and anal fins; young with a few faint dark cross bars on the sides, becoming a faint dark lateral band in the larger females. Length about $2\frac{1}{2}$ inches.

This species is so far known only from the type locality. Time of spawning about the third week in May. A female 2.05 inches in length contained 100 eggs.

92. *Fundulus vinctus* Jordan & Gilbert.

Fundulus vinctus Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 355; Cape San Lucas, Lower California (probably from pools about La Paz): Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 637.

Southern portion of Lower California.

Head $3\frac{3}{4}$; depth $4\frac{1}{3}$; D. 12; A. 11; scales about 10-31. Body little elongate, compressed posteriorly; head large, very broad and somewhat depressed above; mouth moderate; teeth in narrow bands, the outer much enlarged; interorbital space 2 in head; dorsal fin a little in advance of the anal, its origin midway between base of caudal and occiput; pectoral $1\frac{2}{3}$ in head; caudal $1\frac{1}{3}$; scales comparatively large.

Color olivaceous, with about 23 narrow silvery bars with undulating edges, the bars narrower than the darker interspaces; fins all plain. (J. & G.) Length about $2\frac{1}{2}$ inches.

This species is known only from the type locality, which is probably La Paz instead of Cape San Lucas, as given in the original description. (Jordan.)

93. *Fundulus similis* (Baird & Girard). SAC-A-LAIT.

Hydrargyra similis Baird & Girard, Proc. Acad. Nat. Sci. Phila. 1853, 389; Indianola, Texas: Jordan, Bull. U. S. Geol. Sur., 1878, 400; Rio Grande, Brownsville, Texas.

Fundulus similis Günther, Cat., VI, 323, 1866: Jordan & Everman, Bull. 47, U. S. Nat. Mus., 1896, 638.

Brackish and fresh waters along the gulf coast from Florida to Mexico north of the Rio Panuco. (Linares; Victoria.)

Head $3\frac{1}{4}$; depth $3\frac{3}{4}$ to $4\frac{3}{8}$; D. 11 to 13; A. 10; scales 11–33. Body slender, the outlines scarcely arched; adults deeper than young; head very narrow and long, narrowed forward; snout 3 in head; mouth small, maxillary not reaching vertical from anterior nostril; teeth very small, in villiform bands, the outer series not at all enlarged; eye small, 4 to 5 in head; origin of dorsal midway between tip of caudal fin and eye, slightly in advance of anal; pectoral $1\frac{2}{3}$ in head; ventrals $3\frac{1}{4}$ in head; caudal subtruncate.

Color of male olivaceous, lighter below; sides with 10 to 15 narrow dark bars $\frac{1}{3}$ to $\frac{2}{3}$ as wide as interspaces; a large, diffuse, dark, humeral spot; dorsal dusky, a small ocellated spot on last dorsal ray in the young; female olivaceous, sides paler, with metallic luster; white below; 7 to 15 very narrow black bars on sides not extending on the back, scarcely broader than pupil. Length about $3\frac{3}{4}$ inches.

The largest specimen taken by me is 3.75 inches in length. Spawning time not known.

94. *Fundulus heteroclitus* (Linnæus). KILLIFISH.

Cobitis heteroclitus Linnæus, Syst. Nat., Ed. XII, 500, 1766; Charleston, South Carolina.

Fundulus heteroclitus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 640: Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 126; Lagoons, Tampico: Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 149; Progreso.

Abundant in lagoons and brackish waters along the coast from Tampico to Maine. It probably does not enter fresh water.

Head 3 to $3\frac{2}{3}$; depth $3\frac{3}{8}$ to $3\frac{5}{8}$; D. 11; A. 10 or 11; scales 13–35 to 38. Body short and deep; anteriorly broad, posteriorly compressed, the back elevated, the caudal peduncle robust; head rather short, broad, and flat on top; snout bluntish, $3\frac{1}{2}$ in head; teeth in bands, the outer series enlarged; eye small, 4 to 5 in head; origin of dorsal midway between tip of caudal and tip of snout (♂) or eye (♀); caudal fin truncate; least depth of caudal peduncle 2 in head; pectorals $1\frac{2}{3}$ in head; ventrals $2\frac{2}{3}$.

Color of males dull dark green above, more or less orange below; sides with numerous, quite narrow, ill defined silvery spots, most distinct posteriorly, and with conspicuous white or yellow spots

irregularly scattered; vertical fins dark, with numerous small round pale spots; dorsal often with a blackish spot on its last ray; females nearly plain olivaceous above, lighter below; sides often with about 15 dark cross-bars or shades, more definite in the young. Length about 6 inches.

95. *Fundulus grandis* Baird & Girard.

Fundulus grandis Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1853, 389; Indianola, Texas: Girard, Mex. Bd. Sur., 69, pl. xxxvi, 1859; Evermann & Goldsborough, Bull. U. S. Fish Comm., 1901, 149; Progreso.

Fundulus heteroclitus grandis Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 641.

Fresh and brackish water lagoons of coast of Gulf of Mexico.

Head 3; depth 4 to $4\frac{1}{3}$; D. 10 or 11; A. 9 or 10; scales 14 or 15—40 to 46. Body rather robust, compressed posteriorly; interorbital broad, 3 in head; eye $5\frac{3}{4}$ to 6; snout $3\frac{1}{3}$ to $3\frac{2}{3}$; longest dorsal ray (♂) 2 to (♀) $2\frac{1}{3}$.

Color males dark green above, paler posteriorly; sides with many small, round, pearly spots, some of them often in vertical series; posterior y traces of 8 or 9 narrow, pale cross-bars alternating with broader, faint, dusky ones; belly yellowish; base of caudal with numerous small white spots; dorsal olive with many small, white spots; female olive and silvery, with minute speckles below; sides usually with traces of 12 to 15 narrow, silvery, vertical bars, less than half as wide as the dusky interspaces; no white spots on body or fins; fins mostly dusky olive, nearly plain. Length about 6 inches.

This species has been taken on the coast of Texas and of Yucatan, and no doubt occurs in fresh water and brackish lagoons along the eastern coast of Mexico.

***Fundulus labialis* Günther.**

Fundulus labialis Günther, Cat., vi, 319, 1866; Rio San Geronimo, Guatemala; Yzabel: Günther, Fishes Cent. Amer., 48, 1869, Rio San Geronimo; Yzabel: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 644. Guatemala.

Head 4 to $4\frac{1}{3}$; depth $4\frac{1}{2}$; D. 13 or 14; A. 16 or 17; scales 15—37 to 39. Body rather slender, head broad, slightly convex, its width being less than half of the head; snout broad, obtuse, depressed; jaws equal in front; mandible very short; upper lip well developed, broad, extending to the angle of the mouth; diameter of the eye less than the length of the snout, about 4 in the head; origin of dorsal fin midway between tip of caudal fin and eye, opposite anal fin; caudal fin truncate, its basal third scaly.

Color uniform brownish olive above, paler below; sometimes irregular, cloudy markings on the tail; fins plain; the anal fin in male black at the base and bright yellow on its marginal half; upper margin of dorsal fin of male yellowish. (Günther.)

Known only from the above account.

Subgenus *Fontinus* Jordan & Evermann.

96. *Fundulus extensus* Jordan & Gilbert.

Fundulus extensus Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 355; Cape San Lucas (probably from La Paz), Lower California: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 646. Coast of Lower California.

Head $3\frac{3}{4}$; depth $5\frac{2}{3}$; D. 15; A. 13; scales 12-47. Body usually elongate, moderately compressed, head slender, not very broad, the interorbital width $2\frac{2}{3}$ in head; mouth rather large; the teeth moderate in a band, the outer considerably enlarged; eye large, $3\frac{1}{4}$ in head; origin of dorsal fin in front of anal, midway between eye and base of caudal; pectoral $1\frac{2}{3}$ in head; caudal fin truncate; caudal peduncle much longer than head.

Color plain, somewhat translucent, with no markings anywhere, except traces of some very narrow dark bars on the sides; fins low and plain. (Jordan & Gilbert.) Known only from the types.

97. *Fundulus zebrinus* (Jordan & Gilbert).

Hydrargyra zebra Girard, Proc. Acad. Nat. Sci. Phila., 1859, 60; tributaries of Rio Grande, between Fort Defiance and Fort Union, New Mexico: Günther, Cat., vi, 324, 1866: Jordan, Bull. U. S. Geol. Sur., 1878, 664; Brownsville, Texas.

Fundulus zebrinus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 646.

Streams from the mouth of the Rio Grande north to western Kansas, Dakota, Iowa, and Kentucky.

Head $3\frac{1}{2}$ to $3\frac{3}{4}$; depth $4\frac{1}{2}$ to $4\frac{3}{4}$; D. 14 or 15; A. 13 or 14; scales 21-60. Body long and slender; head moderate; snout not much elongate, its length $3\frac{3}{4}$ in head; teeth in bands, the external series much enlarged; eye 4 to $4\frac{1}{3}$ in head; interorbital width $2\frac{2}{3}$ in head; origin of dorsal fin midway between tip of snout and tip of caudal fin; a little more anterior in the males; origin of dorsal fin opposite that of anal in males, a little in advance in females; caudal fin truncate; in males the margins of the scales are rough, with minute tubercles.

Color greenish above, sides and below silvery white, the sides tinged with sulphur yellow; sides with 14 to 18 dusky bars from back to ventral region, occasionally meeting on the ventral line; these bars varying much in width, being rather narrower in females, and with half bars usually between them; the interspaces as wide as the bars or usually wider; fins usually dusky, plain. Length about 3 inches.

45. Lucania Girard.

Lucania Girard, Proc. Acad. Nat. Sci. Phila., 1859, 118. (Type, *Limia venusta* Girard.)

Body oblong, compressed; mouth moderate, its cleft short and very oblique; lower jaw prominent; each jaw with a single series of conical teeth; scales large, usually less than 30 in the lateral series; gill openings not restricted; the dorsal fin above or slightly in advance of the anal; anal fin of male like that of female, not modified into an intromittent organ nor with first rays short and stiff.

98. Lucania venusta (Girard).

Limia venusta Girard, U. S. Mex. Bd. Sur., 71, pl. xxxix, figs. 20-23, 1859; Indianola, Texas.

Lucania affinis Girard, Proc. Acad. Nat. Sci. Phila., 1859, 118; Matamoras, Tamaulipas.

Lucania venusta Günther, Cat., vi, 310, 1866: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 665.

Lagoons and inlets along the gulf coast of Mexico, north of Tampico.

Head $3\frac{1}{2}$; depth $3\frac{1}{2}$; D. 11 or 12; A. 9 or 10; scales 8-26. Body rather strongly compressed, the dorsal and ventral outlines about equally arched; head narrow, compressed, flattened above the eyes; snout compressed, short, and vertically rounded, its height greater than its width; mouth very small, protractile forward, the lower jaw much projecting in open mouth; mandible heavy, short, and strongly convex; less than diameter of orbit; teeth small, firm and conical in a single series; eye large, 3 in head; origin of dorsal fin nearly midway between tip of snout and base of caudal; origin of anal fin opposite middle of dorsal; pectorals $1\frac{3}{4}$ in head; ventrals $1\frac{4}{5}$; caudal fin slightly rounded; caudal peduncle long and slender, its least depth about 2 in head.

Color of male light olive, pale on the belly; sides with some silver luster and with indistinct trace of an obsolete dusky lateral stripe. Length about 2 inches.

46. Zoogoneticus Meek.

Zoogoneticus Meek, Field Col. Mus. Pub. 65, 1902, 91. (Type, *Platypæcilus quitzeoensis* B. A. Bean.)

Body little elongate, rather deep, somewhat compressed; mouth moderate, the lower jaw projecting; jaws each with bands of pointed teeth, the outer series the larger; scales moderate; gill openings not restricted; dorsal fin usually large, of more than 12 rays; anal fin of

male with its first 5 or 6 rays short and stiff and separated from the rest of the fin by a shallow notch; dorsal fin of male higher than that of female; viviparous. The ovary is a strong membranous sack, with several infolded partitions; in this the young develop and reach a comparatively large size when they are born, which is during May and June.

KEY TO THE SPECIES OF ZOOGONETICUS.

	PAGE
a. Four to six black spots about as large as eye on lower half of caudal peduncle; 2 similar black spots at base of caudal..... <i>cuitzeoensis</i>	110
aa. No black spots on lower half of caudal peduncle; not more than one black spot at base of caudal.	
b. Sides of body with 7 to 9 well defined black bars each about as wide as the interspaces..... <i>dugesi</i>	111
bb. Sides of body without well-defined cross-bars.	
c. Anal fin longer than the dorsal; dorsal rays 12 to 14; anal rays 14 to 17.	
d. Scales large, 32 to 35 in the lateral series; head very thick and broad, $3\frac{1}{2}$ in length; dorsal rays 13 or 14; anal rays 15; scales 12-35..... <i>[pachycephalus]</i>	112
dd. Scales smaller, 37 to 39 in the lateral series.	
e. Origin of dorsal fin midway between tip of caudal fin and tip of snout; head large, $3\frac{1}{4}$ in length; depth 3; dorsal rays 14; anal rays 16; scales 16-38..... <i>robustus</i>	112
ee. Origin of dorsal fin midway between tip of caudal fin and opercle..... <i>maculatus</i>	113
cc. Anal fin shorter than the dorsal; dorsal rays 17; anal rays 14.	
f. Origin of dorsal fin midway between base of caudal and posterior margin of opercle; head $3\frac{3}{4}$; depth $3\frac{1}{2}$ <i>diazi</i>	114
ff. Origin of dorsal fin midway between base of caudal and preopercle; head $3\frac{1}{2}$; depth $3\frac{1}{4}$ <i>miniatus</i>	115

99. *Zoogoneticus cuitzeoensis* (B. A. Bean).

Platypæcilus quitzeoensis B. A. Bean, Proc. U. S. Nat. Mus., 1898, 540, fig. 1; Lago de Cuitzeo, Michoacan: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2873.

Zoogoneticus quitzeoensis Meek, Field Col. Mus. Pub. 65, 1902, 91;
Ocotlan; La Barca.
Basin of the Rio Lerma.

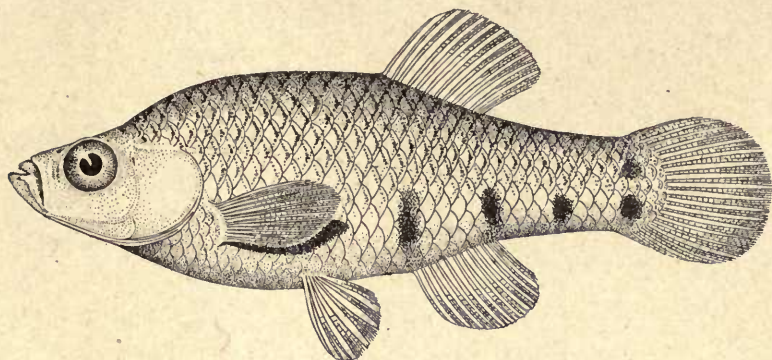


FIG. 29. *ZOOGONETICUS QUITZEOENSIS* (B. A. Bean).
No. 48209 (*Platyæcilius quitzeoensis* B. A. Bean), U. S. National Museum.

Head $3\frac{2}{3}$; depth 3 to $3\frac{1}{4}$; D. 13 or 14; A. 13 to 15; scales 11-30. Body compressed, the back somewhat arched; usually in larger specimens an angle at the nape; head rather small; interorbital space flattish, its width $2\frac{2}{3}$ in head; mouth moderately large, chin prominent; lower jaw projecting; outer series of teeth large; snout $4\frac{1}{3}$ in head; eye $3\frac{3}{4}$; origin of dorsal fin midway between tip of caudal and tip of snout, and in advance of ventral; pectoral fin $1\frac{2}{3}$ in head; ventral 2; caudal fin truncate; caudal peduncle rather deep, its least depth $1\frac{2}{3}$ in head.

Color light brownish tinged with red; on the middle of sides of female to opposite tip of pectoral usually with three faint dark spots, also four to six dark bars on lower half of caudal peduncle, and a dark spot on upper portion of caudal peduncle above last bar; color of the males more uniform and much darker than that of the females; the spots or bars so conspicuous on the females being scarcely noticeable on the male; dorsal and anal fins tipped with yellow; the caudals and tips of ventrals blackish; pectorals light; fins of the female pale. Length $2\frac{1}{2}$ inches.

100. *Zoogoneticus dugesi* (Bean).

Fundulus dugesii Bean, Proc. U. S. Nat. Mus., 1887, 373, pl. xx, fig. 5; Guanajuato: Garman, Memoirs Mus. Comp. Zool., 1895, 101.

Adinia dugesii Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 661.

Zoogoneticus dugesii Meek, Field Col. Mus. Pub. 65, 1902, 92; Lagos; Patzcuaro.

Basin of the Rio Lerma.

Head $3\frac{1}{3}$; depth 3; D. 17; A. 13; scales 12-29. Body rather robust anteriorly, compressed posteriorly; back little arched; head rather large; interorbital area flattish; its width $2\frac{1}{4}$ in head; mouth

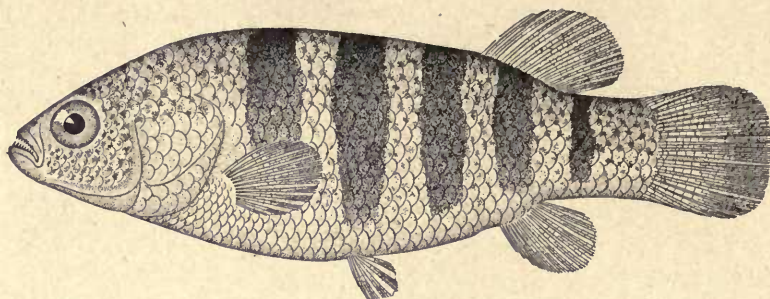


FIG. 30. *ZOOGONETICUS DUGESI* (Bean).
No. 37831, U. S. National Museum.

rather large; upper series of teeth large; lower jaw the longer, chin prominent; length of snout $4\frac{1}{2}$ in head; diameter of eye 4; origin of dorsal slightly in advance of origin of anal, midway between tip of caudal fin and posterior margin of eye; pectoral fin $1\frac{1}{2}$ in head; ventral $2\frac{1}{2}$; caudal peduncle short, its least depth 2 in head.

Color light brownish; sides with about 8 dark cross bands, about equal to the interspaces; the bars not always of equal width. Length about $2\frac{1}{2}$ inches.

The young are born about the last week of May.

***Zoogoneticus pachycephalus* (Günther).**

Fundulus pachycephalus Günther, Cat., VI, 321, 1866; Guatemala: Günther, Fishes Cent. Amer., 483, pl. 86, fig. 6, 1869; Guatemala.

Adinia pachycephalus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 660.

Zoogoneticus pachycephalus Meek, Field Col. Mus. Pub., 65, 1902, 94. Guatemala.

Head $3\frac{1}{2}$; depth $3\frac{1}{2}$ to $3\frac{3}{4}$; D. 13 or 14; A. 15; scales 12-35. Body rather deep, head very thick and broad; interorbital space very broad, slightly convex, its width 2 in head; snout broad, obtuse; lower jaw slightly projecting beyond upper; mandible longer than eye; eye 4 in head; origin of dorsal fin slightly in advance of anal, midway between tip of caudal and posterior margin of the orbit; caudal fin subtruncate.

Color brownish above and on sides, each scale darker on tip; an indistinct dark band along middle of tail; fins plain, anal fin with the lower margin whitish. (Günther.)

Known only from the above description.

101. *Zoogoneticus robustus* (Bean).

Fundulus robustus Bean, Proc. U. S. Nat. Mus., 1892, 285, pl. XLIV, fig. 2; Guanajuato: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 644; Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 126; Lago de Chapala: B. A. Bean, Proc. U. S. Nat. Mus., 1898, 541; Lago de Cuitzeo, Michoacan.

Zoogoneticus robustus Meek, Field Col. Mus. Pub. 65, 1902, 92;
Ocotlan; Patzcuaro; Zirahuen.

Basin of the Rio Lerma.

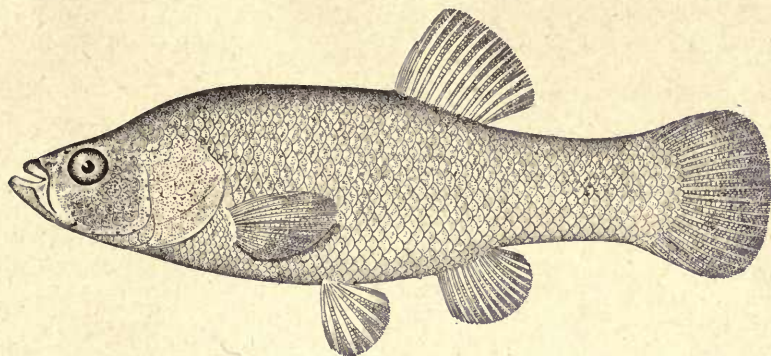


FIG. 31. *ZOOGONETICUS ROBUSTUS* (Bean).
No. 43760, U. S. National Museum.

Head 3 to $3\frac{1}{4}$; depth 3 to $3\frac{1}{3}$; D. 13 or 14; A. 14 to 16; scales 15-38. Body robust anteriorly, compressed posteriorly; head broad, interorbital area nearly flat, its width $2\frac{1}{3}$ in head; mouth rather large; lower jaw the longer; chin prominent; snout $3\frac{1}{2}$ in head; eye 4 to $4\frac{1}{2}$ in head; origin of dorsal fin slightly in front of anal and midway between tip of caudal fin and tip of snout; pectoral fin $1\frac{1}{2}$ in head; ventral fin $2\frac{1}{4}$ in head; caudal fin truncate; least depth of caudal peduncle 2 in head.

Color light brownish, much speckled and variegated with darker; on young specimens a tendency to form a narrow dark lateral band on posterior half of body; fins all plain. Length about $5\frac{1}{2}$ inches.

This species is the largest member of the genus on the Mexican Plateau. Females $4\frac{1}{4}$ to $4\frac{2}{3}$ inches in length, contain from 20 to 38 young, each from .67 to .75 inches in length. The young are born in May.

102. *Zoogoneticus maculatus* Regan.

Zoogoneticus maculatus Regan, Ann. & Mag. Nat. Hist., 1904, 256; Rio Santiago, Mexico.

Head 3 (in total length); depth $3\frac{1}{3}$ to $3\frac{3}{4}$; D. 13 or 14; A. 15; scales 36 to 38; mouth moderate, the lower jaw prominent; length of snout equaling diameter of eye, 4 to $4\frac{1}{2}$ in head; interorbital $2\frac{1}{2}$ to $2\frac{2}{3}$; origin of dorsal fin about midway between posterior edge of preopercle and base of caudal, its longest ray a little longer than the base of the fin, 2 in head (or less); origin of the anal a little behind that of dorsal, the first 6 rays in male, short, stiff, and of equal

length; pectoral fin $\frac{3}{8}$ to $\frac{2}{3}$ the length of the head; ventrals reaching vent; caudal truncate; caudal peduncle $1\frac{2}{3}$ to 2 times as long as deep.

Color brownish above, silvery below, with dark spots which are most conspicuous posteriorly; fins immaculate; total length 84 mm.

Three specimens from the Rio Santiago, Mexico. (Regan.)

103. *Zoogoneticus diazi* Meek.

Zoogoneticus diazi Meek, Field Col. Mus. Pub. 65, 1902, 93;

Patzcuaro; Zirahuen.

Basin of the Rio Lerma.

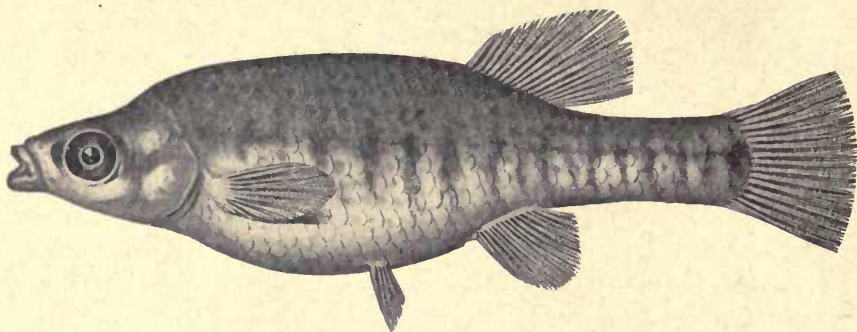


FIG. 32. *ZOOGONETICUS DIAZI* Meek.

No. 3618, Field Columbian Museum.

Head $3\frac{2}{3}$; depth $3\frac{1}{2}$; D. 17; A. 14; scales 13-34. Body elongate, robust, compressed; back much elevated, forming a prominent angle at the nape; top of head slightly convex; interorbital width $2\frac{1}{2}$ in head; snout bluntish, 4 in head; mouth large, teeth conical in a band in each jaw, the outer series being the larger; lower jaw the longer; chin very prominent; eye moderate, $3\frac{1}{2}$ in head; dorsal fin slightly in advance of the anal, its origin midway between base of caudal and posterior margin of opercle; base of dorsal $1\frac{5}{8}$ in head, its height 2 (in male $1\frac{3}{8}$) in head; pectoral fin $1\frac{2}{3}$ in head; ventral $2\frac{2}{3}$; alimentary canal scarcely as long as the body; peritoneum pale.

Color light olivaceous, young much mottled with darker; the darker in form of irregular cross-bars on the sides; many of the larger specimens in life with a reddish tinge over the body, fading to nearly a uniform light olive; fins all plain; the males a little duller and of a more uniform color than the females. Length about 3 inches.

Abundant where found. One female 3 inches in length contained 28 young, each .60 inches in length. A second female 3.15 inches in length contained 47 young, each .43 inches in length. The young are born the last of May and early in June.

104. *Zoogoneticus miniatus* Meek.

Zoogoneticus miniatus Meek, Field Col. Mus. Pub. 65, 1902, 94;
Chalco.

Valley of Mexico.

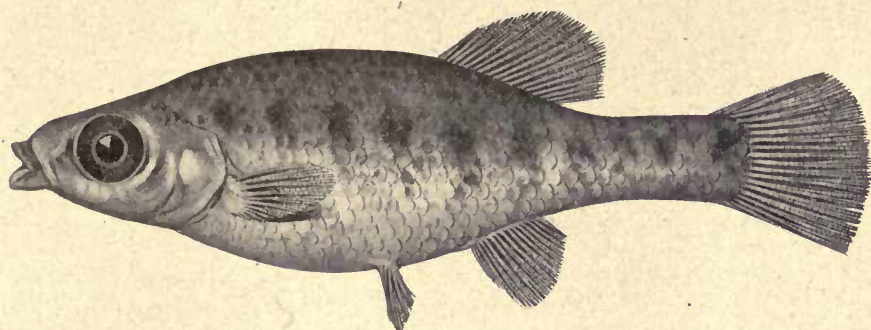


FIG. 33. *ZOOGONETICUS MINIATUS* Meek.

No. 3680, Field Columbian Museum.

Head $3\frac{1}{2}$; depth $3\frac{1}{4}$; D. 17; A. 14; scales 14-32. Body elongate, compressed; head rather narrow, interorbital width 3 in head; mouth rather large; lower jaw slightly the longer; teeth conical in a band, the outer series being the larger; snout $4\frac{1}{2}$ in head; eye $2\frac{2}{3}$ in head; dorsal fin slightly in advance of anal, its origin midway between base of caudal fin and the middle of preopercle; intestinal canal short, about as long as body.

Color olivaceous, much mottled with darker; no distinct lateral band; sides with irregular dark blotches, the last one forming an indistinct black caudal spot. Length about $1\frac{2}{3}$ inches. Known only from the type locality.

47. *Girardinichthys* Bleeker.

Girardinichthys Bleeker, Cyprin., 481, 1860. (Type, *Girardinichthys innominatus* Bleeker.)

Limnurgus Günther, Cat., VI, 309, 1866. (Type, *Limnurgus variegatus* Günther = *Girardinichthys innominatus* Bleeker.)

Body robust; mouth small, its cleft nearly vertical; teeth small, pointed, in one or more series in each jaw; dorsal and anal fins long, the former slightly in advance of the latter; intestinal canal on left side, not coiled, about the length of the body; peritoneum spotted, not wholly black; gill membranes partly united, free from the isthmus; anal fin of the male with its first 6 to 8 rays short and stiff and separated from the rest of the fin by a shallow notch; viviparous.

105. *Girardinichthys innominatus* Bleeker.

Lucania sp. Girard, Proc. Acad. Nat. Sci. Phila., 1859, 118; City of Mexico.

Girardinichthys innominatus Bleeker, Cyprin., 484, 1860; City of Mexico.

Limnurgus variegatus Günther, Cat., vi, 309, 1866; City of Mexico.

Girardinichthys innominatus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 666: Garman, Memoirs Mus. Comp. Zool., 1895, 39, pl. 1, fig. 11 (teeth); City of Mexico: Meek, Field Col. Mus. Pub. 65, 1902, 95; Chalco; Texcoco; Xochimilco.

Characodon geddesi Regan, Ann. & Mag., Nat. Hist., 1904, 257; Texcoco, Mexico.

Valley of Mexico. Abundant in the lakes, canals, and ditches. (Viga Canal.)

Head 4; depth 3 to $3\frac{1}{3}$; D. 18 to 23; A. 20 to 26; scales 16-40 to 44.

Body rather robust, deep, compressed, back not much elevated; head flat above; usually in larger specimens an angle at the nape; interorbital 2 in head; snout 4; eye 4; mouth small, lower jaw the longer, chin prominent; teeth rather strong, conical, in a band rather than in a single series; origin of dorsal fin midway between base of caudal and posterior half of opercle (♀) or eye (♂), and slightly in advance of origin of anal fin; the fins all small; pectoral $1\frac{1}{2}$ in head; ventrals 3; caudal fin rounded; least depth of caudal peduncle $1\frac{3}{4}$ in head; gill rakers short and stiff, about 15 on first gill arch.

Color grayish to dark brownish; some males being almost entirely black; sides variegated with darker, usually in the form of indefinite bars; young specimens usually with a dark spot slightly in advance and a little above anal; the color of this species is extremely variable. Length about $2\frac{3}{4}$ inches.

My attention has been called by Dr. Theo. Gill to the fact that the viviparity of this fish was noticed as early as 1769, a published account of it appearing in 1772. The reference to this account, and a translation of it by Dr. Theo. Gill, appears in his Bibliography of the Fishes of the Pacific United States, Bull. 11, U. S. Nat. Museum, 1882, 8, which I here quote in full.

"Voyage en Californie pour l'observation du passage de Vénus sur le disque du soleil, le 3 juin, 1769; contenant les observations de ce phénomène at la description historique de la route de l'auteur à travers le Mexique. Par feu M. Chappe d'Auteroche . . . Rédigé et publié par M. de Cassini fils . . . A Paris: chez Charles-Antoine Jombert. 1772." (4°, half title, title, 170 (2) pp., plan, and 2 pl. Sabin.)'

“Translated as follows:

“A voyage to California, to observe the Transit of Venus. By Mons. Chappe d'Aueroche. With an historical description of the author's route through Mexico, and the natural history of that province. Also, a voyage to Newfoundland and Sallee, to make experiments on Mr. Le Roy's timekeepers. By Monsieur de Cassini. London: Printed for Edward and Charles Dilly, in The Poultry. 1778. (8°, 4p. i., 315 pp., with 'plan of City of Mexico.')

“Extract of a letter from Mexico addressed to the Royal Academy of Sciences at Paris, by Don Joseph Anthony de Alzate y Ramyrez, now a correspondent of the said academy, containing some curious particulars relative to the natural history of the country adjacent to the City of Mexico. Pp. 77-105.

“It is undoubtedly this work that is meant in the statement that has so largely gone the rounds of the periodical press, to the effect that the Californian viviparous fishes were observed during the voyage for the observation of the transit of Venus to Lower California, 1769. A perusal of the accounts given, however, renders it evident that the fishes in question were not Embiotocids, but rather Cyprinodontids, probably of the genus *Mollienesis*. The account by Don Alzate (pp. 89-91) is as follows:

“‘I send you some viviparous scaly fishes, of which I had formerly given you an account. What I have observed in them this year is, ‘If you press the belly with your fingers, you force out the fry before their time, and upon inspecting them through the microscope, you may discern the circulation of the blood, such as it is to be when the fish is grown up.’ If you throw these little fishes into water, they will swim as well as if they had been long accustomed to live in that element. The fins and tail of the males are larger and blacker than those of the females, so that the sex is easily distinguished at first sight. These fish have a singular manner of swimming; the male and the female swim together on two parallel lines, the female always uppermost and the male undermost they thus always keep at a constant uniform distance from each other, and preserve a perfect parallelism. The female never makes the least motion, either sideways or towards the bottom, but directly the male does the same.’

“To this account is added a footnote (p. 90) containing the following additional information:

“‘Don Alzate has sent those fishes preserved in spirits; their skin is covered with very small scales; they vary in length from an inch to eighteen lines, and they are seldom above five, six, or seven lines in the broadest part. They have a fin on each side near the gills,

two small ones under the belly, a single one behind the anus, which lies between the fin and the single one; the tail is not forked; lastly, this fish has a long fin on the back, a little above the fin which is under the belly.

“We know of some viviparous fishes in our seas, such as loach, etc.; most of these have a smooth skin without any scales. The needle of Aristotle is viviparous, and yet covered with broad and hard scales. I have caught some that had young ones still in their womb. As to these viviparous fishes, it is a particular and new sort, and we are obliged to Don Alzate for making us acquainted with it. It breeds in a lake of fresh water near the City of Mexico.’

“This is, so far as known, the earliest notice of the viviparity of Cyprinodontids. The mode of consorting together (exaggerated in the account) is common to a number of representatives of the family, and is alluded to by Prof. Agassiz in a name (*Zygometes*, i. e., swimming in pairs) conferred on one of the genera of the family.”

Subfamily **Oreistiinæ**.

48. **Characodon** Günther.

Characodon Günther, Cat., vi, 308, 1866. (Type, *Characodon lateralis* Günther.)

Body rather deep, compressed; mouth small; teeth small, fixed, the outer series bicuspid, with a villiform band behind them; origin of dorsal fin nearly opposite that of the anal; anal fin with its first 5 or 6 rays short and stiff and separated from the rest by a shallow notch; alimentary canal short, 1 to 1½ times the total length of the fish; species viviparous.

KEY TO THE SPECIES OF CHARACODON.

- | | PAGE |
|--|--------------------------|
| a. Dorsal and anal fins very long, each of more than 20 rays | <i>multiradiatus</i> 119 |
| aa. Dorsal and anal rays shorter, each of less than 20 rays. | |
| b. Scales large, 30 to 35 in the lateral series. | |
| c. Dorsal fin slightly in advance of origin of anal, its origin about midway between tip of caudal and tip of snout. | |
| d. Anal rays 13; scales 30 to 32; about 9 teeth in the upper jaw and about 14 in the lower | <i>eiseni</i> 119 |
| dd. Anal rays 15 or 16; scales 35; about 14 teeth in the upper jaw and about 16 to 18 in the lower | <i>variatus</i> 120 |

	PAGE
cc. Dorsal fin slightly behind origin of the anal, about midway between tip of caudal fin and opercle.	
e. Head $3\frac{1}{3}$; dorsal rays 10 or 11; anal rays 13 to 16; scales 12-35 <i>lateralis</i>	121
ee. Head 3 to $3\frac{1}{8}$; dorsal rays 12; anal rays 12 or 13; scales 11 or 12-32 <i>garmani</i>	121
bb. Scales small, 50 in the lateral series, origin of dorsal fin midway between base of caudal and base of pectoral, anal fin inserted below seventh ray of dorsal <i>furcidens</i>	122

106. *Characodon multiradiatus* sp. nov.

Type, No. 4523, F. C. M., 1.50 inches in length; Lerma, Mexico.

Girardinichthys innominatus Evermann & Goldsborough, Bull.

U. S. Fish Comm., 1902, 149; Lago de Lerma, Mexico.

Basin of the Rio Lerma. (Lerma.)

Head $3\frac{3}{4}$ to 4; depth $2\frac{3}{4}$ to $3\frac{1}{4}$; D. 26 to 30; A. 26 to 30; scales about 45. Body moderately elongate, somewhat compressed; head small, mouth moderate; jaws with incisor-like bicuspid teeth; diameter of eye slightly greater than the length of the snout, $3\frac{1}{4}$ in head; dorsal fin long, its base equaling length of head (♀) to $\frac{1}{2}$ longer (♂); origin of dorsal in advance of anal, midway between base of caudal and eye (♀) to nearer tip of snout than base of caudal (♂); pectoral fin small, its length $1\frac{1}{2}$ in head; ventral 2 in head; gill rakers short, less than diameter of the eye, about 15 on first gill arch.

Color dark olivaceous, the darker markings with a tendency to form crossbars; a dark blotch on side above space between ventral and anal fins; margins of median fins on male black. Length about 1.80 inches.

This species in general form and color resembles *Girardinichthys innominatus* Bleeker, with which it has been previously identified.

107. *Characodon eiseni* Rutter.

Characodon eiseni Rutter, Proc. Cal. Acad. Sci., 1896, 266; Rio

Santiago, Tepic: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2831; Tepic.

Lowland streams of Jalisco and Tepic.

Head $3\frac{1}{2}$; depth $3\frac{1}{4}$; D. 11 to 13; A. 13; scales 12-30 to 32. Body rather deep, somewhat compressed; mouth almost vertical when closed; anterior teeth bicuspid, the villiform teeth not developed; about 9 teeth in the upper jaw and 14 in the lower; eye 3 in head; insertion of the dorsal in the middle of the total length; origin of anal

under the fourth ray of the dorsal; caudal fin broad, truncate; depth of caudal peduncle 2 in head.

Color, male with a broad indefinite lateral band; female with dark blotches on sides usually forming distinct cross bands (J. & E.). Length about $1\frac{1}{4}$ inches. Known only from the type locality.

108. *Characodon variatus* Bean.

Characodon variatus Bean, Proc. U. S. Nat. Mus., 1887, 370, pl. xx, fig. 10; Guanajuato: Bean, Proc. U. S. Nat. Mus., 1892, 286; Guanajuato: Woolman, Bull. U. S. Fish Comm., 1894, 62; Rio Lerma. Salamanca, Queretaro: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 669; Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 126; Rio Verde, Aguas Calientes: Meek, Field Col. Mus. Pub. 65, 1902, 36; Aguas Calientes: Lagos. Ocotlan; Celaya; Huingo.

Characodon ferrugineus Bean, Proc. U. S. Nat. Mus., 1887, 372, pl. xx, figs. 3 and 4. Guanajuato.

Basin of the Rio Lerma.

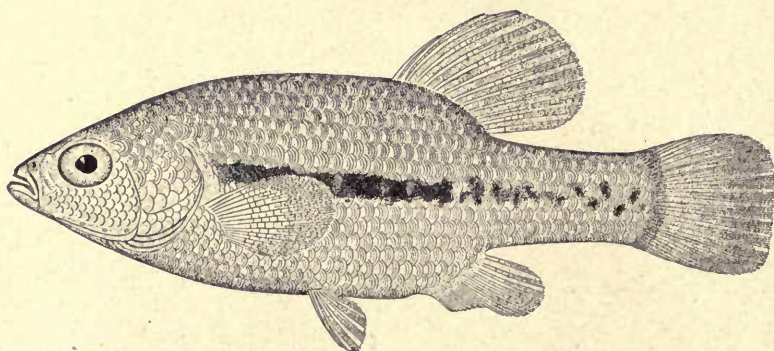


FIG. 34. *CHARACODON VARIATUS* Bean. ♂
No. 37808, U. S. National Museum.

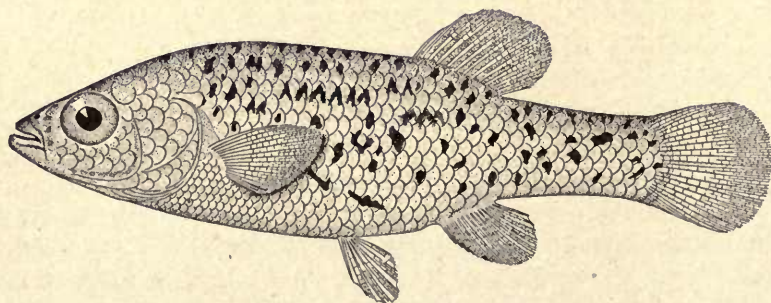


FIG. 35. *CHARACODON VARIATUS* Bean. ♀
No. 37810 (*Characodon ferrugineus* Bean), U. S. National Museum.

Head $3\frac{1}{3}$; depth 3; D. 13 or 14; A. 15 or 16; scales 15-35. Body elongate, somewhat compressed; head broad, usually a slight angle at the nape; mouth small, lower jaw projecting; chin prominent; snout $3\frac{1}{2}$ in head; teeth fixed, outer series bicuspid; eye $3\frac{1}{2}$ in head; origin of dorsal fin midway between base of caudal and middle of opercle (♀) or posterior margin of eye (♂), slightly in advance of origin of anal; pectoral fin $1\frac{1}{2}$ in head; ventral fin $2\frac{1}{3}$; caudal fin emarginate; least depth of caudal peduncle 2 in head.

Color light brownish, the male with a more or less prominent dark lateral band usually broken into blotches; dorsal and caudal fins black with a light yellow border; scales of upper part of body with dark centers forming lateral stripes along the rows of scales; color of female more variegated; sides with spots and blotches; a row of black spots on the lower half of the caudal peduncle; fins all pale; young specimens spotted and much resembling the young of *Zoogoneticus robustus* (Bean), but with larger spots. Length about $3\frac{1}{2}$ inches.

The most abundant and the best known species in the genus. The young are born the last of May. The alimentary canal in some specimens is scarcely the length of the fish, in others about $1\frac{1}{2}$ times its length. One female 2.20 inches in length contained 11 young, each .55 inch in length; a second one 2.50 inches in length contained 23 young, each .46 inch in length; a third 2.70 inches in length contained 37 young, each .40 inch in length.

109. *Characodon lateralis* Günther.

Characodon lateralis Günther, Cat., vi, 308, 1866; Central America: Günther, Fishes of Cent. Amer., 480, pl. 82, fig. 2, 1869; Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 668; Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Estado de Jalisco.

Lowland streams from Central America north to the State of Jalisco.

Head $3\frac{1}{3}$; depth 3; D. 10 or 11; A. 13 (♀) to 15 or 16 (♂), scales 12-35. Body elevated, the neck somewhat arched; head thick and broad, the snout obtuse, as long as the eye; about 20 teeth in each jaw, their tips indistinctly notched; eye 4 in head; origin of the dorsal fin a little nearer end of caudal than of occiput, a little behind anal; caudal fin small, truncate or slightly convex.

Color brownish olive with a darker band running from eye to the root of the caudal; this band sometimes broken up into a more or less regular series of brownish spots. (Günther.)

110. *Characodon garmani* Jordan & Evermann.

Characodon lateralis Garman, Mem. Mus. Comp. Zool., xix, 1895, 36, pl. 1, fig. 9 (not *Characodon lateralis* Günther); Parras, Coahuila, Mexico.

Characodon garmani Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2831.

Spring and headwaters of the Rio Mezquital near Durango, spring at Labor and the Rio Nazas at Parras. (Durango; Labor.)

Head $3\frac{1}{4}$; depth $2\frac{3}{4}$ to 3; D. 13; A. 13; scales 13-33. Body robust, somewhat compressed; snout short, 4 in head; lower jaw the longer, chin prominent; diameter of eye $3\frac{2}{3}$; interorbital area $2\frac{1}{4}$ in head; origin of dorsal to base of caudal about $2\frac{1}{4}$ in its distance from tip of snout; origin of anal slightly in advance of that of dorsal; pectoral fin 2 in head; ventrals $3\frac{1}{4}$; caudal fin rounded; least depth of caudal peduncle 2 in head.

Color olive reddish to light brownish; males uniform or with bars on caudal peduncle, sides of females more or less barred or blotched and lighter in color than males; usually on sides a dark broad lateral band, more broken up in bars on females than on males; on males the dorsal and caudal fins with a dark band near tip bordered with lighter; in life the larger males red, occasionally males with only one or two black blotches on the sides; the color very variable. Length about $1\frac{1}{2}$ inches.

The young are born early in June. It is quite probable that the specimens described by Prof. Garman are from Durango instead of Parras.

111. *Characodon fuscidens* Jordan & Gilbert.

Characodon fuscidens Jordan & Gilbert, Proc. U. S. Nat. Mus., 1882, 354; Cape San Lucas, Lower California: Garman, Memoirs, Mus. Comp. Zool., XIX, 1895, 36; Cape San Lucas (probably from the lagoons at La Paz): Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 670; Cape San Lucas; Colima: Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901; Rio San Pedro, Tuxpan, Jalisco.

Lowland streams of Jalisco and Colima and the southern portion of Lower California.

Head 4; depth $3\frac{2}{3}$; D. 15 to 17; A. 13; scales about 15-50. Body comparatively elongate, not much compressed, the head rather low and broad, depressed, interorbital area slightly more than two in head; anterior teeth large, firmly fixed and bicuspid; a band of minute teeth behind them; eye rather large, $3\frac{1}{3}$ in head, origin of dorsal fin midway between base of caudal and pectoral; origin of anal under seventh dorsal ray; pectoral fin $1\frac{2}{3}$ in head; ventral fin 2; caudal fin obliquely truncate, very slightly emarginate; caudal peduncle comparatively long and slender.

Color of males profusely mottled with darker; sometimes nearly plain; vertical fins each with several brownish bars or blotches and

each with a dusky subterminal bar; a narrow dark line along middle of each row of scales on the back; females with several short dark bars on the posterior half of the body; some dark specks on caudal peduncle. (Jordan & Evermann.)

49. *Chapalichthys* Meek.

Chapalichthys Meek, Field Col. Mus. Pub. 65, 1902, 97. (Type, *Characodon encaustus* Jordan & Snyder.)

Body rather deep, compressed; caudal peduncle long and slender; about half to three-fourths of the dorsal fin in front of origin of anal; origin of dorsal fin midway between base of caudal and anterior margin of the orbit; dorsal fin of male higher than that of female; anal fin with its first five or six rays short and stiff and separated from the rest of the fin by a shallow notch; teeth in 2 series, the outer enlarged, bicuspid and firmly attached; the inner series small, and in small patches; alimentary canal elongate, convolute or irregularly in 3 coils on the right side, its length nearly twice the length of the fish; peritoneum black, caudal fin truncate; gill rakers long and slender; vertebrae $18+19=37$; viviparous.

This genus has the long alimentary canal of *Goodea* and the firm bicuspid teeth of *Characodon*; the dorsal fin is considerably more advanced in this genus than either *Goodea* or *Characodon*.

112. *Chapalichthys encaustus* (Jordan & Snyder).

Characodon encaustus Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 126, fig. 7, Lago de Chapala, Ocotlan, Jalisco: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1901, 3150; Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Estado de Jalisco.

Chapalichthys encaustus Meek, Field Col. Mus. Pub. 65, 1902, 97; La Barca; Ocotlan; La Palma.

Basin of the Rio Lerma.

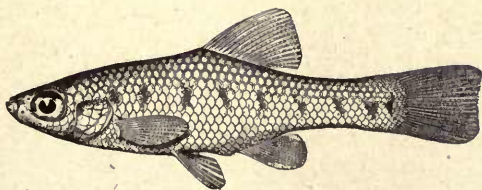


FIG. 36. *CHAPALICHTHYS ENCAUSTUS* (Jordan & Snyder).
No. 6163, Leland Stanford Jr. University.

Head $3\frac{1}{2}$ to $3\frac{4}{5}$; depth $3\frac{1}{3}$ to $3\frac{2}{3}$; D. 16; A. 15 or 16, scales 13-34 or 35. Body oblong, compressed; head moderate; interorbital area nearly flat, its width $2\frac{3}{8}$ in head; lower jaw the longer; chin promi-

nent; outer series of teeth enlarged, firm, and bicuspid; snout 4 in head; eye 3; dorsal fin high, its origin slightly nearer base of caudal than tip of snout; about half of the fin in front of origin of anal; pectoral fin $1\frac{1}{4}$ in head; ventral fin $1\frac{3}{4}$, caudal peduncle long and slender, its least depth 2 in head; the caudal fin slightly emarginate.

Color light brownish with 8 or 9 spots along the middle of the sides, occasionally forming short bars, each sometimes broken in the middle, forming two bars; usually a large black spot about the size of pupil above and a little forward of the origin of the anal; fins all plain. Length about 4 inches.

One female 2.70 inches in length contained 21 young, each .40 inch in length. The young are born the latter part of May.

50. *Cyprinodon* Lacépède.

PURSEY MINNOWS.

Cyprinodon Lacépède, Hist. Nat. Poiss., v, 486, 1803. (Type, *Cyprinodon variegatus* Lacépède.)

Prinodon Rafinesque, Analyse de la Nature, 1815, 88. (Type, *Cyprinodon variegatus* Lacépède.)

Body very short and stout, the dorsal region elevated; mouth small; teeth incisor-like, tricuspid, in a single series; scales large; dorsal fin inserted in advance of anal; ventrals small or wanting; gill openings restricted; the opercle above adnate to shoulder girdle; alimentary canal little longer than the body. Oviparus. Spawning time June and July.

This genus comprises a group of small chubby fishes inhabiting fresh or brackish waters. They are found living in small springs and isolated bodies of water in the desert regions of southwestern United States and northern half of Mexico, where no other fishes are found. The species are very variable. It would perhaps be quite as well to regard the species listed below as varieties of *Cyprinodon elegans*.

KEY TO THE SPECIES OF CYPRINODON.

- | | PAGE |
|---|------|
| a. Color markings on the side with a tendency to form cross-bars. | |
| b. Scales 28 in the lateral series; dorsal rays 8 or 9; anal 8 to 10. | |
| c. Dorsal fin yellow; caudal fin light, much speckled with darker <i>eximius</i> | 125 |
| cc. Dorsal fin dark, or with anterior half yellowish; caudal fin plain, not speckled with darker <i>elegans</i> | 125 |

bb. Scales 24 or 25 in the lateral series; dorsal rays 9 to 11; anal 10 or 11	<i>macularis</i>	126
aa. Color markings on side with a tendency to form longitudinal bands	<i>latifasciatus</i>	126

113. *Cyprinodon eximius* Girard.

Cyprinodon eximius Girard, Proc. Acad. Nat. Sci. Phila., 1859, 158: Rio Chihuahua, Chihuahua: Woolman, Bull. U. S. Fish Comm., 1894, 59, Rio Chihuahua, Chihuahua: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 673; Rio Chihuahua, Chihuahua.

Cyprinodon elegans Woolman, Bull. U. S. Fish Comm., 1894, 59: Rio Chihuahua, Chihuahua: Garman, Memoirs, Mus. Comp. Zool., 1895, 23; Rio Grande; Rio Chihuahua: Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 127; lagoons near Tampico: Meek, Field Col. Mus. Pub. 65, 1902, 97 (in part); Chihuahua, San Andres; Santa Rosalia; Jimenez; San Jose; Ahumada.

North, central, and northeastern Mexico, from the Rio Panuco to the Rio Grande. (Sauz.)

Head $3\frac{1}{4}$; depth $2\frac{1}{3}$; D. 8 or 9; A. 9 or 10; scales 11-28. Body deep, compressed; head small; snout bluntish; interorbital convex, $2\frac{1}{4}$ in head; diameter of eye equals snout $3\frac{2}{3}$ in head; origin of dorsal fin midway between base of caudal and anterior margin of the orbit; base of dorsal fin $1\frac{1}{3}$ in head, pectoral fin $1\frac{1}{3}$ in head; ventral fin $2\frac{3}{4}$; caudal fin truncate; least depth of caudal peduncle $1\frac{1}{3}$ in head.

Color of adult male dark brownish; sides with about 5 indistinct dark bars, much wider than the inter-spacing; dorsal and anal fins nearly white; caudal light, much variegated with black and with a broad dark margin; tips of anal and pectoral black; females lighter, variegated with darker with a tendency to form vertical bars; last rays of dorsal with a black blotch; caudal fin of female variegated or speckled with black. Length about $2\frac{1}{2}$ inches.

Spawning time in July.

114. *Cyprinodon elegans* Baird & Girard.

Cyprinodon elegans Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1853, 389; Comanche Spring, Texas: Girard, Mex. Bd. Sur., 66, pl. xxxvii, figs. 1-7, 1859; Comanche Spring, Texas: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 675; Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 149; Lago de Santa Maria, Chihuahua: Meek, Field Col. Mus. Pub. 65, 1902, 97 (in part); Colonia Juarez; Guzman; Santa Maria; Miñaca.

Cyprinodon eximius Bean, Bull. Amer. Mus. Nat. Hist., 1898, 168; San Diego, Chihuahua.

Northern Mexico, in the basin of the Rio Grande.

Head $3\frac{1}{3}$; depth 2 to $2\frac{1}{3}$; D. 9; A. 8 or 9; scales 12-28. Body deep, compressed; snout bluntish; interorbital convex, $2\frac{1}{4}$ in head; eye equals length of snout, $3\frac{1}{2}$ in head; origin of dorsal midway between base of caudal and preorbital; base of dorsal $1\frac{1}{3}$ in head; pectoral $1\frac{1}{3}$ in head; ventral $2\frac{1}{2}$; caudal fin truncate; least depth of caudal peduncle $1\frac{1}{4}$ in head.

Color of males dark brownish with from 6 to 10 rather indistinct vertical bars; caudal plain with a black margin; anterior half of dorsal yellowish, its last rays dark; pectorals, ventrals, and anal tipped with black; females lighter, marbled with darker, which has a tendency to form cross-bars, and also an indefinite lateral band; dorsal and anal with a black spot on last rays. Length 2.50 inches.

This species spawns in July.

115. *Cyprinodon macularius* Baird & Girard.

Cyprinodon macularius Baird & Girard, Proc. Acad. Sci. Phila., 1853, 389; Rio San Pedro, Arizona: Gilbert & Scofield, Proc. U. S. Nat. Mus., 1898, 498; spring-fed pond at Lerdo, Mexico.

Basin of the Rio Colorado.

Head 3 to $3\frac{1}{4}$; depth 2 to $2\frac{5}{8}$; D. 9 to 11; A. 10 or 11; scales 24 or 25. Body of adults deep, the young more slender; length of snout about equaling diameter of eye, about $3\frac{2}{3}$ in head; origin of dorsal fin midway between base of caudal and occiput.

Color variable; males with back and sides uniformly dusky, the lower parts lighter; all of the fins in most brightly colored individuals broadly margined with black; females with the lower half of the sides as well as belly lighter, often silvery white; the sides crossed by black bars, which are wide along the middle of the body, but becoming much narrower than the interspaces on the lower half of the sides; these bars varying in number and size and often alternating with narrower, fainter, and shorter ones; fins light; the dorsal either with or without a black blotch on its posterior rays; the males sometimes show dusky bars. (Gilbert.)

116. *Cyprinodon latifasciatus* Garman.

Cyprinodon latifasciatus Garman, Bull. Mus. Comp. Zool., 1881, 92; Parras, Coahuila, Mexico: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 676.

Rio Nasas and the headwaters of the Rio Mezquital. (Labor; Durango.)

Head $3\frac{1}{4}$; depth $2\frac{1}{3}$; D. 9; A. 9 or 10; scales 11-26. Body robust, deep, moderately compressed; head short. snout bluntish; mouth

small, terminal; interorbital slightly convex, $2\frac{1}{4}$ in head; eye small, equaling the length of the snout. $3\frac{2}{3}$ in head; origin of dorsal fin midway between base of caudal and anterior margin of orbit; base of dorsal 2 in head; pectoral $1\frac{1}{2}$ in head; ventral 3 in head; caudal fin rounded; least depth of caudal peduncle $1\frac{1}{2}$ in head.

Color of adult males very dark to light brownish; caudal fin plain with a narrow black band at tip; ventrals and anal plain, tipped with black; dorsal fin dark; females are much lighter. the larger ones much speckled with small dark dots; faint dark bands on middle of side along rows of scales; a black blotch on last rays of dorsal and anal; the smaller females more or less blotched with darker, but much less than in the preceding species. Length about 2.55 inches. The females taken are full of quite mature eggs.

The specimens from Labor average larger than those taken in the river at Durango. Professor Garman gives dorsal rays 12; anal rays 11. No doubt he counted the rudiments as well. There is some doubt as to whether or not Prof. Garman's specimens really came from Parras, Coahuila. I am inclined to believe the types of this species, also the types of *Characodon garmani* Jordan & Evermann came from near Durango.

Subfamily Gambusiinæ.

51. *Pseudoxiphophorus* Bleeker.

Pseudoxiphophorus Bleeker, Ichthyol. Ind. Prod. Cupr., 483, 1860.

(Type, *Xiphophorus bimaculatus* Heckel.)

Pecilioides Steindachner, Sitzgsber. Akad. Wiss. Wien, 1863. 176.

(Type, *Xiphophorus bimaculatus* Heckel.)

Body elongate, robust; head flat, depressed forward; dorsal fin long, its base about one-half longer than head; anal fin of male modified into an intromittent organ; teeth conical, in a band on each jaw, the outer series enlarged; gill rakers short and stiff, about 16 on first arch. those on upper portion of the arch the longer; alimentary canal short, less than the length of the body; vertebræ 18+14=32. One species known, viviparous.

117. *Pseudoxiphophorus bimaculatus* (Heckel).

Xiphophorus bimaculatus Heckel, Sitz. Akad. Wiss. Wien, 1848, 196; Mexico.

Pseudoxiphophorus bimaculatus Günther, Cat., VI, 333, 1866: Garman, Memoirs, Mus. Comp. Zool., XIX, 1895, 81, pl. III, fig. 6 (teeth), pl. VIII, fig. 9 (male); Mexico: Woolman, Bull. U. S. Fish Comm. 1894, 65; Rio Blanca, Orizaba: Jordan & Evermann,

Bull. 47, U. S. Nat. Mus., 1896, 678; B. A. Bean, Proc. U. S. Nat. Mus., 1898, 541; Mirador: Meek, Field Col. Mus. Pub. 65, 1902, 98; Jalapa.

*Pseudoxiphophorus pauciradiatus** Regan, Ann. & Mag. Nat. Hist., 1894, 256; Orizaba, Vera Cruz.

Streams of the eastern slope of Mexico from Jalapa to the Isthmus of Tehuantepec. (Jalapa; Xico; Cordoba: Otopa: Motzorongo; El Hule; Obispo; Perez; Sanborn.)

Head 4; depth $3\frac{1}{2}$ to 4; D. 13 to 15; A. 8 or 9; scales 9–30. Body elongate, rather robust, not much compressed; head depressed forward; interorbital nearly flat, $1\frac{1}{3}$ in head; snout $2\frac{3}{4}$ to 3; eye $3\frac{1}{2}$; origin of dorsal fin in advance of anal (φ), midway between base of caudal and tip of snout, or slightly nearer base of caudal; the base of the dorsal very long, about $\frac{1}{2}$ longer than the head; pectoral fin short and broad, $1\frac{1}{3}$ in head; ventral fin 2 in head; caudal fin rounded; caudal peduncle robust, $1\frac{1}{2}$ in head.

Color dark brownish; posterior margin of each scale black, making prominent outlines on scales; a large black blotch on upper $\frac{2}{3}$ of base of caudal; some black on membrane of dorsal fin; a black band across middle of anal. Length about $3\frac{1}{2}$ inches.

This species is very variable, and is quite plentiful in all streams of Vera Cruz from Jalapa to Sanborn. At Xico, the highest point from which I made collections, it was the only species taken. The largest specimens collected are from Cordoba, the longest being about 3.50 inches. One female from Cordoba, 3.35 inches in length, contained 45 eggs, each .115 inch in diameter. The young are probably born in May.

52. *Gambusia* Poey.

GUAZACONES.

Gambusia Poey, Memorias, 1, 382, 1855. (Type, *Gambusia punctata* Poey.)

Body elongate, more or less compressed; mouth moderate, the lower jaw projecting; each jaw with a band of pointed teeth, the outer

*Mr. C. T. Regan admits two species in this genus. He says: "It (*Pseudoxiphophorus bimaculatus* Heckel) differs from *Pseudoxiphophorus pauciradiatus* Regan in having a longer head and longer snout, and in the dorsal fin with 14 to 16 rays commencing midway between tip of snout and base of caudal, its base about $\frac{1}{2}$ of the total length. *P. pauciradiatus* Regan has D. 11 to 13, origin of dorsal nearer base of caudal than to tip of snout, the length of its base about 4 times in the total length."

The species is very variable. In some specimens in the museum collection from Cordoba the base of the dorsal fin is longer than head, in others equal to or shorter, the number of rays in dorsal fin is 13 to 15, very seldom 12 or 16. This species ranges from about 6,000 feet to sea level.

ones being the larger; teeth not movable; scales large; dorsal and anal fins usually small, the dorsal in advance of the anal; anal fin of male much advanced, and modified into an intromittent organ which is about as long as head; alimentary canal short, usually about the length of the body; branchiostegals 6; vertebræ about 32.

This genus comprises a group of small fishes living in swamps, ponds, and small streams of southern United States, Cuba, Mexico, and Central America. They are viviparous and feed on insects, seeds, and crustaceans.

KEY TO THE SPECIES OF GAMBUSIA.

	PAGE
a. Body with from 2 to 6 narrow, dark vertical bars from medial line of dorsal to or below axis of the body.....	<i>fasciata</i> 129
aa. Body without narrow dark vertical bars on its upper half.	
b. Side with a broad dark interrupted band, made up of short vertical bars; origin of dorsal fin to base of caudal 2 in its distance to tip of snout	<i>gracilis</i> 130
bb. Side with a narrow dark continuous band or streak.	
c. Scales in the lateral series 30 or more; head $3\frac{1}{4}$ to $3\frac{3}{4}$ in the body	<i>affinis</i> 130
cc. Scales in the lateral series 26 to 28; head $4\frac{1}{2}$ in the body.....	<i>infans</i> 131
bbb. Sides without band or streak except on middle of caudal peduncle; scales 8-32	<i>bonita</i> 132

118. *Gambusia fasciata* sp. nov.

Type, No. 4715, F. C. M., 2.1 inches in length; San Geronimo, Oaxaca.

Pacific slope streams of the Isthmus of Tehuantepec. (San Geronimo; Tehuantepec.)

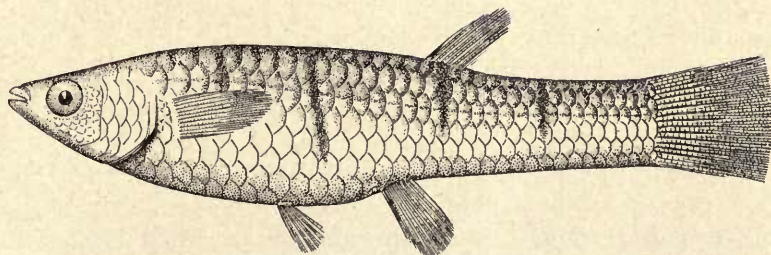


FIG. 37. GAMBUSIA FASCIATA Meek.

Head $4\frac{1}{4}$; depth $3\frac{2}{3}$ to 4; D. 7; A. 7; scales 8-32. Body elongate, not much compressed; head small, flat above; interorbital 2 in head; mouth small; jaws about equal; teeth in jaws in a band, the outer series enlarged; all of the teeth conical; snout $3\frac{1}{2}$ in head; eye 3 in head; origin of dorsal to base of caudal $1\frac{2}{3}$ in its distance from tip of snout, about midway between base of caudal and middle of pectoral fin; anal fin (♀) in advance of dorsal; pectoral fin $1\frac{1}{4}$ in head; ventral $2\frac{1}{4}$; caudal fin truncate; least depth of caudal peduncle $1\frac{1}{2}$ in head; alimentary canal $1\frac{2}{3}$ times total length of the fish; peritoneum black.

Color light brownish; a dark vertebral streak; side with from 3 to 5 narrow vertical bars which extend from dorsal region to middle of side, occasionally one or two bars reaching ventral region; a black spot on first two dorsal rays near their base; region in front of anal and basal half of first rays black; iris black; a dark line on under side of caudal peduncle. Length 2 inches.

One female contained 27 eggs, young quite well developed.

119. *Gambusia gracilis* (Heckel).

Xiphophorus gracilis Heckel, Sitzgsber. Akad. Wiss. Wien, 1848, 300; Orizaba, Mexico.

Gambusia gracilis Garman, Memoirs, Mus. Comp. Zool., xix, 1895, 85; Mexico and Central America: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 683; Meek, Field Col. Mus. Pub. 65, 1902, 99; Puente de Ixtla; Balsas.

Streams on both sides of the divide south of the City of Mexico. (Cuautla; Yautepec; Jojutla; Chietla.)

Head 4; depth $3\frac{2}{3}$ to 3; D. 6; A. 9; scales 8-30. Body rather slender, not much compressed; head small, mouth small, lower jaw the longer, teeth in the outer series enlarged; snout pointed, $3\frac{1}{3}$ in head; diameter of eye $3\frac{1}{3}$; origin of dorsal fin (♀) behind that of anal, its distance from base of caudal $1\frac{3}{4}$ in distance from tip of snout; pectoral fin $1\frac{1}{4}$ in head; ventral 2; caudal fin rounded; least depth of caudal peduncle $1\frac{2}{3}$ in head; peritoneum dark; alimentary canal shorter than the length of the fish.

Color dark brownish, each scale with light edgings; no spots on the fins; a broad dark lateral band more or less broken up into short vertical bars; iris black. Length about 2 inches.

The young are probably born early in May.

120. *Gambusia affinis* (Baird & Girard).

Heterandria affinis Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1853, 390; Rio Medina and Rio Salada, Texas.

Heterandria nobilis Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1853, 390; Comanche Spring, Rio Grande.

Gambusia nobilis Girard, Mex. Bd. Sur., 71, pl. xxxix, figs. 8-11, 1859; Comanche Spring: Woolman, Bull. U. S. Fish Comm., 1894, 60; Rio Chihuahua, Chihuahua.

Gambusia speciosa Girard, Proc. Acad. Nat. Sci. Phila., 1859, 121; Rio San Diego, a tributary of Rio San Juan near Cadereita, Nuevo Leon.

Gambusia gracilis Girard, Proc. Acad. Nat. Sci. Phila., 1859, 121; Matamoras.

Gambusia senilis Girard, Proc. Acad. Nat. Sci. Phila., 1859, 122; Rio Chihuahua, Chihuahua.

Gambusia patruelis Garman, Bull. Mus. Comp. Zool., 1881, 93; Monclova, Mexico: Garman, Memoirs, Mus. Comp. Zool., 1895, 84; Mexico.

Gambusia affinis Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 680; Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 127; lagoons near Tampico: Meek, Field Col. Mus. Pub. 65, 1902, 98; Jimenez; Santa Rosalia; Chihuahua; San Andres.

Lowland streams of the south Atlantic states and Gulf coasts to the Rio Panuco and to the Rio Conchos in Chihuahua. (Sauz; Monterey; Garza Valdez; La Cruz; Santa Engracia; Forlon; Valles.)

Head $3\frac{1}{2}$ to 4; depth $3\frac{1}{2}$ to 4; D. 7 or 8; A. 8; scales 9-32. Body rather robust, not much compressed; head rather large, flat above, interorbital 2 in head; snout 3 in head; lower jaw the longer; teeth in jaws in bands, the outer series enlarged; diameter of eye 3 in head; origin of dorsal fin over middle of last ray of anal, its distance from base of caudal $1\frac{1}{2}$ in its distance to tip of snout; pectoral $1\frac{1}{4}$ in head; ventrals $2\frac{1}{2}$ in head; caudal fin truncate; least depth of caudal peduncle $1\frac{1}{2}$ in head; alimentary canal about as long as the body; peritoneum dusky.

Color light olive, edges of scales dark; a faint dark lateral streak or dusky band on sides; sides and belly dusted with black dots; a narrow band downward and backward from eye; occasionally some dark on anal fin; other fins plain. Length about 2 inches.

One female 1.6 inches in length, collected the last week in May, contained 22 eggs, eye spots not formed.

121. *Gambusia infans* Woolman.

Gambusia infans Woolman, Bull. U. S. Fish Comm., 1894, 62, pl. 2, fig. 3; Rio Lerma, Salamanca, Guanajuato: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 680; Meek, Field Col. Mus. Pub. 65, 1902, 99; Celaya; Ocotlan; La Barca; Huingo.

Gambusia affinis Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Lago de Zacoalco, Estado de Jalisco.

Basin of the Rio Lerma.

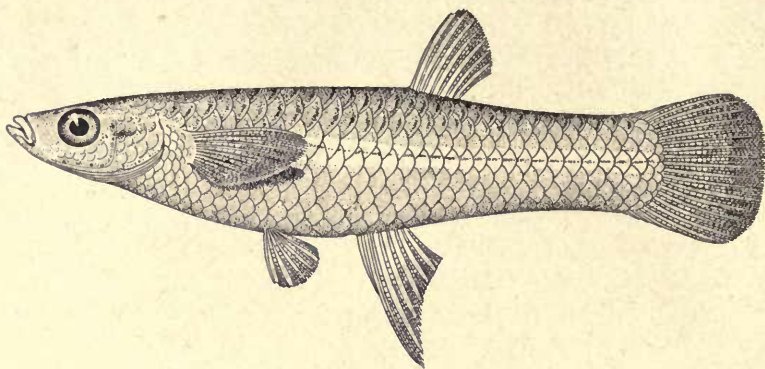


FIG. 38. *GAMBUSIA INFANS* Woolnan.
No. 45570. U. S. National Museum.

Head $4\frac{1}{2}$; depth $3\frac{1}{2}$; D. 7; A. 7; scales 8–28. Body robust, moderately compressed; head small, flat above, its interorbital width 2 in head; snout 4 in head; mouth small, lower jaw the longer; teeth in jaws in bands, outer series the larger; diameter of eye 3 in head; origin of dorsal over last anal rays, its distance from base of caudal $1\frac{2}{3}$ in distance from tip of snout; pectoral $1\frac{1}{3}$ in head; ventral $2\frac{1}{4}$; caudal fin truncate; least depth of caudal peduncle $1\frac{1}{4}$ in head; alimentary canal about $1\frac{1}{4}$ times the length of fish; peritoneum dusky,

Color light olivaceous; edges of scales darker; a narrow dark stripe on body; belly and sides not punctulate with dark dots; fins all plain. Length about 2 inches.

The young of this species are born about the middle of June.

122. *Gambusia bonita* sp. nov.

Type, No. 4630, F. C. M., 2.5 inches in length; Refugio, Vera Cruz.

Upper tributaries of the Rio Papaloapam. (Motzorongo; Refugio.)

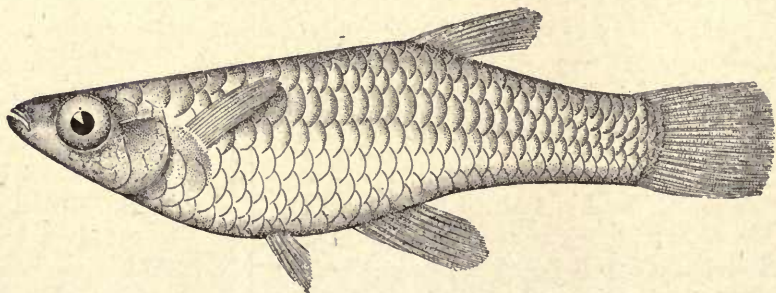


FIG. 39. *GAMBUSIA BONITA* Meek.

Head $3\frac{3}{4}$; depth $3\frac{1}{2}$; D. 7 or 8; A. 9; scales 8-32. Body elongate, somewhat compressed, profile from tip of snout to origin of dorsal a straight line; head moderate, mouth rather large, oblique; the lower jaw the longer; teeth conical, in a band, the outer series enlarged; snout $3\frac{3}{4}$ in head; eye 3 in head; origin of dorsal to base of caudal $1\frac{1}{2}$ in its distance from tip of snout, about midway between base of caudal and base of pectoral fin; anal (in females) well in advance of dorsal; pectoral $1\frac{1}{3}$ in head; ventral $2\frac{1}{4}$; caudal fin slightly rounded, least depth of caudal peduncle $1\frac{2}{3}$ in head; alimentary canal shorter than length of fish; peritoneum black; vertebrae $15+16=31$.

Color dark olivaceous above, white below; on darker portion of the body each scale has a light margin forming lateral stripes along the rows of scales; caudal fin usually tipped with black; a narrow dark streak on middle of caudal peduncle, this more prominent on the males; iris black. Length about $2\frac{3}{4}$ inches.

One female 2.36 inches in length contained 38 partially hatched eggs.

The young are probably born in May.

53. *Paragambusia* gen. nov.

Type, *Gambusia nicaraguensis* Günther.

Anal fin falcate, its first 3 rays much produced, longer than head, otherwise essentially as in *Gambusia*.

123. *Paragambusia nicaraguensis* (Günther).

Gambusia nicaraguensis Günther, Cat., vi, 336, 1866; Lake of Nicaragua: Günther, Fishes Cent. Amer., 483, pl. 82, fig. 3, 1869; Lake of Nicaragua: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 682.

Southern Mexico and Central America. (Otopa; Boca del Rio; El Hule; Obispo; Perez.)

Head $3\frac{1}{2}$; depth $2\frac{1}{2}$; D. 6; A. 10; scales 10-26. Body rather robust, much compressed; head small, depressed; interorbital flat, $1\frac{3}{4}$ in head; snout wedge-shaped, $3\frac{1}{3}$ in head; teeth pointed; diameter of eye 3 in head; origin of dorsal fin (♀) almost entirely behind anal, its distance from base of caudal 2 in its distance from tip of snout; anal fin of female with its first 3 or 4 rays produced and falciform, the longest ray equaling distance from tip of snout to base of pectoral fin; pectoral fin equals length of head; ventral 2 in head, one of its rays slightly produced; caudal fin rounded; least depth of caudal peduncle $1\frac{1}{3}$ in head; peritoneum black; alimentary canal less than length of the fish.

Color light brownish; dorsal and caudal fins spotted with black dots; in the larger females the produced anal rays are black; a dark bar downward and backward from eye. Length about 2 inches.

Female 1.20 inches in length, collected last week of April, contained 18 eggs in which only the eye spots were shown.

54. *Glaridichthys* Garman.

Glaridodon Garman, Mem. Mus. Comp. Zoölogy, XIX, 1895, 40.
(Type, *Girardinus uninotatus* Poey.)

Glaridichthys Garman, Amer. Nat., 1896, 232 (substitute for *Glaridodon*; preoccupied).

Body moderately elongate, compressed; caudal peduncle of moderate depth; head depressed, slightly arched; snout short, blunt; chin steep; mouth directed upward; lower jaws the longer, firmly united; an outer series of broad, cusped, hooked teeth firmly set in each jaw, behind these a band of smaller ones, sharp, pointed, expanded and hooked near the apex; anal fin in advance of dorsal; intestine long; scales large. (Garman.)

124. *Glaridichthys latidens* (Garman).

Glaridodon latidens Garman, Memoirs, Mus. Comp. Zoöl., XIX, 1895, 42, pl. v, fig. 11 (teeth); Chihuahua.

Head about $3\frac{3}{4}$; depth about $3\frac{1}{3}$; D. 8; A. 10; scales 28 to 30. Body moderately elongate, compressed; snout short, blunt, rounded; chin very steep; mouth rather wide, arched transversely, directed upward; teeth chisel-shaped, hooked and strong in the outer series; inner teeth in bands, pointed, commonly expanded near the apex as if 2 or 3 cusped; eye large, longer than snout, 3 in head; dorsal origin a little behind the middle of the total length, above middle of the base of the anal; ventrals very small, not reaching anal; pectorals moderate, reaching behind bases of ventrals; caudal as long as head, subtruncate or convex; vertebræ 13 + 19 = 32.

Color light olivaceous, darker on back, silvery on opercles; throat and belly apparently somewhat lighter along the middle of the flank; narrow brown vertical bars on the sides, more distinct behind the abdomen, one of them situated below the extremity of the base of the dorsal; fins clouded with brownish; top of head dark; a dark line from anal to caudal; in cases a smaller line on the middle of the side; the brown color in punctulations, sometimes arranged toward the edges of the scales. (Garman.)

I do not know this species, and I am inclined to think there is some mistake in the locality given for it. I do not believe this genus is represented in northern Mexico.

55. Belonesox Kner.

Belonesox Kner, Sitzgsber. Akad. Wiss. Wien, 1860, XL, 419.
(Type, *Belonesox belizanus* Kner.)

Body elongate, not much compressed; head broad, flat; jaws much produced; mouth large; premaxillaries forming an elongate triangular plate, but not ankylosed; mandible long, somewhat prominent; each jaw with a broad band of cardiform teeth; anal fin before dorsal; anal fin of male modified into an intromittent organ.

125. Belonesox belizanus Kner.

Belonesox belizanus Kner, Sitzungsber. Wiss. Wien, 1860, 419,
Balize: Günther, Cat., VI, 33, 1866, Mexico; Lago de Peten:
Garman, Memoirs, Mus. Comp. Zool., XIX, 1895, 80; Mexico:
Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 684.

Southern Mexico and Central America. (Boca del Rio; Otopa; El Hule; Obispo; Perez.)

Head $2\frac{3}{4}$ to 3; depth 5 to 6; D. 8 or 9; A. 10; scales 18-56 to 63. Body elongate, not much compressed; head long, slender, and much depressed forwards; interorbital area $3\frac{1}{2}$ in head; upper surface of premaxillary plate 3 in head; snout 2 in head; eye 5 to $5\frac{1}{2}$; origin of dorsal fin about opposite last ray of anal, its distance from base of caudal $2\frac{2}{3}$ in its distance to tip of snout; pectoral $2\frac{1}{10}$ in head; ventral $3\frac{1}{10}$; caudal peduncle slightly compressed, its least depth 3 in head; caudal fin rounded.

Color light brownish, almost uniform above and below; the scales on upper half of side each usually with a black center, forming dark, interrupted lateral stripes, a black spot at base of caudal. Length of females about 8 inches; the males less than half as large as females.

One female $7\frac{1}{2}$ inches in length, taken at Obispo, contained 129 young, each .85 inch in length; a second female 4.35 inches in length contained 26 eggs in which the eye spots and outline of the young were formed. With the possible exception of *Goodea luitpoldi*, this is the largest member of the family in Mexico.

Subfamily **Anablepinæ.****56. Anableps (Artedi) Bloch.**

FOUR-EYED FISHES; CUATRO OJOS.

Anableps (Artedi) Bloch, Ichthyologia, VIII, 7, 1795. (Type, *Anableps tetropthalmus* Bloch = *Cobitis anableps* Linnaeus.)

Body elongate, depressed anteriorly, compressed posteriorly; head broad and depressed, with the supraorbital part very much raised; cleft of mouth horizontal, of moderate width; both jaws armed with a

band of villiform teeth, those of the outer series being largest and somewhat movable; the integuments of eye divided into an upper and lower portion by a dark colored transverse band of conjunctiva; pupil also incompletely divided into two pair of lobes projecting from each side of the iris; nasal opening produced into a short tubule depending from each side of the mouth; dorsal fin behind anal; anal fin of male modified with a thick and long scaly conical organ with an orifice at its extremity; alimentary canal but little convoluted; vertebræ about 46.

126. *Anableps dowii* Gill. FOUR-EYES; CUATRO OJOS.

Anableps dowei Gill, Proc. Acad. Nat. Sci. Phila., 1861, 4; Panama.

Anableps dowii Günther, Cat., VI, 338, 1866: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 685; Chiapam, Guatemala: B. A. Bean, Proc. U. S. Nat. Mus., 1898, 541; Tequisistlan, 40 miles from the sea: Evermann & Goldsborough, Bull. U. S. Fish Comm., 1901, 150; Tehuantepec River at Tehuantepec.

Rio Tehuantepec to the Isthmus of Panama.

Head 4; D. 9; A. 10; scales 65 to 70. Body elongate, head flat, depressed.

Color blackish brown, with a well-defined broad golden band along the sides from axis of pectoral to the base of the caudal; fins pale. Length 7 or 8 inches.

According to Mr. E. W. Nelson, the individuals of this species swim always at the surface and in little schools arranged in platoons or abreast. They swim headed against the current and feed upon floating matter which the current brings them. They may make slight headway up stream or may gradually float down stream at a speed less than that of the current. They are easily frightened, and when a school becomes scattered, and after the cause of their fright has disappeared, the individuals will soon rejoin each other. The species is viviparous. A female 7 inches in length, collected in April, was examined by Dr. Evermann, who found it to contain 9 young, each 1.5 inches in length.

Subfamily **Goodinæ.**

57. *Goodea* Jordan.

Goodea Jordan, Proc. U. S. Nat. Mus., 1879, 299. (Type, *Goodea atripinnis* Jordan.)

Xenendum Jordan & Snyder, Bull. U. S. Fish Comm., 1899, 127. (Type, *Xenendum caliente* J. & S. = *Goodea atripinnis* Jordan.)

Body elongate to rather robust; dorsal fin posterior, about over anal fin; anal fin of males with its first 5 or 6 rays short and stiff and sepa-

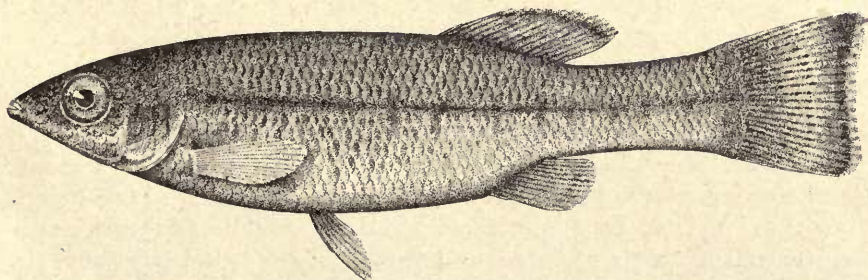
rated from the rest of the fin by a shallow notch; teeth in two series, the outer very loose and bicuspid; intestinal canal long, coiled on right side, about four times the length of the body; peritoneum black; gill rakers numerous, about 40 on first arch.

KEY TO THE SPECIES OF GOODEA.

- | | PAGE |
|---|-----------------------|
| a. Dorsal fin longer than the anal; dorsal rays 15; anal rays 12; scales small, more than 40; about 19 in a cross series; body elongate, its depth $3\frac{1}{2}$ to 4; scales 20-55; a prominent dark lateral band; vertical fins with black bars..... | <i>whitei</i> 137 |
| aa. Anal fin equal to or longer than the dorsal; scales larger, less than 50 in the lateral line; no prominent dark lateral band; no black bars on vertical fins. | |
| b. Body rather slender, its depth $3\frac{1}{2}$ in length; scales moderate, 15-45; dorsal rays 11; anal rays 15; caudal peduncle slender, its least depth $1\frac{1}{2}$ in head | <i>toweri</i> 138 |
| bb. Body rather deep, its depth 3 to $3\frac{1}{2}$ in body; scales large, 35 to 44; dorsal rays 13; anal rays 14; caudal peduncle deep, its least depth about 2 in head. | |
| c. Dorsal fin slightly in advance of anal, its origin to base of caudal $1\frac{2}{3}$ in its distance from tip of snout..... | <i>luitpoldi</i> 139 |
| cc. Dorsal fin slightly behind ventrals, its origin from base of caudal 2 in its distance from tip of snout | <i>atripinnis</i> 140 |

127. *Goodea whitei* sp. nov. MEXPAPATL.

Type, No. 4547, F. C. M., 2.8 inches in length; Yautepec, Morelos. Upper tributaries of the Rio Balsas. (Cuautla; Yautepec.)

FIG. 40. *GOODEA WHITEI* Meek.

Head $4\frac{1}{3}$; depth $3\frac{1}{2}$ to 4; D. 14 to 16; A. 12; scales 18–55. Body rather elongate, not much compressed, back not much elevated; interorbital space slightly convex, its width 2 in head; snout $3\frac{1}{4}$ in head; diameter of eye 3; origin of dorsal in advance of anal midway between tip of caudal and tip of snout; distance from origin of dorsal to base of caudal $1\frac{2}{3}$ in its distance to tip of snout; fins rather large; pectorals $1\frac{1}{4}$ in head; ventrals 2; caudal fins slightly emarginate; caudal peduncle slender, its least depth 2 in head.

Color brownish above, the posterior portion of each scale darker, giving a finely speckled appearance; a narrow blackish lateral band extending from above the opercle nearly to base of caudal, the posterior portion of the band more distinctly defined posteriorly; beneath this band the body is mostly straw color with a variable number of small brown specks; dorsal dusky, with a submarginal line of black, the margin plain; base of caudal fin dotted with several transverse rows of dark dots and usually a clearly defined narrow black submarginal band, the tips plain; anal with a central short black bar; ventrals usually plain, sometimes with black tips. I take pleasure in naming this fish for Mr. E. A. White, of the city of Mexico, in recognition of many favors received through his courtesy.

128. *Goodea toweri* sp. nov.

Type, No. 4519, F. C. M., 2.38 inches in length; Rio Verde, San Luis Potosi.

Upper tributaries of the Rio Panuco. (Rio Verde.)

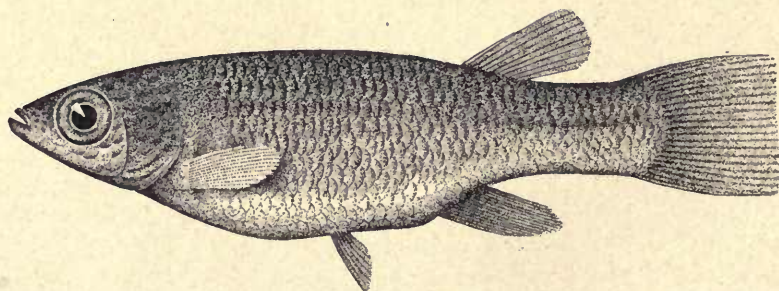


FIG. 41. *GOODEA TOWERI* Meek.

Head 4; depth $3\frac{1}{3}$; D. 11; A. 13; scales 15–45. Body elongate, moderately compressed, back little elevated; head rather small; interorbital flat, 2 in head; snout 4 in head; mouth rather small; the anterior series of teeth bicuspid; eye 3 in head; origin of dorsal fin behind ventrals, midway between tip of caudal and middle of opercle; the distance from origin of dorsal to base of caudal $2\frac{1}{6}$ in its distance to tip of snout; fins small; pectoral $1\frac{2}{3}$ in head; ventrals 2; the dorsal

fin in the male higher than in the female, and its position slightly more forward; caudal fin slightly truncate; caudal peduncle slender, its least depth $1\frac{1}{4}$ in head.

Color dark brownish above, lighter below; where the light and dark colors meet the side more or less speckled; a narrow dark shade on middle of caudal peduncle. Length about 3 inches. Named for its discoverer, Dr. W. L. Tower, of the University of Chicago.

129. *Goodea luitpoldi* (Steindachner).

Characodon luitpoldi Steindachner, Einige Fischarten, Mex., 1895, 12, pl. 3, figs. 3-3b.; Lago de Patzcuaro, Michoacan: Garman, Memoirs Mus. Comp. Zool., 1895, 37; Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2832; Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Lago de Zacoalco, Estado de Jalisco.

Xenendum xaliscone Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 128, fig. 9; Lago de Chapala, Ocotlan, Jalisco: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3153.

Goodea luitpoldi Meek, Field Col. Mus. Pub. 65, 1902, 101; Ocotlan; La Barca; La Palma; Patzcuaro.

Basin of the Rio Lerma.

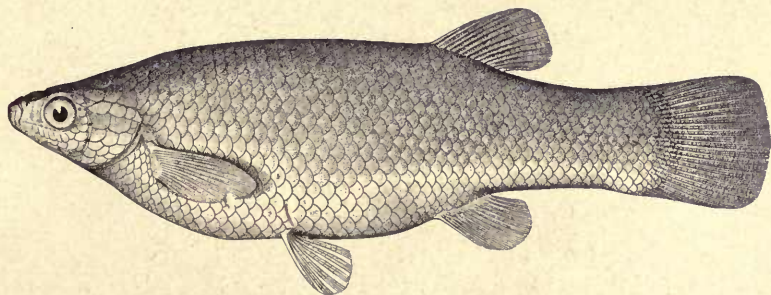


FIG. 42. *GOODEA LUITPOLDI* (Steindachner).
No. 6148 (*Xenendum xaliscone*), Leland Stanford Jr. University.

Head $4\frac{1}{2}$ to $4\frac{2}{3}$; depth 3 to $3\frac{1}{3}$; D. 12 or 13; A. 14 or 15; scales 17-40 to 42. Body rather robust, much compressed posteriorly; head small; interorbital area slightly convex, $1\frac{1}{8}$ in head; snout $3\frac{1}{2}$; eye $3\frac{1}{2}$; origin of dorsal fin midway between tip of caudal and posterior margin of eye, in advance of ventrals; distance from origin of dorsal to base of caudal equals $1\frac{1}{3}$ distance to tip of snout; fins rather large; pectorals $1\frac{1}{6}$ in head; ventrals $1\frac{1}{8}$; caudal fin slightly rounded; caudal peduncle deep, much compressed, its least depth $1\frac{1}{2}$ in head.

Color dark brownish above, lighter below; fins all plain. Length about 8 inches.

One female 5.15 inches in length from Patzcuaro contained 31 young, of about equal length, longest 1.14 inches. There was no

modification of the anal fin in any of these young, as found in the adult male. This modification of the anal fin is probably found with the development of the sexual organs. The young are born the last of May.

130. *Goodea atripinnis* Jordan.

Goodea atripinnis Jordan, Proc. U. S. Nat. Mus., 1879, 299; Leon, Guanajuato: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 685.

Xenendum caliente Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 127, fig. 8; Rio Verde, Aguas Calientes: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3152.

Goodea calientis Meek, Field Col. Mus. Pub. 65, 1902, 100; Aguas Calientes; Lagos; Celaya; Acambaro; Huingo; San Juan del Rio. Basin of the Rio Lerma, and of the Rio San Juan, a tributary of the Rio Panuco on the Mexican plateau.

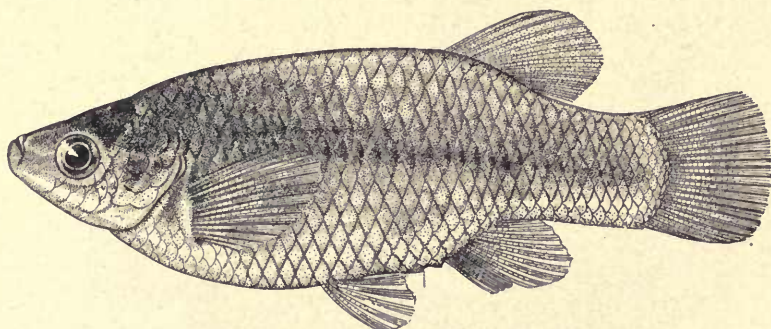


FIG. 43. *GOODEA ATRIPINNIS* Jordan.

No. 6147 (*Xenendum caliente* J. & S.), Leland Stanford Jr. University.

Head $3\frac{3}{4}$ to 4; depth $2\frac{2}{3}$ to 3; D. 13; A. 14; scales 13 or 14-35 to 38. Body rather robust, much compressed posteriorly; interorbital space slightly convex, $1\frac{3}{4}$ in head; snout 4 in head; eye $3\frac{1}{3}$ to 4 in head; origin of dorsal fin midway between tip of caudal and nape; distance from base of caudal to origin of dorsal 2 in distance from the latter point to tip of snout; origin of dorsal slightly behind that of anal fin; fins rather large; pectorals $1\frac{1}{2}$ in head; ventrals 2 in head; the caudal fin slightly rounded at tip; caudal peduncle deep, much compressed, its least depth $1\frac{2}{3}$ in head.

Color dark olive brown, lighter below, each scale with a dark angular band, giving the fish a somewhat speckled appearance; the young are slightly mottled in color; fins all plain; color of the sexes practically alike. Length about 4 inches.

One female 3.50 inches in length contained 44 young, each .53 inch in length. The young are born during the last half of May.

58. *Skiffia* Meek.

Skiffia Meek, Field Col. Mus. Pub. 65, 1902, 102. (Type, *Skiffia lermæ* Meek.)

Body compressed, deep; dorsal fin in advance of the anal, its middle over anal; teeth loose, outer series large, bicuspid, followed by a band of small villiform teeth; alimentary canal elongate, its length 2 to $3\frac{1}{2}$ times the length of the body; peritoneum black; gill rakers long, rather stiff, about 20 on the first arch; vertebræ about $16+18=34$; anal fin of male with its first 5 or 6 rays short and stiff, and separated from the rest of the fin by a shallow notch; dorsal fin of male higher than that of female.

A group of small fishes with much compressed bodies.

KEY TO THE SPECIES OF SKIFFIA.

- | | PAGE |
|---|--------------------------|
| a. A black bar at base of caudal (inconspicuous in some males of <i>lermæ</i> , which have a uniform coloration and a very dark head). | |
| b. Body light olivaceous in females; a dark spot on hinder margin of each scale on upper half of the body, these spots forming lines along the rows of scales; dorsal fin usually black, margined with yellow; D. 16; A. 15; scales 12-33 | <i>multipunctata</i> 141 |
| bb. Body light olivaceous in females, mottled with dark, nearly plain on lower half of body; males nearly plain; head usually quite dark; D. 13; A. 14; scales 14-37 | <i>lermæ</i> 142 |
| aa. No black bar at base of caudal. | |
| c. Body much variegated; no dark lateral band; D. 14 or 15; A. 13 or 14; scales 13-34; alimentary canal 3 times total length of the body | <i>variegata</i> 143 |
| cc. Color uniform with a dark lateral band bifurcated on the anterior third of body; D. 16; A. 16; scales 11-32; alimentary canal 2 to $2\frac{1}{2}$ times total length of body; origin of dorsal fin midway between base of caudal and nape | <i>bilineata</i> 144 |

131. *Skiffia multipunctata* (Pellegrin).

Xenendum multipunctatum Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Estado de Jalisco.

Skiffia multipunctata Meek, Field Col. Mus. Pub. 65, 1902, 103; Ocotlan.

Basin of the Rio Lerma.

Head 4; depth $2\frac{3}{4}$; D. 16; A. 15; scales 12-32. Body deep, much compressed; interorbital slightly convex, 2 in head; snout short, rather pointed, 4 in head; mouth small, lower jaw slightly the longer; eye large, 3 in head; dorsal fin slightly in advance of the anal, its origin midway between base of caudal and eye; base of dorsal $1\frac{1}{4}$ in head; height (in female) $1\frac{1}{3}$, somewhat higher in the male; anterior portion of dorsal shortened as in *Skiffia lermæ*; pectoral $1\frac{1}{3}$ in head; ventral 2; alimentary canal coiled on right side, its length $3\frac{1}{3}$ times total length of the fish; peritoneum black; gill rakers long and rather stout; 20 on the first gill arch; vertebrae 16+18=34.

Color of female light olivaceous; a dark spot on hinder margin of each scale on upper half of body, forming lines along the rows of scales much as in species of *Mollienesia*; a prominent black bar at base of caudal fin; male nearly uniform in color, with the anal and dorsal fins black, margined with yellow; black caudal bar indistinct. Length about $2\frac{1}{2}$ inches.

This species reaches a length of 2.50 inches, and is known only from the Lerma basin, near Ocotlan. The young are born during the latter half of May.

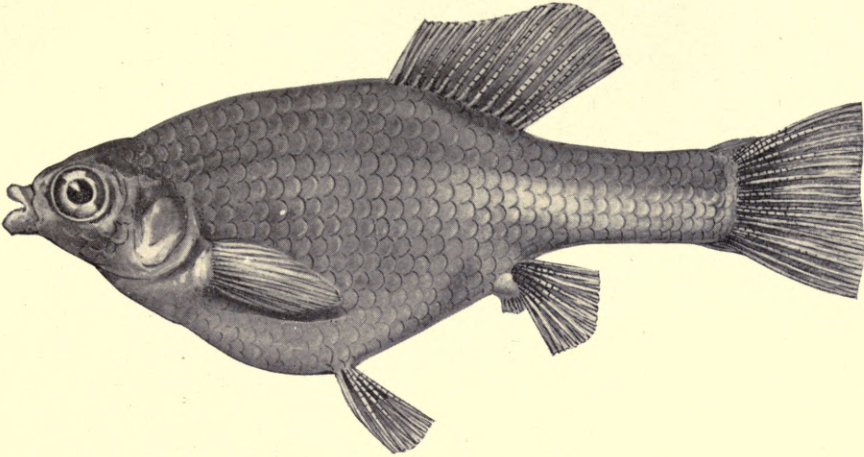
132. *Skiffia lermæ* Meek.

Skiffia lermæ Meek, Field Col. Mus. Pub. 65, 1902, 102; Celaya; Patzcuaro.

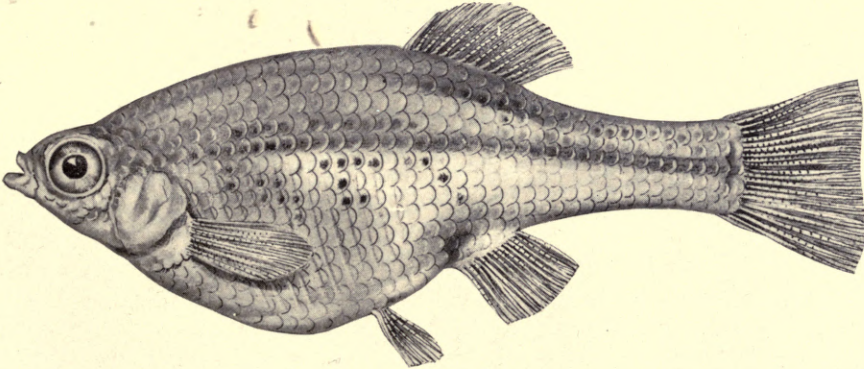
Basin of the Rio Lerma.

Head 4; depth $2\frac{2}{3}$ to $3\frac{1}{4}$; D. 13; A. 14; scales 14-37. Body deep, much compressed; head small; snout pointed, 4 in head; mouth small, the lower jaw the longer; eye large, 3 in head; interorbital slightly convex, its width $2\frac{1}{4}$ in head; dorsal fin slightly in advance of anal, midway between base of caudal and posterior margin of the orbit; base of dorsal 2 in head, its height in females $1\frac{1}{2}$, slightly higher in the males; pectoral $1\frac{1}{3}$ in head; ventrals 2 in head; gill rakers stout, 20 on the first arch; alimentary canal coiled on right side, its length $3\frac{1}{3}$ times the total length of the body; peritoneum black; vertebrae 16+18=34.

Color of females light olivaceous above, much mottled with darker, nearly plain on lower half of the body; young with a few faint brownish bars on lower half of caudal peduncle; a narrow dark lateral band and a prominent black bar at base of caudal; the color of the males nearly uniform dark-olivaceous, the anterior half of some specimens being nearly black; the black caudal bar much less conspicuous than on the females; a dark line on the under side of the caudal peduncle in both sexes. Length about 2.50 inches.



SKIFFIA LERMÆ Meek. ♂
No. 3623, Field Columbian Museum.



SKIFFIA LERMÆ Meek. ♀
No. 3622, Field Columbian Museum.

This species probably occurs throughout the Lerma basin. One female taken about May 20 contained 30 young, each of which was about .34 inches in length.

133. *Skiffia variegata* Meek.

Skiffia variegata Meek, Field Col. Mus. Pub. 65, 1902, 104; Zira-huen; Chalco.

Basin of the Rio Lerma.

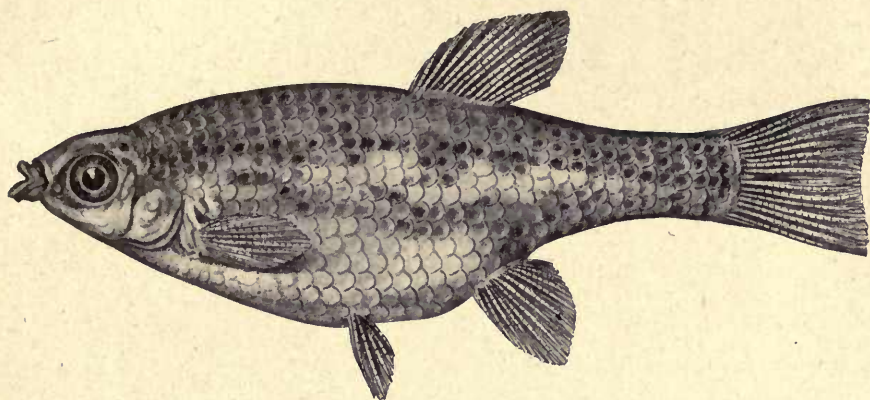


FIG. 44. SKIFFIA VARIEGATA Meek.
No. 3612, Field Columbian Museum.

Head $3\frac{5}{8}$; depth $2\frac{1}{2}$; D. 14; A. 13; scales 13-34. Body deep, compressed; top of head convex; interorbital $2\frac{1}{4}$ in head; mouth small, lower jaw the longer; chin rather prominent; snout 4 in head; eye large, 3 in head; origin of dorsal slightly in advance of anal; its origin midway between base of caudal and posterior margin of orbit; base of dorsal fin $1\frac{1}{2}$ in head; height (in male) $1\frac{1}{4}$ in head, being somewhat lower in the female; anterior dorsal rays short, increasing gradually to the eighth or ninth; pectoral $1\frac{1}{3}$ in head; ventral 2; caudal fin truncate; alimentary canal coiled on the right side, its length 3 times total length of the body; peritoneum black.

Color olivaceous, much mottled; an indistinct dark lateral band, more or less broken in some specimens; four or five light brownish spots on the lower portion of the caudal peduncle, the under surface dark; color of the male more uniform and darker than that of the female; no black bar at base of caudal; chin black. Length about 2.25 inches.

The young of this species are born about the middle of May. A female about two inches in length will give birth to about 20 young, each being about .50 inch in length.

134. *Skiffia bilineata* (Bean).

Characodon bilineatus Bean, Proc. U. S. Nat. Mus., 1887, 371, pl. 20, fig. 2; Rio Lerma, Guanajuato: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 668.

Skiffia bilineatus Meek, Field Col. Mus. Pub. 65, 1902; Huingo. Basin of the Rio Lerma.

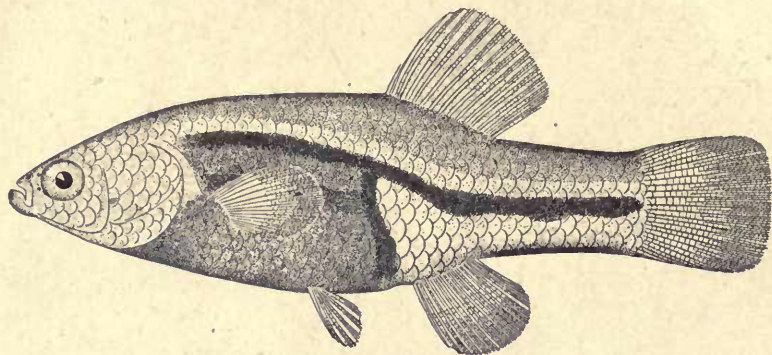


FIG. 45. SKIFFIA BILINEATA Bean.
No. 37832, U. S. National Museum.

Head $3\frac{3}{5}$; depth 3; D. 16; A. 16; scales 11–32. Body robust, dorsal region somewhat elevated; head broad, depressed; interorbital space nearly flat, 2 in head; snout short; outer series of teeth bicuspid, loose, but less so than in other species of the genus; origin of dorsal fin in advance of anal, midway between base of caudal and the nape; opercle connected by a membrane to the shoulder; pectoral fin $1\frac{1}{2}$ in head; ventral 2; alimentary canal elongate, slightly less than $2\frac{1}{2}$ times the total length of the body; peritoneum black.

Color brown above, lighter below; a dark lateral band divided on anterior third of body, the posterior half more or less broken into 12 to 15 short, irregular bars, a few extending almost to dorsal fin; the upper half of the body with a few fine punctulations. Length about 1.60 inches.

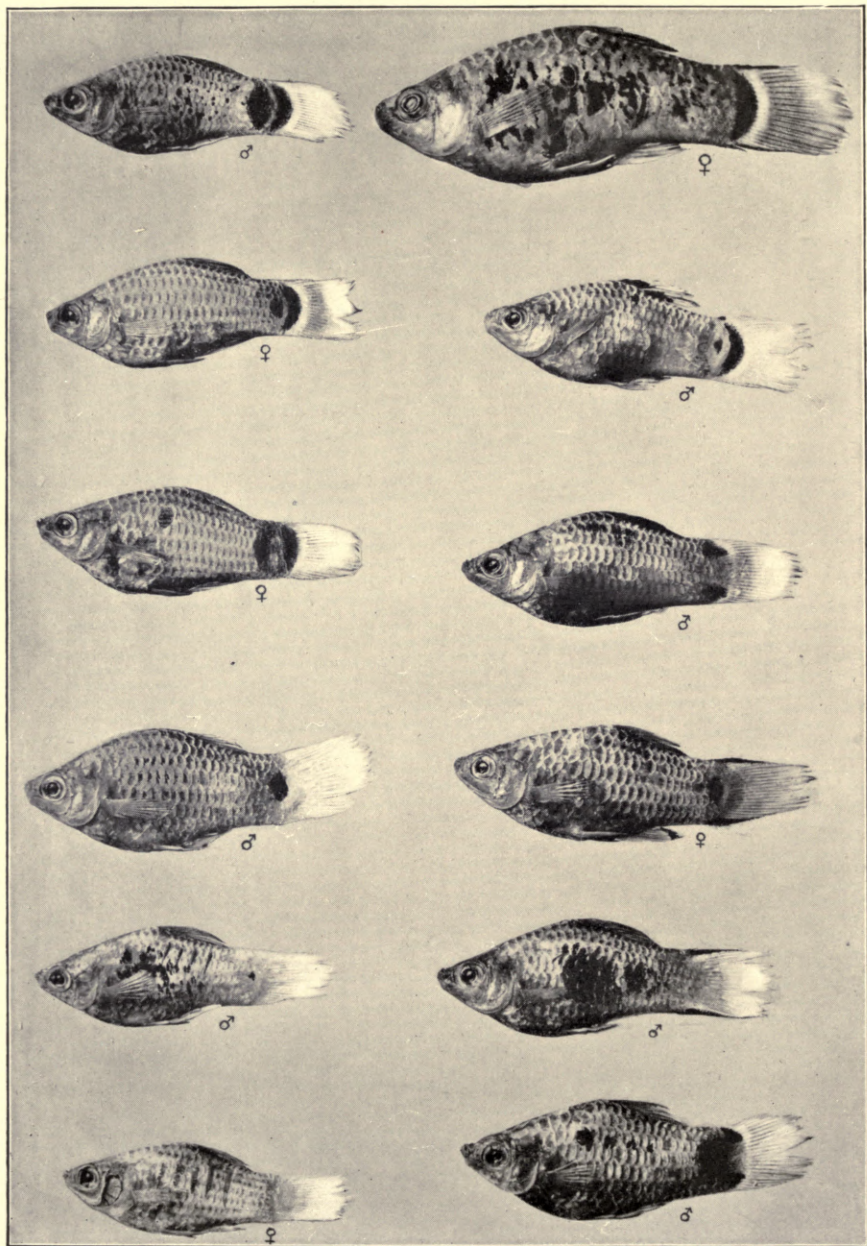
A female 1.50 inches in length contained 27 young, white and very slender, each being .32 inch in length. The young of this species are evidently born the last of May and early in June.

Subfamily **Poeciliinæ.**

59. *Platypœcilus* Günther.

Platypœcilus Günther, Cat., vi, 350, 1866. (Type, *Platypœcilus maculatus* Günther.)

Body deep, compressed; dorsal fin slightly in advance of anal; teeth loose, movable, in a single series in each jaw; alimentary canal



PLATYPÆCILUS MACULATUS Günther

long, coiled on the right side; anal fin of the male modified into an intromittent organ; gill rakers short, about equal to diameter of pupil; vertebræ 26 to 28; sexes similar in size and color. This genus comprises, so far as known at present, three species. They are small fishes, none exceeding 2 inches in length. The two species taken in eastern Mexico live in ponds or bayous among water-plants; to collect them successfully the net must be heavily leaded so as to rake well the bottom.

So far as color markings are concerned these fishes are more variable than any others known to me. Viviparous.

KEY TO THE SPECIES OF PLATYPÆCILUS.

a.	Body deep, compressed, its depth $2\frac{1}{2}$ to $2\frac{3}{4}$.	PAGE
b.	Caudal peduncle deep, its least depth $3\frac{2}{3}$ in the length of the body; depth of body $2\frac{1}{4}$	<i>maculatus</i> 145
bb.	Caudal peduncle slender, its least depth 5 in the length of the body; depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$	<i>variatus</i> 146
aa.	Body slender, elongate, its depth $3\frac{1}{2}$	<i>nelsoni</i> 147

135. *Platypæcilus maculatus* Günther.

Platypæcilus maculatus Günther, Cat., vi, 350, 1866, Mexico: Garman, Memoirs, Mus. Comp. Zool., 1895, 48; Mexico: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 686.

Lowland streams of Mexico which empty into the gulf south of the city of Vera Cruz. (El Hule; Ob'spo; Perez.)

Head $3\frac{1}{4}$; depth $2\frac{1}{4}$; D. 10; A. 7; scales 9-23. Body deep, compressed; profile from tip of lower jaw to dorsal fin a straight line, the highest point at origin of dorsal fin; head rather small; interorbital area flat, its width 2 in length of head; lower jaw slightly the longer; eye 3 in head; snout $3\frac{1}{4}$ in head; teeth loose, small, conical, in a single series in each jaw; dorsal fin slightly in advance of anal, its origin midway between base of caudal and posterior margin of the eye; longest dorsal ray (♀) $1\frac{1}{2}$ in the head to (♂) $1\frac{1}{3}$ in head; caudal peduncle very deep, its least depth $3\frac{2}{3}$ in the length of body; distance between the last dorsal ray and base of caudal slightly less than the least depth of the caudal peduncle; caudal fin rounded; anal fin with falcate margin, its first rays (♀) $1\frac{1}{2}$ in the head; tips of pectorals reaching middle of ventrals, $1\frac{1}{3}$ in head; ventrals reaching past anal, $1\frac{1}{2}$ in the length of head; intestinal canal elongate, coiled on the right side in 10 or 12 coils; gill rakers short, the longest about equal to diameter of the pupil; vertebræ $14+12=26$; anal fin of the male modified into an intromittent organ, its length $1\frac{1}{2}$ in the length of the head.

Color olivaceous, some specimens blotched with black; others with 1 to 3 black spots about $\frac{2}{3}$ size of the eye on the sides; occasional specimens with a large black blotch on side behind shoulders; some with a large black spot at base of caudal fin; this spot very small in others and in some specimens wanting; a broad black crescent on base of caudal rays; often the spot or crescent or both wanting; occasionally these markings reduced to the tips of the crescent or to the base of marginal rays of the caudal fin; dorsal fin black; anal and ventral rays with black tips; pectorals light. Length about $1\frac{3}{4}$ inches.

The color markings of this species are very variable, more so than of any other species I have examined.

136. *Platypœcilus variatus* sp. nov.

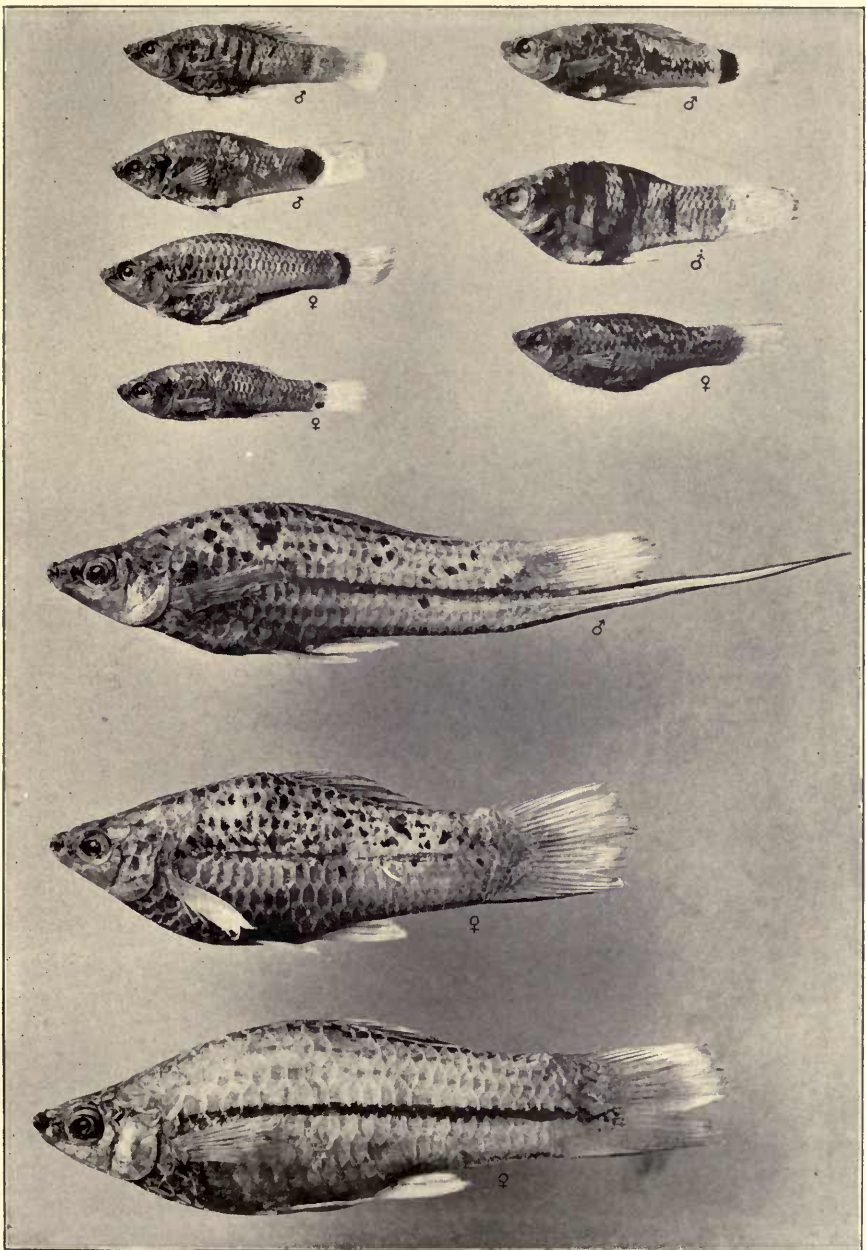
Type, No. 4501, F. C. M., 1.35 inches in length; Valles, San Luis Potosi.

Basins of the Rio Panuco and Rio Soto la Marina, in lowland streams. (Garza Valdez; Santa Engracia; Victoria; Forlon; Valles; Rascon.)

Head $3\frac{3}{4}$; depth $2\frac{1}{2}$ to $2\frac{3}{4}$; D. 10; A. 6 or 7; scales 9-25. Body oblong, compressed; profile from front of dorsal to tip of snout slightly convex, the highest point at origin of dorsal fin; interorbital area flat, its width 2 in head; lower jaw slightly the longer; eye $2\frac{1}{2}$ in head; snout 4 in head; teeth loose, conical, in a single series; dorsal fin in advance of anal, its origin midway between base of caudal and pupil; longest dorsal ray in both sexes, $1\frac{1}{2}$ in head; caudal peduncle moderately compressed, its least depth 5 in length of the body; distance from last dorsal ray to base of caudal $\frac{1}{3}$ greater than least depth of caudal peduncle; caudal fin slightly rounded; anal fin with a slightly convex margin; longest anal ray (in ♀) $1\frac{1}{2}$ in head; tips of pectorals reaching slightly past base of ventrals; length of pectoral fin $1\frac{1}{2}$ in head; tips of ventrals reaching origin of anal, $1\frac{1}{4}$ in head; alimentary canal coiled on right side as in the preceding species; gill rakers 15, the longest equaling diameter of pupil; vertebræ $14+14=28$; anal fin modified into an intromittent organ, its length $1\frac{3}{4}$ in the head.

Color olivaceous, the upper half or two-thirds of the body much mottled with darker; some specimens with a black caudal spot, in some specimens large, in others very small. Length about 2 inches.

The color markings of this species vary greatly. The black crescent and the black caudal spot may both be present or one or the other or both may be absent. One large male, the largest taken, 1.87 inches, has four distinct black vertical bars on the middle of the sides of the body; it also has the black blotch and crescent at base of caudal fin; a second large male (1.70 inches), has the black bars on



PLATYPÆCILUS VARIATUS Meek.
No. 4486, Field Columbian Museum.

XIPHOPHORUS HELLERI Günther.
No. 4668, Field Columbian Museum.



sides, but has neither the black caudal spot nor the crescent; the fourth black bar on left side is bifurcate in its lower half; dorsal fin with a black band across its middle and another at the tips; tips of anal rays black; ventrals and pectorals plain.

137. *Platypœcilus nelsoni* sp. nov.

Type, No. 51484, U. S. National Museum, $1\frac{1}{2}$ inches in length; Papayo, Guerrero.

Basin of the Rio Balsas.

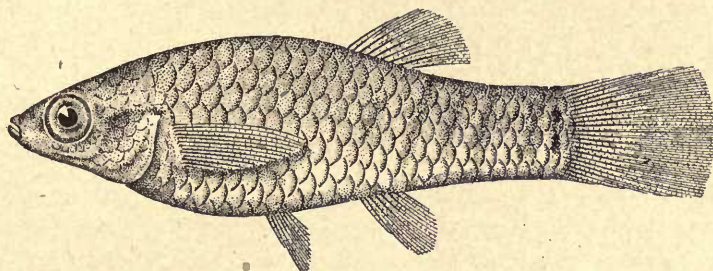


FIG. 46. *PLATYPÆCILUS NELSONI* Meek.

Head $3\frac{3}{5}$; depth $3\frac{1}{5}$; D. 7; A. 6; scales 10-28. Body elongate, moderately compressed; head large, snout pointed, $3\frac{1}{2}$ in head; inter-orbital slightly convex, 2 in head; mouth small; teeth close set, conical, their tips bent slightly backward; diameter of eye $3\frac{1}{4}$; origin of the dorsal fin midway between base of caudal and posterior margin of the opercle; pectoral $1\frac{1}{6}$ in the head; ventrals 2; caudal fin rounded; least depth of caudal peduncle $1\frac{2}{3}$ in head; no lateral line, many of the scales with pore-like depressions in their centers.

Color olivaceous, with a few faint vertical bars on posterior half of body; center of each scale lighter, the margins making faint longitudinal stripes along rows of scales. One specimen has two ink-like spots at base of caudal; a second specimen has only the upper one, the other two have none. Longest specimen 1.86 inches.

The only specimens of this species known were collected by E. W. Nelson at Papayo, Guerrero, on April 20, 1903, and were kindly loaned to the Museum by Dr. B. W. Evermann.

60. *Heterandria* Agassiz.

Heterandria Agassiz, Amer. Jour. Sci. & Arts, 1853, 135 (*Limia formosus* Girard).

Body rather slender; mouth very small; the lower jaw short, its bones not united; snout short; both jaws with a single series of slender,

movable teeth; scales large; dorsal fin inserted behind anal; anal fin of male placed well forward and modified into an intromittent organ; alimentary canal elongate, convoluted, not in definite coils, its length about $1\frac{1}{2}$ times the length of the fish.

A group of small fishes found in ditches and swamps of the warmer parts of America. Viviparous.

KEY TO THE SPECIES OF HETERANDRIA.

	PAGE
a. Origin of dorsal fin nearer base of caudal than base of pectoral fin; spots on sides about as large as orbit	<i>pleurospilus</i> 148
aa. Origin of dorsal fin midway between base of caudal and posterior margin of opercle; spots on sides about as large as pupil	<i>lutzi</i> 148

138. *Heterandria pleurospilus* (Günther).

Girardinus pleurospilus Günther, Cat., vi, 355, 1866; Lago de Dueñas: Günther, Fish. Cent. Amer., 486, pl. 77, fig. 1, 1869; Lago de Dueñas, Guatemala.

Heterandria pleurospilus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 688.

Southern Mexico and Central America, in west coast streams. (San Geronimo.)

Head $4\frac{1}{3}$; depth $3\frac{1}{3}$; D. 7 or 8; A. 7 or 8; scales 8–28. Body rather robust, compressed posteriorly; head broad; interorbital area nearly flat, $1\frac{2}{3}$ in head; snout 4 in head; eye 3; origin of dorsal fin slightly behind that of anal, nearer base of caudal than base of pectoral fin; pectoral equals length of head; ventral $1\frac{4}{5}$ in head; caudal fin slightly truncate; caudal peduncle rather deep, its least depth $1\frac{1}{3}$ in head.

Color light brownish, sides with 8 to 11 black spots on sides, each about as large as eye; some being broken up in two or more spots; a few specimens with a partial second row; fins all plain. Length about $2\frac{1}{2}$ inches.

A well marked species.

139. *Heterandria lutzi* Meek.

Heterandria lutzi Meek, Field Col. Mus. Pub. 65, 1902, 106; Oaxaca; Cuicatlan; Venta Salada.

Rivers of southern Mexico on both sides of the divide. (Motzorongo; Otopa; El Hule; Perez; Tehuantepec.)

Head $4\frac{1}{6}$; depth $3\frac{1}{2}$; D. 7; A. 8; scales 8–29. Body elongate, rather slender; head depressed anteriorly, giving it a wedge-shaped

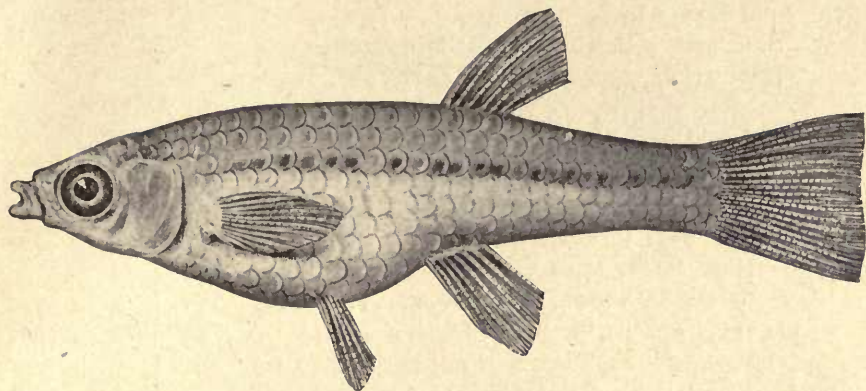


FIG. 47. *HETERANDRIA LUTZI* Meek.
No. 3718, Field Columbian Museum.

appearance; snout $3\frac{1}{2}$ in head; eye large, $3\frac{1}{4}$ in head; teeth movable, in one series, conical, curved backward at the tips; origin of dorsal slightly behind that of anal in females, midway between base of caudal fin and posterior margin of opercle; base of dorsal 3 in head; its height $1\frac{1}{2}$; pectoral $1\frac{1}{4}$; ventral 2; caudal fin truncate; caudal peduncle slender, its least depth $1\frac{3}{4}$ in head; alimentary canal much convoluted, not in definite coils, its length about $1\frac{1}{2}$ times the total length of the fish; peritoneum black.

Color olivaceous, a narrow dark lateral band broken into small round or oblong spots, each scarcely as large as pupil; iris black; a narrow dark streak on under side of caudal peduncle; a faint vertebral streak, more conspicuous in the young. Length about $3\frac{1}{2}$ inches.

One female 2.59 inches in length contained 40 young; each about .35 inch in length. The males are about half as large as the females.

61. *Pæcilia* Bloch & Schneider.

Pæcilia Bloch & Schneider, Syst. Ichthy., 452, 1801. (Type, *Pæcilia vivipara* Bloch & Schneider.)

Body oblong, often rather deep; mouth small, transverse, with weak jaws; teeth small, in narrow bands, the outer teeth enlarged, curved, and movable; scales large; dorsal fin small, of 7 to 11 rays; anal fin short, in female nearly opposite dorsal, in males advanced and modified into a sword-shaped intromittent organ; alimentary canal long; vertebræ about 28. Sexes about equal in size.

KEY TO THE SPECIES OF PÆCILIA.

- | | | |
|---|---------------------|-------------|
| a. Anal rays 9 or 10; sides with a black lateral stripe as wide as eye; scales 8-29 | <i>occidentalis</i> | PAGE
150 |
|---|---------------------|-------------|

- aa. Anal rays 6 to 8. PAGE
- b. Side with a black band made up of more or less distinct spots about as large as eye; dorsal rays 9; anal rays 6; scales 9-28 *latipunctata* 150
- bb. Side without black band.
- c. Origin of dorsal nearer tip of caudal than tip of snout; dorsal rays 7 to 9; anal rays 6 to 8; scales 9-24 to 28.
- d. Head large, $3\frac{1}{5}$ to $3\frac{3}{5}$ in body; depth $2\frac{3}{4}$ to $3\frac{1}{3}$ *butleri* 151
- dd. Head small, $4\frac{1}{5}$ in body; depth $3\frac{1}{2}$ to $4\frac{1}{5}$ *presidionis* 152
- cc. Origin of dorsal nearer tip of snout than tip of caudal.
- e. Least depth of caudal peduncle 6 in length of the body; head 4; depth $3\frac{1}{3}$; dorsal rays 8 or 9; anal rays 6 or 7 *couchiana* 152
- ee. Least depth of caudal peduncle 5 in the length of the body; head $3\frac{3}{4}$; depth $3\frac{1}{3}$; dorsal rays 9; anal rays 8 *sphenops*. 153

140. *Pœcilia occidentalis* (Baird & Girard).

Heterandria occidentalis Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1853, 390; Rio Santa Cruz, Tucson, Arizona: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 689.

Girardinus occidentalis Girard, Mex. Bd. Sur., 73, pl. xxxix, fig. 16-19, 1859; Rio Santa Cruz: Girard, Proc. Acad. Nat. Sci. Phila., 1859, 119; Rio Santa Cruz, Tucson, Arizona.

Girardinus sonorensis Girard, Proc. Acad. Nat. Sci. Phila., 1859, 120; San Bernardino Creek, tributary of the Rio Yaqui.

Pœcilia occidentalis Garman, Mem. Mus. Comp. Zool., 1894, 61; San Bernardino Creek, Arizona: Rutter, Proc. Cal. Acad. Sci., 1896, 261; Opsura (Rio Yaqui); Hermosillo: Rutter, ibid., 267; Rio Santiago, Tepic.

Rivers of Sonora and southern Arizona.

Head $3\frac{1}{2}$; depth $3\frac{1}{2}$ to 4; D. 7 or 8; A. 9 or 10; scales 8-29. Body deep, elevated in front of dorsal; origin of dorsal nearer base of caudal than tip of the snout, slightly in advance (♀) of anal.

Color brownish above, dotted with black; silvery below; with a black lateral stripe as broad as eye from shoulder to caudal; a narrow black line along lower margin of tail; fins plain, without spot or blotch.

141. *Pœcilia latipunctata* sp. nov.

Type, No. 4484, F. C. M., $2\frac{1}{8}$ inches in length; Forlon, Tamaulipas Basin of the Rio Panuco. (Forlon.)

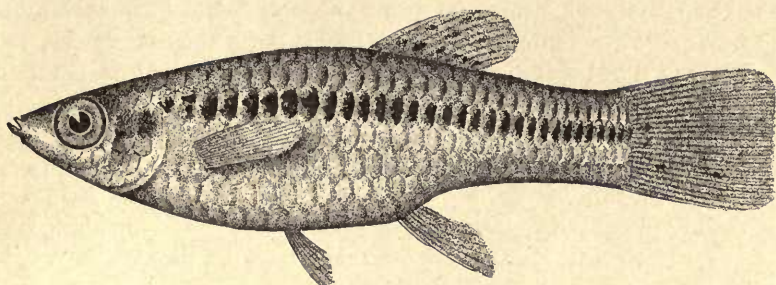


FIG. 48. PÆCILIA LATIPUNCTATA Meek.

Head $3\frac{3}{4}$; depth $3\frac{1}{4}$; D. 9; A. 6; scales 9-28. Body elongate, moderately compressed; head rather small, depressed; interorbital flat, $1\frac{1}{2}$ in head; snout equals diameter of eye, $3\frac{1}{4}$ in head; mouth small; teeth small, outer series not much enlarged; origin of dorsal midway between base of caudal and posterior margin of the orbit; pectoral $1\frac{1}{4}$ in head; ventral 2; caudal fin rounded; least depth of caudal peduncle $1\frac{1}{2}$ in head.

Color olivaceous; a black band on sides made up of spots about as large as pupil; iris black; dorsal and caudal fins on largest specimens (♀) with dark dots. Longest specimen 2.15 inches.

A female 1.75 inches contained 16 eggs with outline of young; about one-half of the egg was absorbed.

142. *Pæcilia butleri* Jordan.

Pæcilia butleri Jordan, Proc. U. S. Nat. Mus., 1888, 330; Rio Presidio, near Mazatlan: Jordan, Proc. Cal. Acad. Sci., 1895, 412; Rio Presidio, Mazatlan: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 691; Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 151; salt water in Gulf of Tehuantepec, Salina Cruz.

Fresh and brackish waters of Pacific coast from Mazatlan to Isthmus of Tehuantepec.

Head $3\frac{1}{5}$ to $3\frac{2}{3}$; depth $2\frac{3}{4}$ (adult) to $3\frac{1}{3}$ (young); D. 9; A. 6 to 8; scales 9-24 to 26. Body rather deep, compressed, the straight anterior profile rising considerably above the dorsal; interorbital width 2 in head; snout equals diameter of the eye, 3 in head; teeth in two series, well separated, the inner series smaller and more closely set; origin of dorsal midway between base of caudal and front of eye; longest dorsal ray $1\frac{1}{4}$ (♂), $1\frac{2}{3}$ (♀) in head; pectoral $1\frac{1}{4}$ in head.

Color of males, green with a pale blue spot on each scale, surrounded by bronze shades; no dark cross-bars except in the young;

dorsal and anal pale orange, with many small round black dots; lower fins pale; color of female similar to male, but paler; no cross bands; a faint dark spot behind pectoral; caudal nearly plain; dorsal and anal less spotted than in the male. Length about 3 inches.

143. *Pœcilia presidionis* Jordan & Culver.

Pœcilia presidionis Jordan & Culver, Proc. Cal. Acad. Sci., 1895, 413, pl. 29; Rio Presido, Sinaloa: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 697; Rio Presidio, Sinaloa,

Fresh and brackish waters of Sinaloa.

Head $4\frac{1}{2}$; depth $3\frac{1}{2}$ to $4\frac{1}{2}$; D. 7 or 8; A. 7; scales 9-28. Body rather elongate, the profile scarcely rising in front of the dorsal fin; interorbital space broad, 2 in head; diameter of the eye equals the length of the snout, $3\frac{1}{2}$ in head; teeth small, in two well separated series; those of the inner row small, close set; origin of dorsal fin nearer tip of caudal than tip of snout; middle of dorsal over origin of anal (♀); fins all low and short; longest dorsal ray $1\frac{1}{3}$ in head; pectoral $1\frac{1}{3}$ in head; caudal truncate.

Color (♀) green sh above; sides with violet sheen; 3 or 4 black cross-bars usually very distinct, sometimes obsolete in large examples; one or two oblong spots before these in the place of other bars; last ray of the dorsal with a trace of a dark ocellus; fins otherwise plain; males without cross-bars and with the lower fins reddish.

144. *Pœcilia couchiana* (Girard).

Limia couchiana Girard, Proc. Acad. Nat. Sci. Phila., 1859, 116; Rio San Juan at Cadereita, near Monterey, Nuevo Leon.

Pœcilia couchiana Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 695.

Headwaters of the Rio San Juan, near Monterey, very abundant in a large spring in the city of Monterey. (Monterey.)

Head $3\frac{1}{2}$; depth 3; D. 9; A. 7 or 8; scales 10-27. Body robust, moderately compressed; back moderately elevated, head small, interorbital $1\frac{2}{3}$ in head; teeth loose, in one series; snout $3\frac{1}{2}$; eye 3; origin of dorsal fin much in advance of anal, midway between base of caudal and eye; pectoral fin $1\frac{1}{2}$ in head; ventral $1\frac{1}{2}$ in head; caudal fin rounded; caudal peduncle $1\frac{1}{3}$ in head; alimentary canal elongate, coiled on the right side.

Color dark brownish on upper two-thirds of body; below white, with a few black specks; each scale on upper half of body with light centers. Length about $1\frac{3}{4}$ inches.

One female 1.75 inches in length contained 22 eggs. The young are probably born early in June.

145. *Pæcilia sphenops* Cuvier & Valenciennes.

Pæcilia sphenops Cuvier & Valenciennes, Hist. Nat. Poiss., xviii, 130, 1836; Vera Cruz: Garman, Memoirs Mus. Comp. Zool., 1895, 59, pl. iv, fig. 13; Mexico and Central America: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 694.

Molienesia fasciata Müller & Troschel, Mon. Akad. Wiss. Berlin, 1844, 36; Mexico.

Gambusia modesta Troschel, Müller's Reise in Mexico, iii, 639, 1865; Mexico.

Gambusia plumbea Troschel, *ibid.*, iii., 640, 1865; Mexico.

Pæcilia mexicana Steindachner, Sitzber. Akad. Wiss. Wien., 1863, 178; southern Mexico: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 692; B. A. Bean, Proc. U. S. Nat. Mus., 1898; Santa Maria, Vera Cruz.

Pæcilia limantouri Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 129, fig. 10; Rio Tamesin, Tampico: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3153; Meek, Field Col. Mus. Pub. 65, 1902, 106; Puente de Ixtla; Balsas; La Antigua: Fowler, Proc. Acad. Nat. Sci. Phila., 1903, 320; Victoria, Tamaulipas.

Lowland streams of eastern Mexico, from Monterey to the Isthmus of Tehuantepec, and in the Rio Balsas, Rio Tehuantepec and Rio San Geronimo. (Monterey; San Juan; Linares; Garza Valdez; La Cruz; Santa Engracia; Victoria; Forlon; Valles; Rascon; Jojutla; Vera Cruz; Boca del Rio; Otopa; El Hule; Obispo; Perez; San Juan Evangelista; San Geronimo; Tehuantepec.)

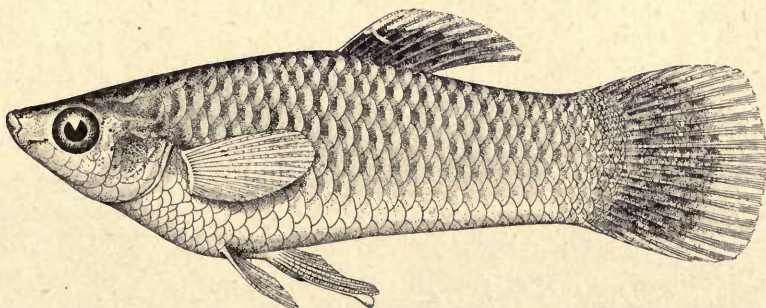


FIG. 49. *PÆCILIA SPHENOPS* Cuvier & Valenciennes.
No. 6165 (*Pæcilia limantouri* J. & S.), Leland Stanford Jr. University.

Head $3\frac{1}{2}$ to .4; depth $3\frac{1}{3}$; D. 9 or 10; A. 8 or 9; scales 9 or 10-25 to 27. Body robust, compressed; back not much elevated; head moderate; interorbital area nearly flat, $1\frac{3}{4}$ in head; snout $3\frac{1}{3}$ in head; eye 3 to $3\frac{1}{2}$; teeth in 2 series in both jaws, the outer series a single

row, small, pointed, and loosely attached; dorsal fin in advance of anal, midway between base of caudal and posterior margin of eye; the dorsal fin in old males extremely high, its longest rays a half longer than head; pectoral 1 1-10 in head; ventral $1\frac{3}{4}$; caudal fin rounded, in old males much expanded and fan-like; caudal peduncle very deep, $1\frac{1}{2}$ in head in females to about equaling length of head in old males; alimentary canal very elongate, coiled on the right side.

Color light brownish above, belly a shade lighter; the edges of the scales usually light, forming more or less indistinct lateral stripes along the rows of scales. Length about 3 inches.

In general coloration this species is very variable. In some specimens nearly half the scales on the side have black centers; males usually have light vertical bars, and the dorsal and caudal fin with many black spots arranged in regular rows, the fins being transversely barred, and the edges are light yellowish, sometimes with a narrow dark border. The caudal and dorsal fins of males may have dark blotches. Some of the males may have dark blotches scattered over the side of the body and caudal and dorsal fins; occasionally these blotches may be so numerous as to form the body-color of the fish. The color of the females is more uniform than that of the males. A very variable and widely distributed species. It is probable that a few of the *Pæcilia* described from Central America belong to this species.

62. *Mollienisia* Le Sueur.

Mollienisia Le Sueur, Jour. Acad. Nat. Sci. Phila., 1821, 3, pl. III.

(Type, *Mollienisia latipinna* Le Sueur.)

Body rather stout; mouth small; mandible very short, its bones united, the dentary being movable; outer edge of both jaws with a narrow band of small teeth, the outer series long, slender, and movable, with tips curved and slightly compressed; dorsal fin over or in advance of the anal (in female); the anal fin of the male placed forward and modified into an intromittent organ; lower angle of caudal in the male slightly produced; alimentary canal elongate, with numerous convolutions; dorsal fin of male very high; vertebrae $17+13=30$.

Small mud-eating fishes of swamps near the coasts from North Carolina to Mexico.

KEY TO THE SPECIES OF MOLLINIENISIA.

- | | | | |
|-----|---|------------------|----------|
| a. | Head large, $3\frac{1}{4}$ in body; dorsal rays 12 or 13;
origin of dorsal fin over that of anal in females..... | <i>formosa</i> | PAGE 155 |
| aa. | Head $3\frac{1}{2}$ to 4 in body; dorsal rays 13 to 16;
origin of dorsal fin in advance of anal in female.... | <i>latipinna</i> | 155 |

146. *Mollienesia formosa* (Girard).

Limia formosa Girard, Proc. Acad. Nat. Sci. Phila., 1859, 115;
Palo Alto, Mexico.

Mollienesia formosa Günther, Cat., VI, 1866, 349.

Mollienisia formosa Jordan & Evermann, Bull. 47, U. S. Nat.
Mus., 1896, 699.

Northeastern Mexico.

Head $3\frac{1}{4}$; depth $3\frac{1}{4}$; D. 12 or 13; A. 10. Body rather stout; snout short; dorsal in male longer than high, its first ray about opposite anal; female with dorsal nearly as high as long, the anal opposite its front.

Color olivaceous; scales with brown spots; dorsal fin with transverse series of blackish spots; other fins plain. (Girard.)

147. *Mollienesia latipinna* Le Sueur.

Mollienisia latipinna Le Sueur, Jour. Acad. Nat. Sci. Phila., 1821, 3; New Orleans: Garman, Memoirs Mus. Comp. Zool., 1859, 50, pl. v, fig. 1, teeth; pl. VIII, fig. 12: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 699: Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 131; Lagoons near Tampico.

Pæcilia lineata Girard, Mex. Bd. Sur., 70, pl. xxxv, figs. 9-11, 1859; Rio Grande, near Brownsville, Texas.

Limia matamorensis Girard, Proc. Acad. Nat. Sci. Phila., 1859, 116; Matamoras, Tamaulipas.

Lowland streams and lagoons, from Yucatan to South Carolina. (La Vega, Tamaulipas, E. W. Nelson.)

Head $3\frac{1}{2}$ (♀) to 4 (♂); depth $2\frac{1}{2}$ (♀) to 3 (♂); D. 13 to 16; A. 8; scales 9 or 10-26. Body oblong, much compressed in males, nearly of equal height from dorsal backward; greatest height of body about $\frac{1}{3}$ more than that of caudal peduncle; females with a more distended abdomen and more slender caudal peduncle; head very small, depressed, not narrowed forward; mouth very small, vertical; teeth small, movable, in a band, the outer series the larger; eye $3\frac{1}{3}$ to $3\frac{1}{2}$ in head; dorsal fin in males enormously high; the longest ray $2\frac{1}{2}$ in body; dorsal in females low, longest ray about $1\frac{1}{2}$ in head; origin of dorsal in front of that of anal, its origin to base of caudal $2\frac{1}{3}$ times to tip of snout; anal fin (♀) very small, that of male modified into an intromittent organ; caudal fin rounded; intestinal canal elongate, about $2\frac{1}{2}$ times the length of the fish.

Color of male, light olive green marbled with darker and spotted with pale green; each scale on back and sides with an oblong, blackish spot, these forming continuous lengthwise stripes; head dusky above;

opercle and cheek minutely speckled; an orange stripe above opercle; lower parts of head mostly orange; dorsal with about 5 series of linear blackish, horizontal spots forming interrupted lines; a large roundish dark spot above middle of fin or membrane between each pair of rays; many round brown spots between these and above them; caudal with a narrow black margin; dorsal and caudal fins of females olivaceous, with indistinct narrow cross bands formed by a series of small dark dots or rays. Length about 3 inches.

The male of this species with his highly colored dorsal fin is a fish of remarkable beauty.

63. *Xiphophorus* Heckel.

Xiphophorus Heckel, Sitzgsber. Akad. Wiss. Wien, 1848, 1, pt. 3, 163. (Type, *Xiphophorus helleri* Heckel.)

Body elongate, not much compressed; dorsal fin in advance of the anal in females; teeth in two series, the outer enlarged, loose; the lower rays of the caudal fin of the male produced into a long, sword-shaped filament; anal fin of male placed forward and modified into an intromittent organ; alimentary canal in about four coils on right side, its length about twice that of the fish; vertebræ 16 + 14 = 30.

KEY TO THE SPECIES OF XIPHOPHORUS.

	PAGE
a. Anal fin long, with 8 or 9 rays; edges of scales on upper part of body not especially dark, very faint.	
b. Body slender, its depth $3\frac{1}{3}$; least depth of caudal peduncle $2\frac{1}{2}$ in head.....	<i>jalapæ</i> 156
bb. Body more robust, its depth $3\frac{1}{2}$ to 3; least depth of caudal peduncle $2\frac{1}{2}$ in head.....	<i>helleri</i> 157
aa. Anal fin short, with 7 rays; edges of scales on upper part of body very dark, making their outlines very distinct.....	<i>montezumæ</i> 158

148. *Xiphophorus jalapæ* Meek.

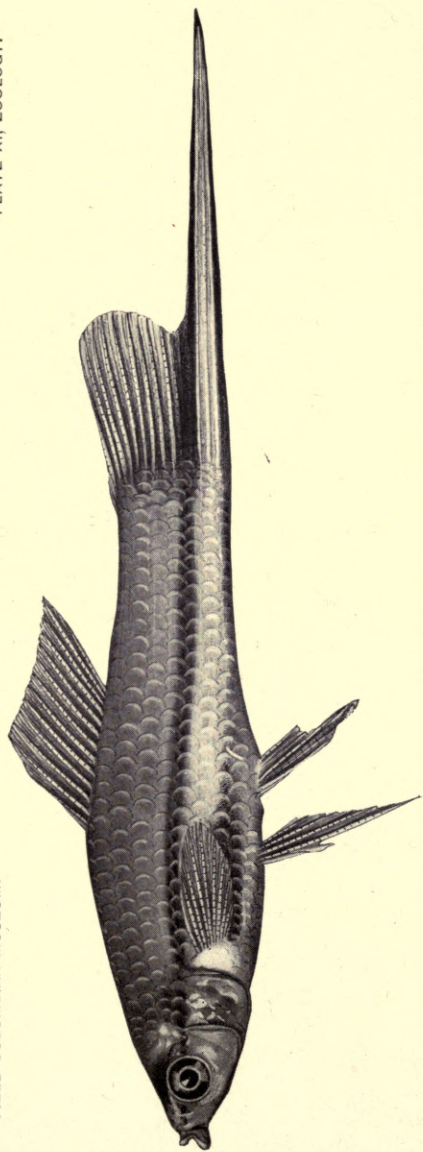
Xiphophorus jalapæ Meek, Field Col. Mus. Pub. 65, 1902, 107; Jalapa.

Streams of Central Vera Cruz, at an altitude of about 5,000 feet. (Jalapa).

Head 4; depth $3\frac{1}{3}$; D. 13; A. 9; scales 8-28. Body elongate, not very robust, but with a deep caudal peduncle; head flattish, depressed forward, being wedge-shaped; interorbital broad, convex, 2 in head; mouth rather small, lower jaw the longer; outer series of

FIELD COLUMBIAN MUSEUM.

PLATE XI, ZOOLOGY.



XIPHOPHORUS JALAPÆ Meek.
No. 3724, Field Columbian Museum.

teeth pointed and loose, followed by a band of smaller conical pointed teeth, eye large, 3 in head; origin of dorsal fin well in advance of the anal, midway between base of caudal fin and middle of snout; base of dorsal $1\frac{1}{2}$ in head; longest dorsal ray $1\frac{4}{5}$ (♀) to $1\frac{2}{3}$ (♂) in head; pectoral $1\frac{1}{2}$ in head; ventrals $1\frac{3}{4}$; caudal sub-truncate; caudal appendage of male pointed, its length $1\frac{2}{3}$ in the length of the body; caudal peduncle slender, its least depth $2\frac{1}{2}$ in head; modified anal of the male short and thick, its length $1\frac{1}{4}$ in head, a notch on under side near its tip.

Color of female olive brown above, nearly plain white below, a narrow lateral band passing around snout on upper half of the body; each scale with a dark center, giving faint brownish lines on the sides; dorsal fin with two rows of black spots near the base; other fins plain; color of male similar to that of the female, except the dark lateral band extending on caudal fin and forming the upper black margin of caudal appendage; a second lateral band from lower angle of pectoral to origin of the anal fin, and a dark streak on ventral surface of caudal peduncle, forming the lower black margin of caudal appendage; in life the middle of the caudal appendage and the lighter portion of lower half of the body is a bright yellow; dorsal fin of both sexes spotted. Length about 4 inches.

This species is smaller than *X. helleri*; it is more slender and the male has the second lateral band from angle of pectoral to origin of the anal fin. Known only from the type locality, where it is abundant.

149. *Xiphophorus helleri* Heckel.

Xiphophorus helleri Heckel, Sitz. Akad. Wiss. Wen, 1898, 163; Rio Chisoy; Cordoba: Günther, Fishes Cent. Amer., 485, pl. 87, figs. 2-6, 1869; Rio Chisoy: Garman, Memoirs Mus. Comp. Zool., 1895, 68, pl. iv, fig. 14, teeth, pl. viii, fig. 4; Mexico and Central America: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 701.

Xiphophorus helleri Var. g Günther, Cat., vi, 350, 1866; Rio Chisoy, Guatemala.

Xiphophorus guntheri Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 702.

Lowland streams of southern Mexico and Guatemala, which empty into the Gulf of Mexico. (Cordoba; Otopa; Motzorongo; Refugio; El Hule; Obispo; Sanborn.)

Head $4\frac{1}{5}$ to $4\frac{2}{5}$; depth 3 to $3\frac{1}{5}$; D. 12 or 13; A. 8 or 9; scales 9-30. Body elongate, compressed; head small; interorbital slightly convex, $1\frac{1}{2}$ in head; snout $3\frac{1}{2}$ in head; eye $3\frac{1}{3}$ in head; origin of dorsal fin slightly nearer tip of snout than base of caudal, about $\frac{1}{3}$

of the fin in advance of origin of anal; pectoral fin $1\frac{1}{6}$ in head; ventrals (♂) 1 to (♀) $1\frac{1}{2}$ in head; modified anal fin of male with a hook near its tip, the length of the fin $1\frac{1}{6}$ in head; caudal appendage pointed, $1\frac{1}{6}$ to 2 in body; caudal peduncle deep, much compressed, least depth $1\frac{1}{3}$ in head.

Color light brown, lighter below; the lower half of the body in life a bright yellow, which extends to the tip of the caudal filament. The caudal filament is bordered above and below with black; a dark lateral band from snout to upper third of caudal fin forming the black on the upper part of the caudal filament; some specimens with from 2 to 4 vertical bars on the side near the tip of the pectoral fin; dorsal fin in both sexes much spotted with black. Length about 5 inches.

Some of these fishes have large black blotches on sides and on fins, which appear like large ink stains. This peculiar blotching forms the basis of the description of the nominal species of *Xiphophorus guntheri* Jordan & Evermann.

Eggs of females taken the last week of April have the eye spots and the outline of the body formed.

150. *Xiphophorus montezumæ* Jordan & Snyder.

Xiphophorus montezumæ Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 131, fig. 11; Rio Verde, near Rascon, San Luis Potosi:

Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3156.

Basin of the Rio Panuco. (Rascon.)

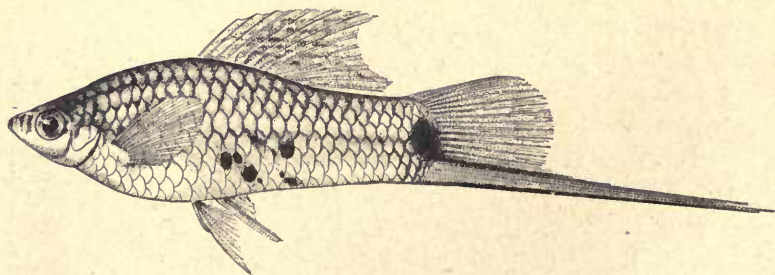


FIG. 50. *XIPHOPHORUS MONTEZUMÆ* Jordan & Snyder.
No. 6145, Leland Stanford Jr. University.

Head 4 to $4\frac{1}{4}$; depth 3 to $3\frac{1}{3}$; D. 11 to 13; A. 7; scales 9-27 to 29. Body robust, deep, compressed, dorsal region somewhat elevated; head broad; interorbital space slightly convex, 2 in head; snout $3\frac{1}{2}$; eye 3; origin of dorsal midway between tip of snout and base of caudal; pectoral (♂) equaling length of head to (♀) $1\frac{1}{6}$ in its length; origin of anal fin under middle of dorsal; caudal appendage pointed, its length almost equal to length of body.

Color yellowish olive; a rather faint lateral band extending from snout to upper third of caudal fin, above this a light band; the scales on upper fourth of body with dark edges, forming stripes along the rows of scales; specimens occasionally with a dark caudal spot, and some have a few dark blotches on the side; caudal appendage bordered above and below with black; dorsal fin with black spots, the other fins plain. Length about $2\frac{3}{4}$ inches.

Females taken May 6th with developed eggs. One specimen 1.74 inches in length contained 16 eggs.

Order IX. **Synentognathi.**

Lower pharyngeal bones fully united; ventral fins abdominal, without spine; no mesacorocoid; lateral line concurrent with the belly, peculiar in structure; air bladder without duct in the adult; vertebræ numerous, the abdominal ones much more numerous than the caudal.

Family XII. **Belonidae.**

THE NEEDLE FISHES.

Body elongate, very slender, little compressed, covered with small thin scales; both jaws produced in a beak, the lower the longer, very much so in the young; each jaw with a band of small sharp teeth; no finlets; dorsal and anal fins opposite each other; air bladder present; pectoral fins on axis of body; vertebræ numerous.

This family comprises a group of voracious carnivorous fishes which bear considerable resemblance in form to the Garpikes. They are found in all warm seas, a few species entering fresh water.

64. **Tylosurus Cocco.**

Tylosurus Cocco, "Lettere in Giornale Sci. Sicilia, xvii," 18, 1829.
(Type, *Tylosurus cantrainii* Cocco.)

Body elongate, very slender, not much compressed; both jaws prolonged into a beak; each jaw armed with a band of small, sharp teeth, besides which is a series of longer, wide-set, sharp, conical, unequal teeth; no teeth on vomer or palatines; lateral line running along the side of the belly, becoming median on caudal peduncle; ventral fins small, inserted behind the middle of the body; caudal fin lunate or forked.

Species numerous, chiefly American, the following one entering the eastern rivers of Mexico south of Vera Cruz.

151. **Tylosurus marinus** (Walbaum). GAR FISH; NEEDLE FISH.

Esox marinus Walbaum, *Artedi Piscium*, iii, 88, 1792 (after the Sea Snipe of Schöpfung); Long Island.

Belone truncata Günther, *Cat.*, vi, 244, 1866.

Tylosurus marinus Jordan & Evermann, *Bull.* 47, U. S. Nat. Mus., 1896, 714.

Very abundant on our Atlantic coast from Cape Cod to Yucatan; often ascending rivers far above tide water. (San Francisco; Perez.)

Head 3; depth about 18; D. 14; A. 15; scales about 300. Body slender, not compressed; snout $4\frac{2}{3}$; interorbital slightly concave, its width $2\frac{1}{2}$ in posterior part of head; upper jaw from center of eye twice the length of the rest of the head; lateral line passing into a slight keel; caudal peduncle depressed.

Color greenish, sides silvery; a dark silvery lateral band; a dark bar on anterior part of opercle. Length about 4 feet. A very good food fish.

Order X. **Lophobranchii.**

THE LOPHOBRANCHS.

Body elongate, covered with bony plates, which are firmly connected forming a carapace; gills tufted, composed of small, rounded lobes attached to the gill arches; gill openings small; snout produced, bearing the small, toothless mouth at its end; pectoral fins elevated; ventrals wanting. An interesting group of small fishes found in warm seas.

Family XIII. **Syngnathidæ.**

THE PIPE FISHES.

Body elongate, usually slender, covered with bony plates, which are firmly connected; head slender, the snout long, tube-like, bearing the short, toothless jaws at the end; gill openings small; tail long, provided with a small caudal fin; males with an egg pouch usually placed on the underside of the tail, sometimes on the abdomen; dorsal fin single, nearly median, of soft rays only; pectorals small or wanting; ventrals none; anal fin small.

The egg pouch of the male is formed of two folds of skin which meet on the median line of the ventral surface. The eggs are received into this pouch and retained until sometime after hatching, when the pouch opens and the young fishes escape. Very few species of this family are found in fresh water.

65. **Siphostoma** Rafinesque.

Siphostoma Rafinesque, Caratteri Nuovi Generi, 18, 1810. (Type, *Syngnathus pelagicus* Osbeck.)

Body elongate, very slender, 6 or 7 angled, not compressed, tapering into a very long tail; the dorsal keels of the trunk not continuous with those of the tail; snout long and slender; jaws short and toothless; caudal fin present, small; pectorals present, short and broad; ventrals none; anal small; the females deeper than the males, with a more robust trunk and a more distinct ventral keel.

KEY TO THE SPECIES OF SIPHOSTOMA.

- | | | |
|-----|---|------|
| a. | Tail shorter than the body; body rings 19 + 24; | PAGE |
| | dorsal rays 44..... <i>brevicauda</i> | 163 |
| aa. | Tail twice as long as the body; body rings | |
| | 14 + 37 or 38; dorsal rays 38..... <i>starksi</i> | 163 |

152. *Siphostoma brevicaudum* sp. nov. PIPE FISH.

Type, No. 4586, F. C. M., 5.9 inches in length; Boca del Rio, Vera Cruz.

Head $5\frac{1}{2}$; depth 23; D. 44, on $2 + 7$ rings; body rings 18 or $19 + 24$. Body rather robust; snout slender, with a low median and two lateral keels on upper surface and a deep groove on under side; distance from gill opening to anterior margin of the orbit $1\frac{1}{2}$ in the snout; diameter of eye 2 in postorbital part of head; a prominent ridge across middle of opercle; body with 7 keels, those on middle of sides reaching the dorsal keels below just back of vent; a second short lateral keel begins opposite origin of dorsal fin, meeting the one above it opposite posterior end of dorsal fin; base of dorsal fin equals distance from tip of snout to posterior margin of orbit; shields without spines; body longer than the tail; total length 5.9 inches; length of tail 2.5 inches.

Color olive brown, head darker; two rows of black spots of four each on under side of snout. Length about 6 inches.

Three specimens of this species were taken in brackish water at Boca del Rio.

153. *Siphostoma starksi* Jordan & Culver.

Siphostoma starksi Jordan & Culver, Proc. Cal. Acad. Sci., 1895, 416, pl. xxx; Rio Presidio, Presidio: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 771; Rutter, Proc. Cal. Acad. Sci., 1896, 263; San Jose del Cabo, Lower California.

Pacific coast streams, Rio Presidio to Rio San Geronimo. (San Geronimo.)

Head $10\frac{1}{2}$; depth 21; D. 38, on $0 + 10$ or 11 rings; body rings $14 + 37$ or 38. Body rather stout; head scarcely carinate above; snout very short, with a slight, smooth keel; no keel on opercle; belly slightly keeled; two lateral keels on body confluent into one behind; tail twice as long as the body.

Color dark olive, much mottled with darker, but without distinct markings; belly yellowish. Length about 6 inches.

A small species entering fresh waters. One specimen taken by me at San Geronimo is 4.2 inches in length.

FIG. 51. SIPHOSTOMA BREVICAUDUM Meek.



Order XI. **Acanthopteri.**

THE SPINY-RAYED FISHES.

Anterior vertebræ unmodified; one or more fins, with spines; ventral fins usually placed anterior, normally attached to the pelvis and typically with one spine and five soft rays, sometimes fewer or wanting, sometimes without spine or with many rays, or otherwise modified; gill openings normal, large; scales usually ctenoid.

KEY TO THE FAMILIES OF ACANTHOPTERI.

- | | PAGE |
|---|-------------------------|
| a. Eyes symmetrical, one or more fins with spines; dorsal fin short, its combined spines and rays less than 30. | |
| b. Lateral line present; ventral fins not close together, the outer rays the longer. | |
| c. Dorsal fins 2, well separated, the first of 3 to 8 spines; no well developed lateral line; some scales often with rudimentary mucus tubes. | |
| d. Anal fin with one weak spine; dorsal spines 3 to 8, flexible; stomach not gizzard-like; alimentary canal short; species carnivorous. | <i>Atherinidæ</i> 165 |
| dd. Anal spines 2 or 3; dorsal with 4 stiff spines, the last one being much shorter than the others; stomach gizzard-like; alimentary canal long. | <i>Mugilidæ</i> 185 |
| cc. Dorsal fin single, or, if 2 fins, the spinous slightly separated from the soft portion; lateral line more or less developed. | |
| e. Lateral line not interrupted; nostrils 2 on each side. | |
| f. Maxillary not sheathed by the preorbital, or only partially covered by its edge; ventral with its accessory scale very small, or wanting. | |
| g. Anal spines 3 to 9; dorsal fins confluent; body usually much compressed. | <i>Centrarchidæ</i> 189 |
| gg. Anal spines 1 or 2; dorsal fins 2, slightly separate; body but slightly compressed. | <i>Percidæ</i> 196 |
| ff. Maxillary slipping for most of its length under the edge of the preorbital, which | |

forms a more or less distinct sheath; ventral with an accessory scale; lateral line usually extending on the caudal fin.	PAGE
h. Anal spines 3, the second long and very strong.	
i. Vomer and palatines with teeth; pre- opercle with 2 margins, the posterior one strongly toothed.....	<i>Centropomidæ</i> 198
ii. Vomer and palatines without teeth; pre- opercle with single margin.....	<i>Hæmulidæ</i> 199
hh. Anal spines 2; lateral line extending on the caudal fin.....	<i>Sciænidæ</i> 202
ee. Lateral line interrupted, usually ceasing opposite the posterior part of the dorsal, and then recommencing lower down on the caudal peduncle; anal fin with 3 or more spines; dorsal fin single, the spinous portion usually longer than the soft por- tion.....	<i>Cichlidæ</i> 204
bb. No lateral line; ventral fins close together, separate, or fully united, the inner rays the longer.....	<i>Gobiidæ</i> 225
aa. Eyes unsymmetrical, both on same side of the head; fins without spines; dorsal fin very long, of more than 40 rays.....	<i>Soleidæ</i> 234

Family XIV. **Atherinidæ.**

Body elongate, somewhat compressed, covered with scales of moderate or small size, and usually cycloid; no lateral lines; some scales often with rudimentary mucus tubes; mouth moderate, terminal; premaxillary usually protractile; opercle without spines or serrations; gill openings wide, the membranes not connected; free from the isthmus; gills 4, a slit behind the fourth; pseudobranchiæ present; dorsal fins 2, well separated, the first of 3 to 8 slender flexible spines, the second of soft rays; ventral fins small, abdominal, of one spine and 5 soft rays: pectorals inserted high; air bladder present; no pyloric cœca.

KEY TO THE GENERA OF ATHERINIDÆ.

- a. Belly before ventrals not compressed to an edge; pectoral fin equal to or shorter than the head.

b.	Origin of spinous dorsal in front of origin of the anal fin; base of the anal usually shorter than head.....	<i>Chirostoma</i>	166
bb.	Origin of spinous dorsal over or behind origin of anal fin.		
c.	Scales cycloid; iris silvery.....	<i>Menidia</i>	181
cc.	Scales with crenate edges; iris black.....	<i>Melaniris</i>	183
aa.	Belly before ventrals compressed to an edge; pectoral fin much longer than head.....	<i>Thyrina</i>	184

66. *Chirostoma* Swainson.

Chirostoma Swainson, Class'n. Fishes, etc., 243, 1839. (Type, *Atherina humboldtiana* Cuv. & Val.)

Atherinoides Bleeker, Verhand. Batav. Gen., Japan, xxv, 40, 1853. (Type, *Atherina vomerina* Cuv. & Val. = *Atherina humboldtiana* Cuv. & Val.)

Atherinichthys Bleeker, l. c., 40. (Type, *Atherina humboldtiana* Cuv. & Val.)

Heterognathus Girard, Proc. Acad. Nat. Sci. Phila., 1854, 198. (Type, *Atherina humboldtiana* Cuv. & Val.)

Lethostole Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 792. (Type, *Chirostoma estor* Jordan.)

Eslopsarum Jordan & Evermann, Check-list Fishes, 330, 1896. (Type, *Chirostoma jordani* Woolman.)

Body elongate, slightly compressed; mouth more or less oblique, terminal; the upper jaw curved near its middle; premaxillaries very protractile; spinous dorsal near middle of the body, in advance of origin of anal fin; gill rakers rather long and slender, 14 to 27 on first gill arch; peritoneum black; alimentary canal short, shorter than total length of the body; vertebræ 36 to 44.

KEY TO THE SPECIES OF CHIROSTOMA.

a.	Scales large, less than 45 in the lateral series; edges of scales entire (occasionally crenate in bartoni); vertebræ usually less than 40; species of small size.		
b.	Mouth small, very oblique; snout short, 4 in length of head; base of anal equal to or slightly longer than head; anal rays 16 to 18; teeth very minute; scales with entire edges, 37 or 38 in the lateral series.....	<i>jordani</i>	169
bb.	Mouth larger, less oblique; snout longer, $2\frac{1}{2}$ to $3\frac{2}{3}$ in head.		

- c. Base of anal much longer than head, its ray 19 to 21; scales 40; origin of spinous dorsal nearer tip of snout than base of caudal fin *mezquital* 170
- cc. Base of anal equal to or shorter than head.
- d. Origin of spinous dorsal over tips of ventrals, midway between base of caudal and nostril.
- e. Body robust, its depth $4\frac{1}{2}$ in the length of the body; base of anal $1\frac{1}{2}$ in the head, its rays 16 or 17; scales 11-38 to 40; teeth large, sharp, in two definite rows in each jaw; gill rakers long and slender, $3+11$ to 14 on first arch *arge* 171
- ee. Body slender, its depth 6 in the length of the body; scales 10-42; anal rays 15; gill rakers long and slender, $4+17$ on the first arch *bartoni* 172
- dd. Origin of spinous dorsal over middle of ventrals, being nearer tip of snout than base of caudal by a distance equal to the diameter of the eye; base of anal $1\frac{2}{3}$ in the head, its rays 13 or 14; gill rakers $4+18=22$; teeth very small. *attenuatum* 172
- ddd. Origin of spinous dorsal over space between tips of ventrals and origin of anal fin, midway between base of caudal and posterior margin of orbit; base of anal fin equaling length of the head, its rays 20; teeth large, in a single row, except near tip of upper jaw; few anterior teeth large, canine-like scales 12-42; gill rakers $4+13$ *labarca* 173
- aa. Scales smaller, more than 45 in the lateral series; edges of the scales usually crenate; vertebræ more than 40.
- f. Scales entire; base of anal about $1\frac{2}{3}$ in length of head, its rays 13 to 19; snout 3 to $3\frac{1}{4}$ in length of head.
- g. Origin of spinous dorsal nearer tip of snout than base of caudal fin.
- h. Anal rays 17; gill rakers $4+21=25$; scales 12-48; body light, translucent, slightly compressed; depth $5\frac{1}{4}$; origin of spinous

dorsal slightly nearer tip of snout than base of caudal.....	<i>patzcuaro</i>	PAGE 174
hh. Anal rays 13 or 14; gill rakers 4 + 17 = 21; scales 54-12; body dark, opaque, scarcely compressed; depth $6\frac{1}{3}$; origin of spinous dorsal nearer tip of snout than base of caudal by a distance greater than diameter of eye.....	<i>zirahuén</i>	174
gg. Origin of spinous dorsal midway between base of caudal fin and anterior margin of orbit, or nostril; anal rays 17 to 19; scales 15-54; gill rakers 4 + 15 = 19; species of large size	<i>humboldtianum</i>	175
ff. Scales with crenate edges; origin of spinous dorsal nearer base of caudal than tip of the snout; anal rays 18 to 24.		
i. Snout short, $3\frac{1}{4}$ in length of the head, being equal to or shorter than the diameter of the eye; species of small size.		
j. Scales in lateral series 49, transverse 13; anal base equals the length of the head, its rays 21	<i>chapalæ</i>	176
jj. Scales in the lateral series 62, transverse 14; base of anal fin $1\frac{1}{4}$ in the length of the head, its rays 19	<i>grandocule</i>	176
ii. Snout long, $2\frac{1}{2}$ to $2\frac{2}{3}$ in the length of the head; diameter of eye $4\frac{1}{2}$ to $5\frac{3}{4}$ in head; species of large size.		
l. Upper jaw decidedly longer than the lower, mandible $2\frac{1}{2}$ in the head; tip of snout black; base of anal fin $1\frac{1}{2}$ in the head, its rays 19 or 20; scales 15-53 to 56; teeth large, not in definite rows; snout $2\frac{1}{2}$ in head; diameter of eye $5\frac{2}{3}$; gill rakers 5 + 19.....	<i>promelas</i>	177
ll. Lower jaw decidedly longer than the upper; mandible $1\frac{4}{5}$ to $2\frac{1}{5}$ in the head; tip of jaws not black (dusky in some specimens).		
m. Scales between dorsal fins very small, more than 20 in a series between the fins; scales 22-60 to 70; gill rakers ? + 23; teeth large anteriorly, canine-like, not arranged in definite rows; mandible 2 in head	<i>sphyræna</i>	177

- mm. Scales in the region of dorsal fins larger, less than 15 in a series between the two fins.
- n. Scales in the lateral series 54 to 60.
- o. Lower jaw projecting but little beyond the upper, mandible about $2\frac{1}{3}$ in head.
- p. Teeth weak, in patches, not arranged in definite rows; gill rakers $4+23$; scales 18-56 to 60; mandible $2\frac{1}{3}$ in head.....*lucius* 178
- pp. Teeth large and strong, in two definite rows, the larger teeth on inner row of upper jaw and outer row on lower; mandible $2\frac{1}{3}$ in head; gill rakers $5+20$; scales 20-58.....*lermæ* 179
- oo. Lower jaw projecting much beyond the upper; mandible $1\frac{2}{3}$ in the head; teeth on jaws small, in bands; scales 19-54 to 57; gill rakers $5+20$; base of anal fin $1\frac{1}{2}$ in head, its rays 20.....*ocotlanæ* 180
- nn. Scales in the lateral series 70, transverse 18; teeth on jaws large and numerous, not arranged in definite rows; usually 1 to 3 large teeth on vomer; base of anal $1\frac{1}{2}$ in head, its rays 18 to 19.....*estor* 180

Subgenus *Eslopsarum* Jordan.154. *Chirostoma jordani* Woolman.

Chirostoma brasiliensis Jordan, Proc. U. S. Nat. Mus., 1879, 299; Lago de Chapala.

Chirostoma jordani Woolman, Bull. U. S. Fish Comm., 1894, 62; Rio Lerma, Salamanca, Guanajuato, and 64, City of Mexico: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 793; B. A. Bean, Proc. U. S. Nat. Mus., 1898, 540; Lago de Cuitzeo, Michoacan: Meek, Field Col. Mus. Pub. 65, 1902, 112; Chalco; Texcoco; Xochimilco; Aguas Calientes; Lagos; Ocotlan; Acambaro; Huingo.

Atherinichthys brevis Steindachner, Anz. der Kais. Akad. Wiss., Wien, 1894, 149; Lago de Cuitzeo, Michoacan.

Eslopsarum jordani Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 133; Rio Verde, Aguas Calientes: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 3157; Evermann & Goldsborough, Bull. U. S. Fish Comm., 1900; Yautepec, Morelos; these

specimens were gotten in the markets, having been sent there from the Lerma basin.

Basin of the Rio Lerma and the Valley of Mexico. (Viga Canal.)

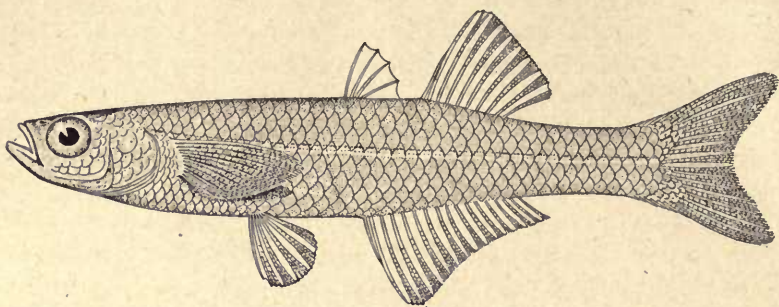


FIG. 52. *CHIROSTOMA JORDANI* Woolman.
No. 45572, U. S. National Museum.

Head $3\frac{3}{8}$; depth $4\frac{1}{3}$; D. IV, 8 or 9; A. 16 to 18; scales 37 or 38. Body elongate, moderately compressed; snout short, its length 4 in head; mouth small, very oblique, the maxillary scarcely reaching anterior margin of the eye; teeth minute; diameter of eye $3\frac{1}{2}$ in the head; origin of spinous dorsal midway between base of caudal and anterior margin of the orbit; anal fin long, its base slightly longer than head; scales with entire edges; pectoral fin $1\frac{1}{2}$ in the head; ventral $1\frac{5}{8}$; scales at the nape not much reduced in size.

Color light olivaceous; a narrow blue stripe on sides; edges of scales on upper half of body with black dots. Length about $2\frac{1}{2}$ inches.

This species is smaller, more abundant, and more widely distributed than any other member of the genus. It, with the other small species and the young of the larger ones, is dried and shipped in large quantities to the larger cities, where it is used for food.

155. *Chirostoma mezquital* sp. nov.

Type, No. 4389, F. C. M., $2\frac{3}{4}$ inches in length; Durango, Durango.

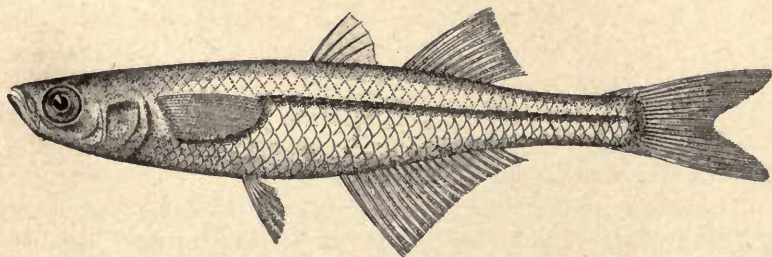


FIG. 53. *CHIROSTOMA MEZQUITAL* Meek.

Head $4\frac{1}{3}$; depth $5\frac{1}{3}$; D. iv-10; A. 19; scales 11-40 to 42. Body elongate, not much compressed; snout short, its length $3\frac{1}{2}$ in head; mouth small, quite oblique; maxillary scarcely reaching vertical from front of eye; jaws equal; teeth small, in one series in each jaw; eye large, 3 in head; interorbital 3 in head; origin of spinous dorsal over middle of ventrals, about a distance equal to diameter of eye nearer tip of snout than base of caudal; anal fin long, its base nearly one-half longer than head; scales with entire edges; pectoral $1\frac{1}{2}$ in head; ventrals $1\frac{2}{3}$; a few scales at the nape reduced in size.

Color light olivaceous, a narrow blue strip on the side; edges of scales on upper half of body with black dots; very few dark dots on scales on lower half, except near base of anal fin. Length about 3 inches.

This species is more nearly related to the preceding than to any other; it is more slender, and the spinous dorsal has a more forward position. At present it is the only member of the genus in Mexico known outside of the Lerma basin. A few specimens were taken from the Rio Mezquital near Durango.

156. *Chirostoma arge* (Jordan & Snyder).

Eslopsarum arge Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 113, fig. 12; Rio Verde, Aguas Calientes: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3158.

Chirostoma arge Meek, Field Col. Mus. Pub. 65, 1902, 112; Aguas Calientes; Lagos.

Basin of the Rio Lerma.

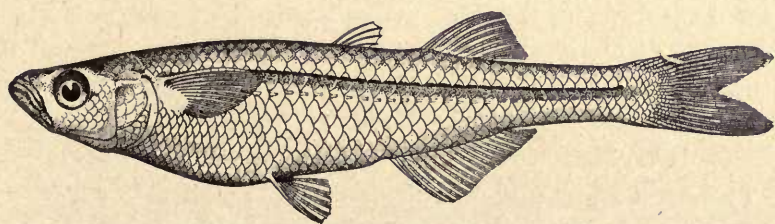


FIG. 54. *CHIROSTOMA ARGE* (Jordan & Snyder).
No. 6154, Leland Stanford Jr. University.

Head $4\frac{1}{4}$; depth $4\frac{1}{3}$; D. iv-8; A. 16 or 17; scales 11-38 to 41. Body rather robust, deepest part just anterior to base of ventrals; mouth rather large, oblique; lower jaw projecting slightly beyond the upper; snout pointed, its length 3 in head; teeth large, sharp, in two definite rows on each jaw, none on vomer or palatines; maxillary reaching vertical from anterior margin of the orbit; diameter of eye $2\frac{2}{3}$.

in head; origin of spinous dorsal midway between base of caudal and nostril; pectoral $1\frac{1}{2}$ in head; ventral $2\frac{3}{8}$; anal fin moderate, its base $1\frac{1}{8}$ in the head; lateral line represented by a few partly developed pores on fifth row of scales; gill rakers long and slender, 14 on first arch; vertebrae $18+18=36$.

Color silvery; a dark lateral band, not prominent in pectoral region; scales edged with dark dots; snout, top of head, and upper part of eye dusky; dorsal and caudal dusky. Length about $2\frac{3}{4}$ inches.

157. *Chirostoma bartoni* Jordan & Evermann.

Chirostoma humboldtianum Jordan, Proc. U. S. Nat. Mus., 1879, 299 (not of C. & V.); Rio Lerma, near Guanajuato.

Chirostoma bartoni Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 793; Rio Lerma, near Guanajuato: Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 152; Rio Lerma, near Lerma, Mexico: Meek, Field Col. Mus. Pub. 65, 1902, 112; Lerma.

Basin of the Rio Lerma. (Lerma.)

Head 4; depth $5\frac{1}{2}$ to 6; D. IV-10; A. 1, 13 to 15; scales 11-41. Body elongate, moderately compressed, the back rounded; snout pointed, $3\frac{3}{8}$ in head; mouth moderate, oblique, the lower jaw slightly projecting; the mandible $2\frac{3}{16}$ in the head; maxillary $3\frac{1}{8}$; diameter of eye 4 in head; origin of dorsal fin slightly nearer tip of snout than base of caudal; pectorals $1\frac{3}{8}$ in head; ventrals 2; base of anal $1\frac{3}{8}$; scales cycloid or occasionally crenate, a few on nape reduced in size; gill rakers slender, 21 on first gill arch.

Color silvery, with scattered punctulations; a narrow dark lateral band. Length about 4 inches.

A few specimens were taken at the fish hatchery near Lerma. This species was first described from specimens taken in the Rio Lerma near Guanajuato.

158. *Chirostoma attenuatum* Meek.

Chirostoma attenuatum Meek, Field Col. Mus. Pub. 65, 1902, 112; Patzcuaro.

Basin of the Rio Lerma.

Head $4\frac{1}{2}$; depth $5\frac{1}{2}$; D. V-9; A. 13; scales 11-42. Body rather slender, not much compressed; lower jaw slightly the longer; mouth small, oblique; maxillary reaching vertical from front of orbit; teeth very small, numerous in both jaws, those in the upper jaw mostly in two series, in a band in lower jaw; snout pointed, $3\frac{1}{2}$ in the head; mandible 3; interorbital space 3; origin of spinous dorsal over middle of ventrals and nearer tip of snout than base of caudal by a distance

greater than diameter of eye; eye $3\frac{3}{8}$; length of pectoral fin $1\frac{1}{2}$ in head; ventral $2\frac{1}{8}$; base of anal $1\frac{3}{8}$; caudal peduncle long and slender; scales large, with entire edges, those on the nape slightly reduced in size; gill rakers $4+18=22$; vertebrae $23+20=43$.

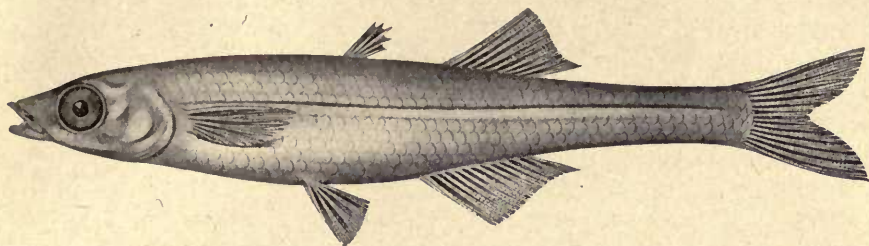


FIG. 55. *CHIROSTOMA ATTENUATUM* Meek.
No. 3631, Field Columbian Museum.

Color light olivaceous, translucent; smallest specimens ($2\frac{3}{4}$ inches in length) darker, more opaque; silvery band on sides narrow, inconspicuous under the pectoral fin, being widest on anterior part of the caudal peduncle. Length about 4 inches.

Common in Lago de Patzcuaro, not taken elsewhere.

159. *Chirostoma labarcæ* Meek.

Chirostoma labarcæ Meek, Field Col. Mus. Pub. 65, 1902, 113; La Barca; La Palma.

Basin of the Rio Lerma.

Head $3\frac{3}{8}$; depth $4\frac{1}{2}$; D. 14-10; A. 20 or 21; scales 11-41. Body slender, compressed; snout rather long, pointed, its length $2\frac{5}{8}$ in head; lower jaw slightly the longer; eye $3\frac{3}{4}$ in head; interorbital 3; mouth moderate, not very oblique, maxillary reaching slightly beyond anterior margin of the eye; length of the mandible $2\frac{1}{2}$ in head; a single series of large teeth in each jaw, a few smaller teeth behind these, a few near tip of jaws large and canine-like; scales large, with edges entire, those on the nape very slightly reduced in size; origin of spinous dorsal over vent, midway between base of caudal and pupil; base of anal fin equals length of head; length of pectoral fin $1\frac{1}{4}$ in head; ventral fins 2 in head; gill rakers $4+13=17$.

Color light olivaceous, translucent; a few dark dots on margins of scales on upper half of body; lateral band narrow, the portion under the edge of the pectoral indistinct and made up of a few dark dots. Length about 4 inches.

Apparently not abundant, known only from a few specimens taken at La Barca and La Palma.

160. *Chirostoma patzcuaro* Meek.

Chirostoma patzcuaro Meek, Field Col. Mus. Pub. 65, 1902, 113;
Patzcuaro.

Basin of the Rio Lerma.

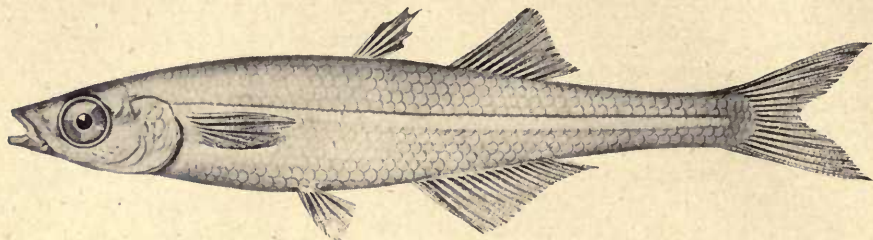


FIG. 56. *CHIROSTOMA PATZCUARO* Meek.
No. 3628, Field Columbian Museum.

Head $4\frac{1}{4}$; depth $5\frac{1}{4}$; D. v-10; A. 17; scales 12-48. Body slender, moderately compressed; mouth oblique; snout short, pointed, its length $3\frac{1}{4}$ in length of head; lower jaw slightly projecting beyond upper mandible, $2\frac{2}{3}$ in head; diameter of eye $3\frac{3}{4}$ in the head; teeth small, numerous, in a narrow band on anterior part of each jaw, becoming laterally, in two series; origin of spinous dorsal slightly nearer tip of snout than base of caudal; base of anal fin $1\frac{1}{4}$ in length of the head; pectoral $1\frac{1}{2}$; ventral $2\frac{1}{4}$; scales moderately large, edges entire, those at the nape slightly reduced in size; gill rakers $4+21=25$.

Color light olivaceous, translucent; lateral band narrow. Length about 4 inches.

This species resembles *Chirostoma chapalæ*, from which it differs in having a less oblique mouth, a shorter anal fin, and a less compressed body. At present it is known only from Lago de Patzcuaro, where it is apparently scarce.

161. *Chirostoma zirahuen* Meek.

Chirostoma zirahuen Meek, Field Col. Mus. Pub. 65, 1902, 114;
Zirahuen.

Basin of the Rio Lerma.

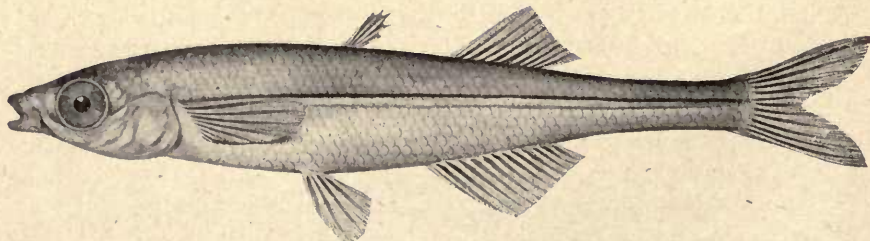


FIG. 57. *CHIROSTOMA ZIRAHUEN* Meek.
No. 3609, Field Columbian Museum.

Head $4\frac{1}{4}$; depth $5\frac{2}{3}$; D. v-10; A. 13; scales 12-54. Body elongate, nearly terete, less compressed than in any other *Chirostoma*; mouth moderately oblique, lower jaw slightly the longer; length of snout equal to diameter of eye, $3\frac{1}{2}$ in length of the head; interorbital broad, 3 in head; teeth very small, in a narrow band in each jaw; origin of the dorsal fin nearer tip of snout than base of caudal by a distance greater than diameter of eye; base of anal fin $1\frac{1}{3}$ in head; pectoral $1\frac{1}{3}$; ventral 2; scales with entire margins; caudal peduncle long and slender; gill rakers $4+17=21$; vertebræ $23+18=41$.

Color dark olivaceous above, lighter below; opaque. This species, characterized by its dark opaque color, its terete body, the backward position of the dorsal fin, and the short anal, is one of the darkest found in the Lerma basin. Length about 4 inches. It is the most abundant species in Lago de Zirahuen.

Subgenus *Chirostoma* Swainson.

162. *Chirostoma humboldtianum* (Cuv. & Val.). PESCADA BLANCA.

Atherina humboldtiana Cuvier & Valenciennes, Hist. Nat. Poiss., x, 479, 1835; lake near City of Mexico.

Atherina vomerina Cuvier & Valenciennes, l. c.; lake near City of Mexico.

Atherinichthys humboldtianus Günther, Cat., III, 404, 1861.

Chirostoma humboldtianum Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 793; Evermann, Proc. Biol. Soc. Washington, 1898, 2; Laguna de Juanacatlan, Jalisco: Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 134; Lago de Chalco: Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 152; La Laguna, Jalisco: Meek, Field Col. Mus. Pub. 65, 1902, 114; Chalco; Xochimilco; Patzcuaro.

Basin of the Rio Lerma and the Valley of Mexico. (Viga Canal; Xochimilco.)

Head $3\frac{3}{4}$; depth $4\frac{3}{4}$ to $5\frac{1}{3}$; D. IV-11 to 13; A. 17 to 20; scales 15-54. Body elongate, rather robust, not much compressed; snout pointed, 3 in head; mouth moderate, lower jaw projecting; mandible $2\frac{2}{3}$ in head; teeth in jaws in bands, the outer slightly enlarged; occasionally 1 to 3 canine teeth on vomer; eye 4 to $4\frac{1}{2}$ in head; origin of spinous dorsal midway between base of caudal and anterior margin of eye or nostril; pectoral $1\frac{2}{3}$; ventral $2\frac{1}{3}$; scales usually cycloid, occasionally more or less crenate; gill rakers long and slender, about 20 on the first gill arch; vertebræ $23+19=42$.

Color brownish olive, sometimes quite translucent; a narrow dark silvery lateral band; specimens from lakes with much vegetation are very dark. Length about 12 inches.

This is one of the largest species in the genus. It is very abundant in the lakes near the City of Mexico, and in this region is the most important food fish. By far the larger number of white fishes (*Pescadas blancas*) offered for sale in the markets of the City of Mexico belong to this species.

163. *Chirostoma chapalæ* Jordan & Snyder.

Chirostoma chapalæ Jordan & Snyder, Bull. U. S. Fish Comm. 1900, 135, fig. 13; Lago de Chapala; Ocotlan, Jalisco: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3159; Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Estado de Jalisco: Meek, Field Col. Mus. Pub. 65, 1902, 115; Ocotlan; La Palma. Basin of the Rio Lerma.

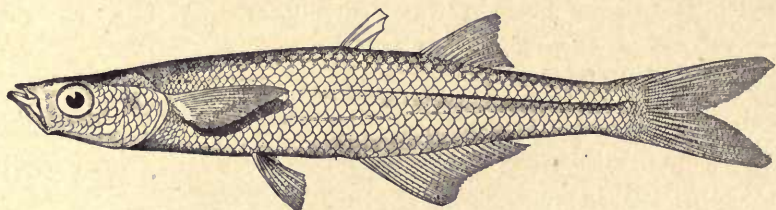


FIG. 58. *CHIROSTOMA CHAPALÆ* Jordan & Snyder.
No. 6155, Leland Stanford Jr. University.

Head 4; depth $5\frac{1}{2}$; D. IV-10; A. 21; scales 13-49. Body slender, compressed, its deepest part below first dorsal; snout pointed, its length 3; mouth oblique, the lower jaw slightly the longer; maxillary not quite reaching vertical from anterior margin of the orbit; teeth minute, in bands, not arranged in definite rows; no teeth on vomer or palatines; diameter of eye $3\frac{2}{3}$ in head; origin of spinous dorsal midway between base of caudal and nostril; pectoral $1\frac{1}{4}$ in head; ventrals $2\frac{1}{3}$; base of anal fins equals the length of the head; lateral line on eighth row of scales, not well defined; scales with crenate edges, the scales on nape and before pectorals reduced in size; the others quite uniform; gill rakers long and slender, 30 on first gill arch; vertebræ $24+20=44$.

Color silvery, translucent; a dark lateral band; scales on dorsal region edged with dark dots. Length about 4 inches.

Very abundant in Lago de Chapala and neighboring region.

164. *Chirostoma grandocule* Steindachner.

Chirostoma grandocule Steindachner, Anzeiger der Kais. Akad. d. Wiss. Wien, 1894, 149; Lago de Patzcuaro, Michoacan: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2839; Meek, Field Col. Mus. Pub. 65, 1902, 115; Ocotlan; La Palma; Patzcuaro.

Basin of the Rio Lerma.

Head $3\frac{5}{8}$; depth $5\frac{1}{4}$; D. v-11; A. 19; scales 14-62. Body elongate, compressed; snout pointed, 3 in head; lower jaw slightly the longer; mandible $2\frac{1}{3}$ in head; mouth rather small, oblique; teeth in jaws in narrow bands, none canine-like; no teeth on vomer or palatines; eye $3\frac{1}{8}$ in head; origin of dorsal fin slightly nearer base of caudal than tip of snout; pectoral $1\frac{1}{2}$ in head; ventral $2\frac{1}{2}$ in head; base of anal $1\frac{1}{4}$; scales small, edges slightly crenate, those in nape and before pectoral fin much reduced; gill rakers slender, about 27 on first gill arch; vertebrae $23+20=43$.

Color light brownish, translucent; a dark silvery lateral band; scales with few dark punctulations. Length about 5 inches.

This is the most abundant member of the genus in Lago de Patzcuaro. It is probably quite widely distributed throughout the Lerma basin.

165. *Chirostoma promelas* Jordan & Snyder.

Chirostoma promelas Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 136, fig. 14; Lago de Chapala (market of Guadalajara): Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3160; Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 182; Lago de Chapala: Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Estado de Jalisco: Meek, Field Col. Mus. Pub. 65, 1902, 115; Ocotlan; La Palma.

Basin of the Rio Lerma.

Head $3\frac{3}{8}$; depth $4\frac{3}{8}$; D. iv-11; A. 19 or 20; scales 15-53 to 56. Body elongate, compressed; head slender, triangular; mouth large, very little oblique; snout pointed, $2\frac{1}{2}$ in the head, upper jaw the longer; maxillary reaching vertical from anterior margin of the orbit; teeth large, not arranged in definite rows, none on vomer or palatines; diameter of eye $5\frac{2}{3}$ in head; origin of spinous dorsal midway between base of caudal and nostril; pectorals $1\frac{2}{3}$ in head; ventrals $2\frac{1}{2}$; base of anal $1\frac{1}{2}$ in head; scales with crenate edges, those on nape and in front of pectorals much reduced in size; gill rakers slender, 24 on first gill arch.

Color silvery, translucent, a distinct dark lateral band; scales on upper part of the body with dusky edges; snout and jaws black. Length about 7 inches.

This is the only member of the group which has the upper jaw decidedly longer than the lower. Only a few specimens known.

Subgenus *Lethostole* Jordan & Evermann.

166. *Chirostoma sphyraena* Boulenger.

Chirostoma sphyraena Boulenger, Ann. & Mag. Nat. Hist., 1900, 55; Lago de Chapala: Meek, Field Col. Mus. Pub. 65, 1902, 116.

Chirostoma diazi Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 137, fig. 15; Lago de Chapala (Guadalajara market): Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3161.
Basin of the Rio Lerma.

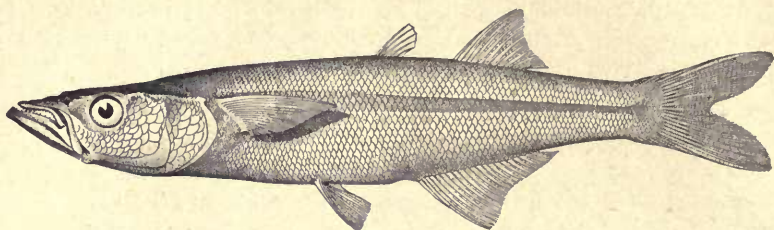


FIG. 59. *CHIROSTOMA SPHYRÆNA* Boulenger.
No. 6157 (*Chirostoma diazi* J. & S.), Leland Stanford Jr. University.

Head $3\frac{1}{3}$; depth 5; D. v-11; A. 20; scales 20-63 to 70. Body elongate, moderately compressed; head large; upper jaw the longer; snout $2\frac{1}{2}$ in head; mouth large; teeth large anteriorly, growing gradually smaller posteriorly, some canine-like, not arranged in definite rows, no teeth on vomer or palatines; origin of spinous dorsal midway between base of caudal and eye; scales crenate, those on the dorsal region very small, about 20 in a series between the dorsal fins; base of anal $1\frac{2}{3}$ in head.

Color light silvery, translucent; a narrow dark silvery lateral band. Length about 8 inches.

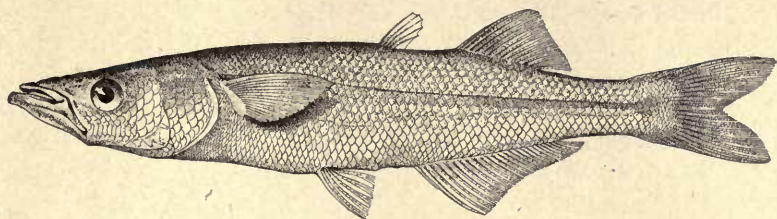
The small scales between the dorsal fins easily distinguishes this species from those most nearly related to it.

167. *Chirostoma lucius* Boulenger.

Chirostoma lucius Boulenger, Ann. & Mag. Nat. Hist., 1900, 54; Lago de Chapala: Meek, Field Col. Mus. Pub. 65, 1902, 15; La Barca; Ocotlan; La Palma: Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 152; Lago de Chapala, Guadalajara market.

Chirostoma crystallinum Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 139, figs. 16 and 17; Lago de Chapala, and Guadalajara: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3162.
Basin of the Rio Lerma.

Head $3\frac{1}{4}$; depth $4\frac{3}{8}$; D. v-13; A. 23 or 24; scales 17-56. Body elongate, compressed; head pointed; snout $2\frac{3}{8}$; mouth large, the lower jaw projecting; mandible $2\frac{1}{8}$ in head; teeth in bands in each jaw, all small, none canine-like; no teeth on vomer or palatines; eye $5\frac{3}{4}$ in head; origin of spinous dorsal midway between base of caudal and

FIG. 60. *CHIROSTOMA LUCIUS* Boulenger.No. 6159 (*Chirostoma crystallinum* J. & S.), Leland Stanford Jr. University.

anterior margin of orbit; pectoral $1\frac{3}{4}$ in head; ventral $2\frac{3}{4}$; base of anal $1\frac{1}{3}$ in head; scales large, a few at nape and pectoral region reduced, the edges of all slightly crenate; scales between dorsal fins very large; gill rakers long and slender, 27 on first gill arch.

Color light silvery, translucent; a dark lateral silvery band; scales on upper part of body with few dark dots. Length about 10 inches.

Known at present only from Lago de Chapala and its environs.

168. *Chirostoma lermæ* Jordan & Snyder.

Chirostoma lermæ Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 142, fig. 19; Lago de Chapala: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3163; Meek, Field Col. Mus. Pub. 65, 1902, 116; La Palma; Ocotlan.

Basin of the Rio Lerma.

FIG. 61. *CHIROSTOMA LERMÆ* Jordan & Snyder.

No. 6159, Leland Stanford Jr. University.

Head $3\frac{1}{8}$; depth $5\frac{1}{3}$; D. IV or V-10 to 12; A. 19 to 22; scales 18-56. Body elongate, slender, not much compressed; snout long and pointed; mouth large, the lower jaw slightly projecting; mandible $2\frac{1}{3}$ in head; teeth large and strong, in definite rows; the larger teeth on the inner row of the upper jaw and the outer row of the lower; origin of dorsal fin midway between base of caudal fin and eye; pectoral $1\frac{2}{3}$ in head; ventral 3; scales with crenate edges, those in region of nape and pectoral fin much reduced.

Color light silvery, a dark silvery lateral band; few punctulations on scales on dorsal region. Length about 12 inches.

This species is easily recognized on account of its strong dentition. Known only from Lago de Chapala.

169. *Chirostoma ocotlanæ* Jordan & Snyder.

Chirostoma ocotlanæ Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 140, fig. 18; Lago de Chapala, Ocotlan: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3163; Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Estado de Jalisco: Meek, Field Col. Mus. Pub. 65, 1902, 116; Ocotlan; La Palma. Basin of the Rio Lerma.



FIG. 62. *CHIROSTOMA OCOTLANÆ* Jordan & Snyder.
No. 6160, Leland Stanford Jr. University.

Head $3\frac{1}{4}$; depth $4\frac{2}{3}$; D. v-12; A. 20 to 24; scales 17 to 19-54 to 57. Body elongate, somewhat compressed; head broad, profile with slight angle at nape; mouth large, the lower jaw much projecting; mandible $1\frac{1}{3}$ in head; teeth small, in bands in both jaws; no teeth on vomer or palatines; eye $4\frac{1}{3}$ to $4\frac{3}{4}$ in head; origin of dorsal fin midway between base of caudal and anterior margin of the eye; pectorals $1\frac{1}{2}$ in head; ventrals $2\frac{3}{4}$; base of anal fin $1\frac{1}{2}$ in head; scales with crenate edges, those on nape and about base of pectoral fin much reduced in size; gill rakers long and slender, about 25 on first gill arch; vertebræ 44.

Color light silvery, translucent; sides with a narrow dark silvery band; scales on upper part of body with few punctulations. Length about 12 inches.

This species is easily recognized because of its much projecting lower jaw.

170. *Chirostoma estor* Jordan.

Chirostoma estor Jordan, Proc. U. S. Nat. Mus., 1879, 298; Lago de Chapala: Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 141.

Atherinichthys albus Steindachner, Anzeiger de Kais. Akad. Wiss. Wien, 1894, 148; Lago de Patzcuaro, Michoacan.

Lethostole estor Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 792, and 1900, 3165.

Chirostoma album Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3165.

Basin of the Rio Lerma and the Valley of Mexico. (Xochimilco)

Head $3\frac{2}{3}$; depth 5; D. v-12; A. 18 to 20; scales 19-75. Body elongate, compressed; snout rather depressed, its length $2\frac{3}{4}$ in head; mouth large, lower jaw slightly the longer; mandible $2\frac{1}{3}$ in head; teeth in a band, not close set, some slightly enlarged, canine-like; occasionally a few canine-like teeth on vomer; eye 5 to $5\frac{1}{4}$ in head; origin of dorsal fin midway between base of caudal fin and nostril; pectoral $1\frac{1}{2}$ in head, ventral $2\frac{1}{3}$; base of anal fin $1\frac{2}{3}$ in head; scales small, with crenate edges, those on nape and breast much reduced; lateral line represented by a few pores; gill rakers slender, about 26 on first arch; vertebræ $23+20=43$.

Color light brownish, translucent; a dark silvery lateral band; individuals taken in lakes with much vegetation very dark with anterior half of head often black. Length about 12 inches.

Of the larger fishes of this group this one is the most widely distributed. It is one of the most important market fish in the regions where found.

67. *Menidia* Bonaparte.

Menidia Bonaparte, Fauna Italica, about 1836. (No type indicated, *Atherina menidia* Linnæus probably intended.)

Body elongate, more or less compressed; head compressed; belly before ventrals more or less rounded, not compressed to an edge; mouth small, the gape curved, very oblique, the maxillary quite or entirely slipping under preorbital; teeth in jaws in band or in more than one series, none on vomer or palatines; premaxillaries freely protractile; dorsal fins short; first dorsal over or in front of anal fin; no scales on dorsal and anal fins.

A large group of small fishes belonging to salt or brackish water, a few species entering fresh water.

KEY TO THE SPECIES OF MENIDIA.

- | | | | |
|-----|---|---------------|----------|
| a. | Anterior rays of soft dorsal and anal produced, longest anal rays equaling depth of body; pectoral fin as long as head | <i>sallei</i> | PAGE 181 |
| aa. | Anterior rays of soft dorsal and anal scarcely produced, longest anal ray less than depth of body; pectoral fin shorter than length of head | <i>lisa</i> | 182 |

171. *Menidia sallei* (Regan).

Atherinichthys sallei Regan, Proc. Zool. Soc. London, 1903, 60; Mexico.

Distribution not known.

Head 5 (in total); depth less than length of head; D. iv-1, 8; A. 11, 19; scales 10-43. Diameter of eye greater than length of snout, $2\frac{2}{3}$

in head; interorbital width equaling postorbital part of head, $2\frac{2}{3}$ in length of head; lower jaw somewhat shorter than upper; maxillary extending to vertical from anterior margin of eye; origin of spinous dorsal above that of anal; anterior rays of soft dorsal and anal produced, longest anal rays equaling depth of body; pectorals falcate, as long as head; origin of ventrals midway between posterior opercular margin and first anal ray; caudal emarginate.

A sharply defined silvery lateral band as broad as a scale. One specimen 75 mm. in total length from Mexico (Regan).

It is quite probable that this species is a resident of salt water.

172. *Menidia lisa* sp. nov. LISA.

Type, No. 4633. F. C. M., 2.1 inches in length; Refugio, Vera Cruz.

Basin of the Rio Papaloapam. (Refugio; El Hule.)

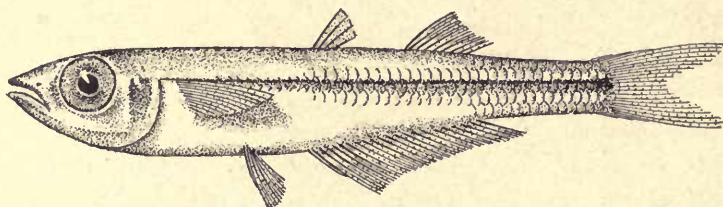


FIG. 63. *MENIDIA LISA* Meek.

Head $3\frac{2}{3}$ to 4; depth $4\frac{1}{2}$ to 5; D. IV or V-I, 8 or 9; A. 1, 19 to 21; scales about 42. Body elongate, compressed, belly rounded; snout pointed, margin of upper lip on level with upper edge of pupil; mouth moderate, very oblique; premaxillary curved, very protractile; teeth in two series in each jaw, the outer series the larger; snout very short, $3\frac{1}{2}$ in head; the maxillary reaching about vertical below pupil; eye large, $2\frac{1}{4}$ in head; origin of dorsal fin midway between base of caudal and anterior margin of eye, over or slightly behind origin of anal; base of anal longer than head, $3\frac{1}{2}$ in body; pectoral high, its length $1\frac{1}{3}$ in head; ventrals 2 in head; scales thin, deciduous, cycloid (on all specimens in our collection there are scales on posterior half of body, on belly, and a band on dorsal region; as the specimens are all scaled alike it is probable a larger part of the anterior part of the body is naked); caudal fin forked; caudal peduncle slender; gill rakers slender, 15 on first gill arch; vertebrae $17+22=39$.

Color light silvery; a narrow dark lateral stripe; spinous dorsal profusely covered with black dots; iris silvery. Length about $2\frac{1}{2}$ inches.

68. *Melaniris* Meek.

Melaniris Meek, Field Col. Mus. Pub. 65, 1892, 117. (Type, *Melaniris balsanus* Meek.)

Body elongate, slender; lower jaw rounded; origin of spinous dorsal fin behind that of the anal; caudal peduncle short; peritoneum black; alimentary canal shorter than total length of the fish; iris black; vertebræ $17+19=36$.

173. *Melaniris balsanus* Meek.

Melaniris balsanus Meek, Field Col. Mus. Pub. 65, 1902, 117; Balsas.

Basin of the Rio Balsas; not taken above the falls and cascades.

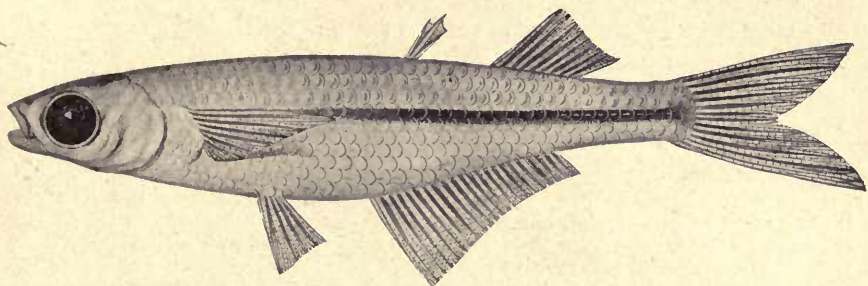


FIG. 64. *MELANIRIS BALSANUS* Meek.
No. 3706, Field Columbian Museum.

Head $4\frac{1}{3}$; depth $5\frac{1}{4}$; D. III-9; A. 21; scales 10-39. Body elongate, slender, not much compressed; snout rounded laterally; mouth small, lower jaw slightly the longer; outer row of teeth large, canine-like, wide apart, behind these a band of small villiform teeth; gill rakers $4+13=17$; vertebræ $17+19=36$; scales large, with entire margins; caudal peduncle very short; dorsal fins posterior; origin of spinous dorsal considerably behind origin of anal fin, and midway between base of caudal fin and posterior margin of opercle; base of anal $\frac{1}{3}$ longer than head, its rays varying from 20 to 23; dorsal spines 2 to 4, usually 3; pectoral fin high on sides of body, its length $1\frac{1}{4}$ in head; ventrals $2\frac{1}{4}$.

Color olivaceous, rather opaque, dorsal region finely punctulate with black; a well defined silvery band on sides. Length about 3 inches.

This species is very abundant in the Rio Cocula and the Rio Balsas at Balsas. It has not been taken elsewhere. It probably spawns in May.

69. *Thyrina* Jordan & Culver.

Thyrina Jordan & Culver, Proc. Cal. Acad. Sci., 1896, 419.
(Type, *Thyrina evermanni* Jordan & Culver.)

Body elongate, compressed, the abdominal region before ventrals compressed into a bluntish edge or keel; pectoral fin falcate, longer than the head; anal fin very long, its origin in advance of spinous dorsal; scales cycloid.

To this genus belong only the two following species:

KEY TO THE SPECIES OF THYRINA.

- | | |
|---|------------------------|
| a. Anal rays about 1, 24; base of anal fin $2\frac{3}{4}$ in body; pectoral $3\frac{1}{2}$ in body; ventral fins pale | PAGE
184 |
| aa. Anal rays about 1, 21; base of anal fin 3 in body; pectoral $4\frac{1}{4}$ in body; ventral fins black | <i>crystallina</i> 184 |

***Thyrina evermanni* Jordan & Culver.**

Thyrina evermanni Jordan & Culver, Proc. Cal. Acad. Sci., 1895, 419;

Mazatlan: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 804.

Brackish water near Mazatlan.

Head $4\frac{3}{4}$; depth $4\frac{1}{2}$ to 5; D. IV-1, 7; A. 1, 23 to 25; scales 9-36. Body elongate, much compressed; the belly sharp-edged, concave on each side below pectorals, the edge almost carinate; back narrow; mouth small, terminal, jaws curved; teeth moderate, those in the upper jaw the longer; snout $3\frac{1}{2}$ in head; eye $2\frac{3}{4}$; origin of spinous dorsal over about 6th anal ray, midway between base of caudal and edge of preopercle; pectoral fin $\frac{1}{4}$ longer than head; anal fin long; its base $2\frac{3}{4}$ in body; gill rakers long and slender, numerous; scales cycloid.

Color light green, much dotted above, translucent below; a dark lateral stripe; no black on dorsal fin. Length about 3 inches.

This species known only from the estuary at Mazatlan, its type locality.

174. *Thyrina crystallina* (Jordan & Culver).

Atherinella crystallina Jordan & Culver, Proc. Cal. Acad. Sci., 1895, 420; Rio Presidio, below Presidio, Sinaloa.

Thyrina crystallina Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1895, 804; Rio Presidio, below Presidio, Sinaloa.

Basin of the Rio Presidio.

Head $4\frac{3}{4}$; depth $4\frac{1}{2}$ to 5; D. IV-1, 8; A. 1, 21; scales 11-40. Body rather deep, compressed, the belly sharp-edged; mouth small, terminal; jaws curved; teeth rather strong, the outer curved, those in the upper jaw the longer; snout $3\frac{1}{4}$ in head; eye $2\frac{3}{4}$; origin of spinous dorsal behind anal, midway between gill opening and base of caudal; base of anal one-half longer than head, 3 in body; pectoral $\frac{1}{2}$ longer than head; gill rakers numerous, long and slender; scales cycloid.

Color translucent green, with considerable dusky dottings; a dark silvery lateral stripe; first dorsal and base of anal dusky. Length $3\frac{1}{4}$ inches.

Known only from the type locality.

Family XV. **Mugilidæ.**

THE MULLET.

Body oblong, more or less compressed, covered with rather large cycloid scales; no lateral line, but the furrows often deepened on the middle of each scale forming lateral streaks; mouth small, the jaws with small teeth or none; premaxillaries protractile; gill rakers long and slender; gills 4, a slit behind the fourth; two dorsal fins well separated, the anterior one of 4 stiff spines, the last one of which is much shorter than the others; air bladder large, simple; alimentary canal long; peritoneum usually black; vertebræ 24.

A large family of fishes inhabiting the coasts of warm seas, a few entering fresh water.

KEY TO THE GENERA OF MUGILIDÆ.

- | | | |
|---|--------------------|----------|
| a. Stomach muscular, gizzard-like; front of lower jaw angular..... | <i>Mugil</i> | PAGE 185 |
| aa. Stomach not gizzard-like; front of lower jaw not angular. | | |
| b. Teeth small, conical, in villiform bands on jaws, vomer and palatines; mouth with lateral cleft, not overhung by the blunt tumid snout. | | |
| c. Anal spines 2..... | <i>Agonostomus</i> | 186 |
| cc. Anal spine single..... | <i>Neomugil</i> | 187 |
| bb. Teeth coarse, broad, truncate, incisors with their free edges serrate; smaller teeth on vomer, none on palatines; mouth small, inferior; lower jaw forming a sharp soft edge..... | <i>Foturus</i> | 188 |

Subfamily **Mugilinæ.****70. Mugil** (Artedi) Linnæus.

Mugil (Artedi) Linnæus, Syst. Nat., Ed. x, 3161, 758. (Type, *Mugil cephalus* Linnæus.)

Body oblong, somewhat compressed, covered with large scales; head large, convex, scales above and on sides; mouth small, subinferior, the lower jaw angulate; jaws with one or a few series of short, flexible, ciliform teeth; no teeth on vomer or palatines; eye large, with an adipose eyelid little developed in the young; stomach muscular, like the gizzard of a fowl.

The species of this group run in large schools along the shores and in brackish lagoons of all warm regions. They feed on organic matter contained in the mud.

175. *Mugil cephalus* Linnæus.

Mugil cephalus Linnæus, Sys. Nat., Ed. x, 316, 1758; Europe:

Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 811.

Tropical and temperate seas of America, southern Europe, and northern Africa. (Tehuantepec.)

Head $3\frac{3}{8}$; depth $3\frac{5}{8}$; D. IV-1, 8; A. III, 8; scales 12-40. Body elongate, compressed; head broad, depressed; interorbital slightly convex, its width $2\frac{1}{2}$ in head; mouth terminal, oblique; jaws about equal; teeth minute; snout rounded laterally; adipose eyelid well developed; diameter of eye about 4 in head; origin of spinous dorsal midway between tip of snout and base of caudal; about 20 scales in a series from tip of snout to origin of spinous dorsal; first dorsal spine $1\frac{3}{4}$ in head; pectoral fin nearly reaching front of dorsal, $1\frac{3}{8}$ in head; ventrals reaching half way to anal fin, $1\frac{3}{4}$ in head; caudal forked; least depth of caudal peduncle $2\frac{1}{2}$ in head.

Color bluish brown above, silvery below; dark stripes along the rows of scales, most prominent on the middle of the sides; fins more or less dusky, with a yellowish tinge on the ventrals, anal, and caudal; a black bar at base of pectorals; soft dorsal and anal fins naked.

A salt-water fish which ascends rivers to a considerable distance above tide-water. One specimen 5 inches in length was taken by me at Tehuantepec.

Subfamily **Agonostominae.**

71. *Agonostomus* Bennet.

Agonostomus Bennet, Proc. Comm. Zool. Soc., 1830, 166. (Type, *Agonostomus telfairii* Bennet.)

Dajaus Cuv. & Val., Hist. Nat. Poiss., XI, 164, 1836. (Type, *Mugil monticola* Bancroft.)

Body elongate, compressed posteriorly; mouth with lateral cleft extending to opposite anterior margin of eye; snout bluntish, lower jaw the shorter, included; edge of lower lip rounded, not sharp as in *Mugil*; stomach not gizzard-like; anal spines 2, the first soft ray slender and spine-like; villiform teeth on jaws, vomer, and palatines in American species. A small group of fishes inhabiting streams of mountainous regions in tropical countries.

Subgenus *Dajaus* Cuvier & Valenciennes.

176. *Agonostomus monticola* (Bancroft). TRUCHA.

Mugil monticola Bancroft, Griff. Anim. King. Fishes, 367, pl. 36, 1836.

Agonostoma monticola Günther, Cat., III, 464, 1861; Mexico: B. A. Bean, Proc. U. S. Nat. Mus., 1898, 540; Santa Maria.

Agonostomus monticola Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 819.

Agonostoma nasutum Günther, Cat., III, 463, 1861; Rio Geronimo.

Agonostomus nasutus Jordan, Proc. Cal. Acad. Sci., 1895, 424; Rio Presidio, Sinaloa: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 819; Rutter, Proc. Cal. Acad. Sci., 1896, 263; San Jose del Cabo, Lower California: Evermann, Proc. Biol. Soc. Wash., 1898, 2; Ixtapa (12 miles above the Bay of Banderas); Maria Magdalena Island, 2,500 feet above tide-water; Maria Cleofa Island, off Jalisco: Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; river below Lago de Chapala, Estado de Jalisco: Meek, Field Col. Mus. Pub. 65, 1902, 118; Balsas; Puente de Ixtla; Cuicatlan.

Fresh waters of the West Indies and the Atlantic and Pacific streams of Mexico and Central America. (Cuautla; Jojutla; Vera Cruz; Otopa; Motzorongo.)

Head $3\frac{1}{5}$ to $4\frac{1}{4}$; depth $4\frac{1}{4}$ to $4\frac{1}{2}$; D. IV-1, 8; A. II, 9; scales 12-42. Body elongate, not much compressed; head rather conical, somewhat decurved in specimens 9 or more inches in length; interorbital convex, its width $2\frac{1}{2}$ in head; snout blunt in large examples, more pointed in the young; lips very thick in adults, thin in young specimens 2 to 4 inches long; maxillary reaching vertical from front of eye, entirely hidden when the mouth is closed; diameter of eye about equal to length of snout, 4 in head; origin of spinous dorsal nearer tip of snout than base of caudal; tip of pectoral reaching nearly to spinous dorsal; soft dorsal over the last $\frac{3}{4}$ of the anal fin, without scales; anal spines weak; pectorals inserted above the axis of the body.

Color brownish above, silvery below; each scale with a darker margin; a silvery band from base of pectoral to caudal fin; very conspicuous on fishes in the water; back and sides with many black or dark colored scales scattered about, making irregular spots; these most abundant on small specimens from Vera Cruz, and least so on specimens from Jojutla.

There seems to be but little difference in the descriptions of *A. monticola* and of *A. nasutus*; the difference is mainly in the thick and thin lips, a character much modified by age. In this paper I regard the specimens from western Mexico ascribed to *A. nasutus* as being the adult of the present species.

72. *Neomugil* Vaillant.

Neomugil Vaillant, Bull. Soc. Philom., IV, 1893-4, 72. (Type, *Neomugil digueti* Vaillant.)

Body elongate, not much compressed; mouth widely cleft; maxillary extending beyond anterior edge of orbit; small teeth in many series in each jaw, the outer series on intermaxillary most developed; teeth on vomer and palatines; stomach siphonal; walls very thin in pyloric region; one large and one small pyloric cœcum; pseudo-branchiæ present.

177. *Neomugil digueti* Vaillant.

Neomugil digueti Vaillant, Bull. Soc. Philom., IV, 1894, 73; torrent in the Sierra de las Cacachilas de Santa Cruz, Lower California: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3165.

An inhabitant of mountain streams of Lower California south of La Paz.

Head 3; depth 4; D. IV-1, 8; A. I, 9; scales 3-43-11. Body elongate, not much compressed; interorbital $2\frac{3}{4}$ in head; eye 6 in head; entire head covered with ctenoid scales; mouth deeply cleft; upper jaw the longer; no adipose eyelid; origin of first dorsal at middle of the body; origin of anal in advance of soft dorsal. Length about 8 inches. (Vaillant.)

73. *Joturus* Poey.

THE BOBOS.

Joturus Poey, Memorias, II, 263, 1861. (Type, *Joturus pichardi* Poey.)

Body elongate, not much compressed; head large, snout blunt and projecting beyond the small, inferior mouth; mouth broad, with little lateral cleft; lower lip very thick, its edges forming a soft sharp-edged fold, its outline very obtuse; teeth coarse, blunt incisors, with serrated edges, arranged in broad patches on jaws and vomer.

178. *Joturus pichardi* Poey. BOBO.

Joturus pichardi Poey, Mem. II, 263, 1861, Cuba.

Agonostoma globiceps Günther, Ann. & Mag. Nat. Hist., 1874, 370; Misantla, Vera Cruz: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 821.

Fresh-water streams of Cuba, and southern Mexico to Panama, in swift currents and mountain torrents.

Head $4\frac{1}{2}$; depth $3\frac{2}{3}$; D. IV-19; A. III, 9; scales 13 or 14, 42 to 45. Body elongate, rather robust, a little compressed behind; head large, gibbous above and anteriorly; snout thick, broad, and blunt, considerably overhanging the small inferior mouth, and entirely below the level of the eye; maxillary reaching posterior margin of the eye, $2\frac{1}{2}$ in head; mouth broad, but without much lateral cleft; lower jaw in-

cluded; upper lip thick, slipping beneath the snout; lower lip very thick, its anterior edge forming a sharp-edged fold; outline of lip very obtuse; no teeth in the palatines; nostrils roundish, close together, in front of the small round eye; eye nearer the angle of the mouth than level of top of head; no adipose eyelid; all of the fins, including spinous dorsal, covered with small scales; gill membranes broadly united, free from the isthmus; caudal forked.

Color dull olivaceous above, without distinct markings, paler below. Length about 2 feet.

Family XVI. **Centrarchidæ.**

THE SUNFISHES.

Body more or less shortened, compressed; head compressed; mouth terminal, large or small; teeth in villiform bands, the outer slightly enlarged; no canines; teeth present on premaxillaries, lower jaw and vomer, usually on palatines, also sometimes on tongue, pterygoids and hyoid; premaxillaries protractile; preopercle entire or slightly serrate; opercle ending in two flat points or prolonged in a black flap at its angle; gill membranes separate, free from the isthmus; cheeks and opercles scaly; ventral fin with one spine and 5 soft rays; dorsal spines 6 to 13; anal spines 3 to 9; vertebræ 28 to 35. Fresh-water fishes of North America. All are voracious and gamy and are good food fishes. A few species are found in northern Mexico, the most southern range for the family.

KEY TO THE GENERA* OF CENTRARCHIDÆ.

- | | |
|---|------|
| a. Body comparatively short and deep, the depth usually more than $\frac{3}{4}$ of the length; dorsal fin not deeply emarginate. | PAGE |
| b. Lower pharyngeals narrow, the width in the length of toothed portion about 3 in adults; lateral margin straight or slightly inbent from tip of posterior spur to anterior extremity of bone; teeth on lower pharyngeals long and slender and more or less acuminate; no red on margin of opercular flap..... | 190 |
| bb. Lower pharyngeals broad, the width in the length of toothed portion about 2 in adults; outer margin a double curve, moderately in- | |

*For an account of the genera *Lepidopomus* and *Eupomotis*, see R. E. Richardson in Bull. Ill. Lab. of Nat. Hist., vol. VII, article III, pages 27 to 35. The characterization of these two genera and the keys relating to them and their species are largely taken from that paper.

bent posteriorly in front of spur, and more or less decidedly rounded anteriorly as the margin of a lateral ledge-like prominence; a red spot on lower posterior margin of opercular flap.....	<i>Eupomotis</i>	193
aa. Body comparatively elongate, the depth in the adult about $\frac{1}{3}$ of the length; dorsal fin low and deeply emarginate.....	<i>Micropterus</i>	194

Subfamily **Lepidopominae**.

74. Lepidopomus Rafinesque.

Lepomis Rafinesque, Journ. de Physique, Paris, 1819, 402. (Type, *Labrus auritus* Linnæus.)

Apomotis Rafinesque, Journ. de Physique, Paris, 420, 1819 (*Lepomis cyanellus* Rafinesque).

Body variously elongate, elliptical, or short and deep, most of the species being rather robust, the others thin and compressed; mouth usually rather large; supplemental maxillary bone well developed, rudimentary or wanting, best developed in species with largest mouth; teeth on palatines usually present; lower pharyngeals narrow and weak, flattened or hollowed out underneath, its width in length of toothed portion about 3. in adults; inner angle 120° to 140° , outer margin straight or slightly inbent from tip of posterior spur to anterior extremity of bone; pharyngeal teeth always long and slender and more or less acuminate; brilliant colors on posterior margin of opercular flap, if present, always blending with the adjacent paler or darker color and not forming a definitely localized spot as in *Eupomotis*; gill rakers well developed, long, stiff, and rough to rather slender, or very soft and weak; pectorals not longer than head; dorsal spines usually low.

This genus is represented in the waters of North America by about twelve species.

KEY TO THE SPECIES OF THE GENUS LEPIDOPOMUS.

- a. Opercle more or less stiffened posteriorly, its osseous portion always distinctly differentiated from a posterior fleshy or membranous margin, partly or wholly of paler color than the osseous portion, to which the black of the opercular spot is entirely or for the most part confined; a well developed supplemental

- maxillary bone; body oblong, depth $2\frac{1}{3}$ to $2\frac{1}{2}$ in length; scales small, 42 to 50 in lateral series . . . *cyanellus* 191
- aa. Opercle not composed of well differentiated osseous and membranous portions, the bone becoming gradually thinner posteriorly and terminating in a flexible osseo-membranous flap; flap usually considerably produced in adults, sometimes exceedingly so, and entirely black, or with only a very narrow pale edging; supplementary maxillary bone very rudimentary or entirely wanting.
- b. Dorsal spines low, the longest but slightly more than length of snout; gill rakers short and weak; body very robust anteriorly; head large; wavy blue lines on cheeks faint or absent *occidentalis* 192
- bb. Dorsal spines higher, the largest almost equaling or greater than snout and eye; gill rakers rather slender and firm.
- d. Eye large, $2\frac{3}{4}$ to 3 in head; no dusky spot on posterior dorsal or anal rays *haplognathus* 192
- dd. Eye smaller, $3\frac{1}{2}$ to 4 in head; dorsal and anal not large, blotch of dusky near base of last rays *pallidus* 193

Subgenus *Apomotis* Rafinesque.179. *Lepidopomus cyanellus* Rafinesque. BLUE-SPOTTED SUNFISH; GREEN SUNFISH.

Lepomis cyanellus Rafinesque, Jour. de Physique, 1819, 420; Ohio River: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 996.

Pomotis aquilensis Girard, Mex. Bd. Sur., 7, pl. III, 1-8, 1858; Eagle Pass, Texas: Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1853, 388; Eagle Pass.

Apomotis cyanellus Jordan, Bull. U. S. Geol. Sur., 1878, 398; Rio Grande at Brownsville, Texas.

Northeastern Mexico to the Great Lakes.

Head 3; depth $2\frac{1}{2}$; D. x, 11; A. III, 9; scales 6 or 7-42 to 50-16. Body rather elongate, becoming deeper with age; head moderately large; mouth large; maxillary nearly reaching vertical from middle of eye, broad, with a well developed supplemental bone; lower jaw the longer; opercle more or less stiffened posteriorly, its black osseous portion always distinctly differentiated from the posterior fleshy, or

usually paler colored membranous margin; dorsal spines low, the longest 3 to 4 in head; pectorals short, not reaching anal, $1\frac{1}{2}$ in head; ventrals not reaching anal.

Color greenish with brassy luster on sides; each scale with a blue spot, these forming pale lateral streaks; a conspicuous dark spot on posterior base of dorsal and anal; cheeks with narrow blue stripes. Length about 7 inches.

A very variable and widely distributed species; ranging from Mexico to the Great Lakes; not found east of the Alleghenies.

Subgenus *Lepidopomus* Rafinesque.

180. *Lepidopomus occidentalis* Meek. WESTERN SUNFISH.

Lepomis occidentalis Meek, Field Col. Mus. Pub. 65, 1902, 118; Jimenez; Santa Rosalia.

Rio Conchos and its tributaries in Chihuahua.

Head $2\frac{3}{5}$; depth 2; D. x, 11; A. III, 9; scales 7-37-14. Body oval, compressed, the dorsal outline more arched than the ventral; profile convex, nearly straight in small specimens, in larger concave above eyes and convex at nape; mouth moderate, the maxillary reaching vertical from pupil, its length 3 in head; no supplemental maxillary bone; lower jaw slightly the longer; eye small, $4\frac{1}{5}$ in head; $1\frac{1}{4}$ in interorbital space; opercle not composed of well differentiated osseous and membranous portions, the bone becoming gradually thinner posterior and terminating in a flexible osseo-membranous flap; flap usually very long; gill rakers short, 8 on lower part of arch; dorsal fin rather low, its fourth spine $3\frac{1}{4}$ in head; pectoral short, rounded, not extending to anal; caudal fin very short, its lobes rounded and of equal size, its length $1\frac{3}{4}$ in head.

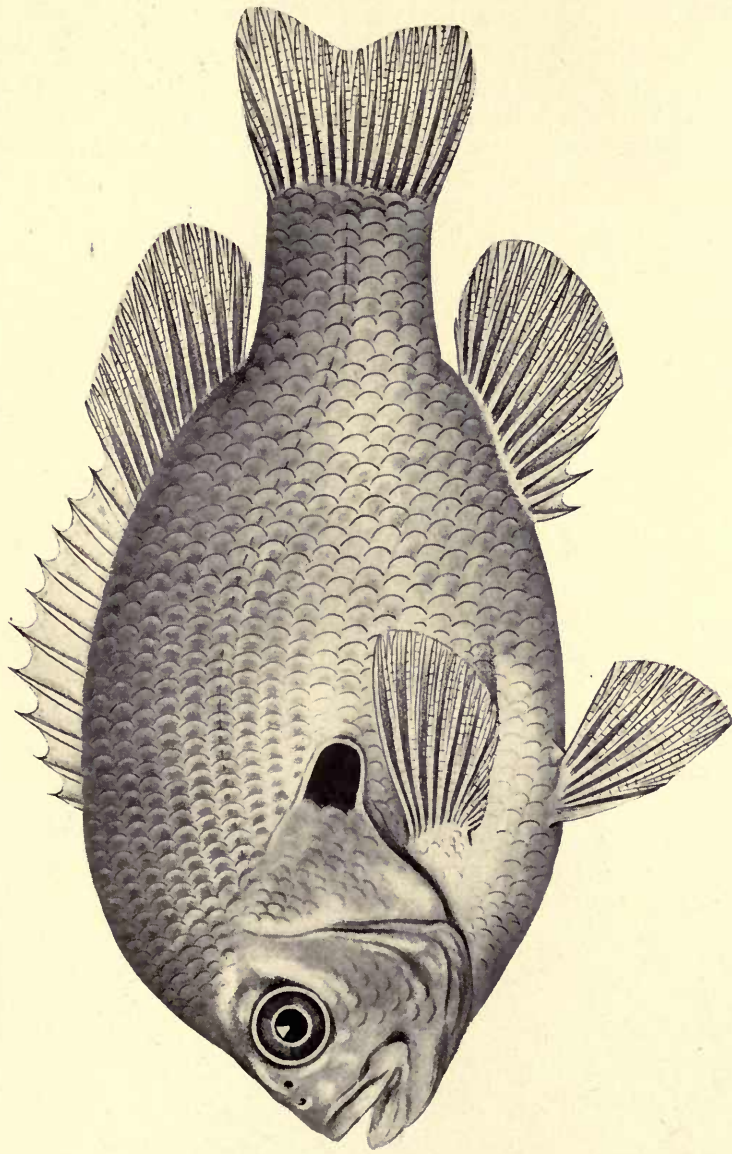
Color olivaceous above, lighter below, each scale with a light margin, forming longitudinal lines along the rows of scales; no black markings on the fins; no blue lines on the cheeks, a few dusky brown ones being present; opercular flap with a narrow pale border. Length about 6 inches.

This species ranges farther southwest than any other member of the sunfish family. *Lepidopomus haplognathus* and *Micropterus salmonoides*, which occur farther east, range a little farther south. Spawning time the last of July.

181. *Lepidopomus haplognathus* Cope.

Lepomis haplognathus Cope, Proc. Amer. Philos. Soc., 1884 (1885), 168; Monterey, Nuevo Leon: Jordan & Evermann, Bull. 47, Proc. U. S. Nat. Mus., 1896, 1004.

Tributaries of the Rio Grande near Monterey, Nuevo Leon. (Monterey.)



LEPOMIS OCCIDENTALIS Meek.
No. 3666, Field Columbian Museum.

Head $2\frac{2}{3}$ to 3; depth $2\frac{1}{2}$; D. x, 10; A. III, 9; scales 7-38-13. Body elongate, compressed; profile convex; head large; mouth moderate; maxillary reaching past vertical from anterior margin of pupil, its length $3\frac{1}{3}$ in head; no supplemental maxillary; snout short, $3\frac{1}{2}$ to 4 in head; eye very large, $2\frac{3}{4}$ to 3 in head; gill rakers rather strong, short, about 8 in lower part of angle; opercular flap moderate, without pale margin; pectoral fin short, not reaching first anal spine, its length $1\frac{1}{3}$ in head; ventral $1\frac{1}{4}$; dorsal spines moderate, longest $2\frac{1}{4}$ in head.

Color uniform greenish, the center of each scale darker; no markings on fins; a few bluish bands on cheeks. Length about 6 inches.

This species at present is known only from Monterey, its type locality. Four specimens were taken by me in a spring in Monterey.

182. *Lepidopomis pallidus* (Mitchill). BLUE GILL; BLUE SUNFISH.

Labrus pallidus Mitchill, Trans. Lit. & Phil. Soc. N. Y., 1815, 407; New York.

Pomotis speciosus Girard, Pac. R. R. Sur., 23, 1858; Brownsville, Texas; Cadereita, Nuevo Leon: Girard, Mex. Bd. Sur., 5, pl. IV, figs. 5-8, 1859; Cadereita, Nuevo Leon.

Lepomis pallidus Jordan, Bull. U. S. Geol. Sur., 1878, 397; Rio Grande, Brownsville, Texas: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 1005.

Eupomotis pallidus Boulenger, Cat., 1, 1896, 9.

Rio Grande to Florida and the Great Lakes.

Head $2\frac{3}{4}$ to $3\frac{1}{4}$; depth $1\frac{4}{5}$ to $2\frac{1}{4}$; D. x, 11 or 12; A. III, 10 or 11; Body comparatively short and deep, compressed (the young more slender than the elder); head moderate, profile usually forming an angle above eye; mouth small, the jaws subequal, the maxillary scarcely reaching vertical from anterior margin of the eye; opercular flap rather short, and without pale edge; gill rakers moderate, 11 to 13 on lower portion of gill arch; dorsal spines high, the longest 2 in head, and usually longer than snout and eye; pectoral fin about as long as head, its tip reaching past origin of anal.

Color greenish olive; sides often with chain-like transverse greenish bars, which disappear in adult; no blue stripes on cheeks; a dark blotch on base of posterior rays of dorsal and anal fins; opercular flap without pale edge. Length about 12 inches.

75. *Eupomotis* Gill & Jordan.

Eupomotis Gill & Jordan, Field and Forest, 1877, 190. (Type, *Sparus aureus* Walbaum.)

Body deep, more or less compressed, the back elevated; mouth rather small; no supplemental maxillary bone and no teeth on pala-

tines; gill rakers always short, sometimes very much reduced; pectoral fins always longer than head, sometimes extending past middle of anal; dorsal spines rather high; lower pharyngeal deep and broad, with inferior and lateral prominences, never flattened or hollowed underneath, width in length of toothed portion about 2 in adults, inner angle 95° to 111° , outer margin a double curve, moderately inbent posteriorly in front of spur, and more or less decidedly rounded anteriorly as the margin of a lateral ledge-like prominence; teeth on lower pharyngeals short and heavy, their upper surfaces very bluntly rounded or paved; red or orange on posterior portion of opercular flap definitely marked off from the paler or blackish portions adjacent, and not blended with them as in the preceding genus.

183. *Eupomotis heros* (Baird & Girard).

Pomotis heros Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854, 25; Rio Cibolo, Texas: Girard, Mex. Bd. Sur., 6, pl. 11, figs. 1-4, 1859; Rio San Juan, Cadereita, Nuevo Leon.

Eupomotis heros Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 1007; Meek, Field Col. Mus. Pub. 47, 1900, 13.

Northeastern Mexico in lowland streams, north to southern Illinois.

Head $2\frac{5}{8}$; depth $2\frac{1}{8}$; D. X, 12; A. III, 10; scales 6-40-13. Body moderately elongate, compressed; anterior profile slightly concave about eyes, slightly convex at nape; head rather small; mouth small, maxillary scarcely reaching vertical from anterior margin of the pupil, its length equaling length of snout, $3\frac{1}{2}$ in head; diameter of eye 4 in head; opercular flap short, in life a red spot at its lower posterior angle, the margin pale; dorsal spines strong, the last one $2\frac{1}{3}$ in head; pectoral fin very long, its tip reaching base of second anal ray, the fin slightly longer than the head; ventral short, $1\frac{1}{2}$ in head; 5 rows of scales on the cheeks; caudal fin emarginate.

Color light olivaceous with silvery reflections, some of the scales with darker centers forming indistinct lateral streaks along the rows of scales; cheeks without blue stripes. Length about 12 inches.

Subfamily **Micropterinae**.

76. *Micropterus* Lacépède.

BLACK BASS.

Micropterus Lacépède, Hist. Nat. Poiss., IV, 325, 1802. (Type, *Micropterus dolomieu* Lacépède.)

Body oblong, compressed, the back not much arched; head oblong, conic; mouth very large, its gape extending to near vertical from posterior margin of eye; teeth on jaws, vomer and palatines; preopercle

entire; dorsal fin divided by a deep notch, the spines low and not very strong; scales small, ctenoid.

This genus includes two species found only in North America, both being among the best of our game fishes. One species only is found in Mexico.

184. *Micropterus salmonoides* (Lacépède). LARGE-MOUTHED BLACK BASS; BESUGO.

Labrus salmoides Lacépède, Hist. Nat. Poiss., III, 716, 1802; South Carolina.

Dioplites nucensis Girard, Mex. Bd. Sur., 3, pl. 1, 1859; San Juan River, Nuevo Leon.

Grystes nuecensis Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854, 25; Rio San Juan, Nuevo Leon.

Micropterus salmonoides Boulenger, Cat., 1, 16, 1896.

Micropterus salmoides Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 1012.

Mexico from Tampico to Florida and north to the Great Lakes and Red River of the north. (San Juan; Montemorelos; Linares; La Cruz; Santa Engracia.)

Head 3 to $3\frac{1}{2}$; depth 3 to $3\frac{1}{4}$; D. x, 12 or 13; A. III, 10 or 11; scales 7-65 to 70-18. Body ovate-fusiform, moderately compressed; head large; mouth large, the maxillary broad and with a well developed supplemental bone, its tip reaching vertical from posterior margin of eye; gill rakers longer than gill fringes, 7 or 8 on lower portion of gill arch; scales on cheeks in about 10 rows.

Color dark green above, below greenish silvery; a black lateral band which disappears in the adult; 3 dark oblique stripes across cheeks and opercles; a few dark spots above and below the lateral band which breaks up and grows fainter as the fish grows older. Length about 18 inches.

This species prefers bayous, lakes, and sluggish water. It is not regarded as good a game fish as the small-mouthed black bass, which prefers rapid and cooler waters. The angler often finds considerable difficulty in distinguishing these species, because of the slight differences between them, and he usually finds less difference in their fighting qualities.

This species is abundant in the streams of Mexico north of Santa Engracia. I saw many specimens over a foot in length here and in the river at La Cruz. So far as known the river at Santa Engracia is its southernmost range.

Family XVII. **Percidæ.**

THE PERCHES.

Body more or less elongate, terete, or moderately compressed; mouth terminal or inferior, small or large; the premaxillaries protractile; teeth usually villiform, on jaws, vomer and palatines (occasionally they are absent on vomer and palatines); scales usually small, ctenoid; opercle usually ending in a flat spine; branchiostegals 6 or 7; gill membranes free or connected; lateral line usually present, never extending on the caudal fin; dorsal fins 2, the first composed of 6 to 15 spines; ventral fins thoracic, each with one spine and 5 soft rays; caudal fin truncate, lunate, or rounded.

Subfamily **Etheostomatinae.**77. **Etheostoma** Rafinesque.

Etheostoma Rafinesque, Journ. de Phys. etc., Paris, 1819, 419.

(Type restricted by Cope & Jordan to *Etheostoma flabellare* Raf.)

Oligocephalus Girard, Proc. Acad. Nat. Sci. Phila., 1859, 67.

(Type, *Boleosoma lepidum* Baird & Girard.)

Torrentaria Jordan & Evermann, Bull. 47, U. S. Fish Comm., 1896, 1080. (Type, *Etheostoma australe* Jordan.)

Rafinesquiellus Jordan & Evermann, Bull. 47, U. S. Fish Comm., 1896, 1082. (Type, *Aplesion pottsii* Girard.)

Body robust or rather elongate, somewhat compressed; mouth terminal or subinferior; premaxillaries not protractile; teeth rather strong, usually present on vomer and palatines; gill membranes separate, or more or less broadly connected; scales moderate or small, ctenoid; no scales on top of head; scales on belly persistent, of the ordinary sort; dorsal spines 7 to 15; anal spines 1 or 2; vertebræ usually 33 to 39.

The darters comprise a large group of small, highly colored fishes inhabiting the streams of North America east of the Rocky Mountains; one species, *Etheostoma pottsii*, occurs in a Pacific coast stream.

KEY TO THE SPECIES OF ETHEOSTOMA.

- | | | |
|-----|--|---------------------|
| a. | Anal spine single; gill membranes connected; | PAGE |
| | scales in the lateral series 58 to 66..... | <i>australe</i> 197 |
| aa. | Anal fin with two spines; gill membranes not connected. | |
| b. | Head rather large, $3\frac{1}{2}$ to $3\frac{2}{3}$ in the body; | |
| | scales in the lateral series 44 to 50..... | <i>pottsii</i> 197 |
| bb. | Head smaller, $4\frac{1}{4}$ in the body; scales in the lateral series 48 to 54..... | <i>lepidum</i> 198 |

Subgenus *Torrentaria* Jordan & Evermann.

185. *Etheostoma australe* (Jordan).

Aplesion fasciatus Girard, Proc. Acad. Nat. Sci. Phila., 1859, 101 (not *Catonotus fasciatus* Girard); Chihuahua River, Mexico.

Etheostoma australe Jordan, Proc. U. S. Nat. Mus., 1884, 362; Chihuahua River, Mexico: Woolman, Bull. U. S. Fish Comm., 1894, 60; Chihuahua: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 1080; Meek, Field Col. Mus. Pub. 65, 1902, 119; San Andres; Santa Rosalia; Chihuahua; Jimenez.

Etheostoma scouelii Woolman, Amer. Nat., 1892, 261; Rio de los Conchos, Chihuahua, Mexico.

Headwaters of the Rio Conchos in Chihuahua.

Head $3\frac{1}{2}$ to $3\frac{3}{4}$; depth $4\frac{1}{4}$ to $4\frac{2}{3}$; D. x to xii, 9 to 11; A. i, 7 or 8; scales 6-58 to 66-111. Body elongate, not much compressed; mouth small, the lower jaw the shorter; maxillary reaching front of pupil; eye small, $3\frac{3}{4}$ in head; snout bluntish, 4 in head; premaxillary not protractile; gill membranes moderately connected, free from the isthmus; pectorals large, nearly as long as head; ventrals close together, $1\frac{1}{3}$ in head; head, breast and nape naked; lateral line incomplete.

Color light olivaceous, sides with about 10 dusky cross-bars, these more prominent in the males; the pale interspaces red in life; the dusky bars alternate with the pale blotches on the sides; soft dorsal and anal with dark cross-bars; spinous dorsal with a dark base and dark tips, otherwise pale; a dark bar downward and one forward from the eye. Length about $2\frac{1}{4}$ inches. Spawning time the latter part of May and in June.

Subgenus *Rafinesquiellus* Jordan & Evermann.

186. *Etheostoma pottsii* (Girard).

Aplesion pottsii Girard, Proc. Acad. Nat. Sci. Phila., 1888, 289; tributary of the Rio Chihuahua.

Etheostoma micropterus Gilbert, Proc. U. S. Nat. Mus., 1888, 289; Chihuahua, Mexico: Woolman, Bull. U. S. Fish Comm., 1894, 60; Rio Chihuahua, Chihuahua.

Etheostoma pottsii Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 1083; Chihuahua: Meek, Field Col. Mus. Pub. 65, 1902, 119; San Andres; Chihuahua; Santa Rosalia; Jimenez.

Headwaters of the Rio Conchos, Rio Nazas, and Rio Mezquital, in Chihuahua and Durango. (Santiago Papasquiaro; Durango.)

Head $3\frac{1}{2}$ to $3\frac{2}{3}$; depth $3\frac{3}{4}$ to $4\frac{1}{4}$; D. ix to xi, 10 to 12; A. ii, 7 or 8; scales 5-44 to 50-10. Body moderately elongate, not much com-

pressed; head small, mouth rather large, oblique, the maxillary reaching past anterior margin of the eye; snout bluntish, $4\frac{1}{2}$ in head; premaxillary not protractile; gill membranes not united, free from the isthmus; pectorals large, almost as long as the head; ventrals close together, $1\frac{1}{3}$ in head; preopercle entire; sides of head, breast, and nape naked; lateral line straight, incomplete.

Color light olive, sides tessellated with darker; 6 to 9 dark cross-bars on back, traces of about an equal number on the sides; a black humeral spot; a dark streak downward and one forward from eye; soft dorsal and caudal barred; spinous dorsal with some small dark dots. Length about 2.10 inches. Females taken May 23 at Durango full of eggs, evidently about spawning time.

So far as known at present, this is the only darter found in a Pacific coast stream. Its range is farther south than any member of the family to which it belongs.

Subgenus *Oligocephalus* Girard.

187. *Etheostoma lepidum* (Baird & Girard).

Boleosoma lepida Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1853, 338; upper tributaries of the Rio Nueces, Texas.

Pæcilichthys lepidus Jordan, Bull. U. S. Geol. Survey, 1878, 663; Brownsville, Texas.

Etheostoma lepidum Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 1089.

Lower Rio Grande and the streams of Texas, Indian Territory, and Arkansas.

Head $4\frac{1}{4}$; depth $4\frac{2}{3}$; D. IX, 11 to 13; A. II, 6 to 8; scales 6-48 to 54-8. Body rather stout, compressed, tapering backward; head sub-conical; mouth moderate, the jaws equal; maxillary reaching vertical from anterior margin of the orbit; eyes large; first dorsal rather low and somewhat connected to soft dorsal; no scales on head, breast, or nape; lateral line incomplete; gill membranes not connected.

Color olivaceous, with some dark blue bars; scales dusky at base, sometimes a slight trace of a humeral spot; dorsal and caudal mottled or barred. Length $2\frac{1}{2}$ inches.

Family XVIII. **Centropomidae.**

THE ROBALOS.

Body elongate, compressed; dorsal region elevated; abdominal region straight to angulated base of anal; head depressed, pike-like, the lower jaw projecting; villiform teeth in bands on jaws, vomer, and palatines; no teeth on tongue; maxillary broad, truncate behind, with

a strong supplemental bone; preopercle with a double ridge, the posterior margin strongly serrate; opercle without true spines; scales ctenoid; lateral line conspicuous; dorsal fins well separated, the first with 8 spines; anal spines 3, the second strong, the third long and slender; these fins moving in scaly sheathes; air bladder well developed; branchiostegals 7. Species all American, one species found in the rivers of southeastern Mexico far above tide-water.

78. *Centropomus* Lacépède.

ROBALOS.

Centropomus Lacépède, Hist. Nat. Poiss., IV, 248, 1802. (Type restricted by Cuvier & Valenciennes to *Sciæna undecemalis* Bloch).

Characters of the genus are included in the description of the family.

188. *Centropomus mexicanus* Bocourt. ROBALO.

Centropomus mexicanus Bocourt, Ann. Sci. Nat. Paris, 1868, 90; Gulf of Mexico: Vaillant & Bocourt, Miss. Sci. Mex., 1875, 23, pl. 1, fig. 2; Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 1121.

Both coasts of Mexico, ascending rivers to a considerable distance above tide-water. (San Francisco; Boca del Rio; El Hule; Perez.)

Head $2\frac{3}{4}$; depth 4 to $4\frac{1}{2}$; D. VIII-1, 10; A. III, 6; scales 11-69 to 72-16. Body elongate, moderately compressed; mouth large, maxillary reaching nearly to posterior margin of pupil; preopercle with sharp teeth on its posterior limb, the two at the angle larger than the others; 2 spines at angle of anterior limb; diameter of eye $5\frac{1}{2}$ in head; third dorsal spine the longest, 2 in head; second anal spine very strong, $1\frac{2}{3}$ in head; lateral line well developed; caudal fin forked.

Color olivaceous, lighter below; lateral line blackish; tips of dorsal and caudal blackish. Length 12 inches or more.

Family XIX. *Hæmulidæ*.

THE GRUNTERS.

Body oblong, more or less elevated, covered with moderate sized scales, usually ctenoid; lateral line concurrent with the back, usually not extending on caudal fin; head large; no suborbital stay; premaxillaries protractile; maxillary without supplemental bone, for the most of its length slipping under edge of preorbital; preorbital usually broad; no barbels; no teeth on vomer or palatines; ventral fin thoracic, its rays 1.5; pyloric cœcæ few; vertebræ usually $10+14=24$; alimentary canal short. Mostly shore fishes, a few entering fresh water.

79. *Pomadasys* Lacépède.

BURROS.

Pomadasys Lacépède, Hist. Nat. Poiss., IV, 516, 1803. (Type, *Pomadasys argentatus* Lacépède.)

Rhonciscus Jordan & Evermann, Check-List, Fishes 387, 1896. (Type, *Pristipoma crocro* Cuv. & Val.)

Body oblong, somewhat compressed; mouth rather small, terminal, low, maxillary scarcely reaching eye; premaxillaries protractile; teeth on jaws only, in villiform bands; cheeks and opercles scaly; preopercle serrate, the serræ below not turned forward; suprascapula serrate; scales large, those above lateral line in series parallel with it; dorsal fin emarginate; second anal spine very strong.

Some of these fishes when taken from the water make a loud, snore-like sound very much like the noise of a burro or donkey.

KEY TO THE SPECIES OF POMADASYS.

- | | |
|--|--------------------|
| a. Second anal spine not reaching tip of soft rays,
its length $1\frac{3}{4}$ in head; mouth large, maxillary
reaching to pupil, $2\frac{2}{3}$ in head. | PAGE |
| b. Scales small, 65 in the lateral series | <i>starri</i> 200 |
| bb. Scales larger, 56 in the lateral series | <i>bayanus</i> 201 |
| aa. Second anal spine reaching beyond tips of soft
rays, its length $1\frac{1}{4}$ in head; mouth small, max-
illary not reaching to anterior margin of orbit,
its length $3\frac{1}{3}$ in head..... | <i>templei</i> 201 |

Subgenus *Rhonciscus* Jordan & Evermann.

189. *Pomadasys starri* sp. nov. BURRO.

Type, No. 4693, F. C. M., 11½ inches in length; Perez, Vera Cruz.

Head 3; depth $3\frac{2}{3}$; D. XIII, 12; A. III, 7; scales 9-65-17. Body elongate, compressed; ventral outline nearly straight; back arched; profile slightly concave above the eyes, convex at nape; head pointed; snout bluntish; mouth rather large, low, its gape horizontal; jaws subequal; maxillary reaching slightly past vertical from anterior margin of pupil, its length $2\frac{2}{3}$ in head; teeth villiform, a few in upper jaw enlarged; eye large, its diameter $4\frac{1}{2}$ in head; snout 3 in head; preopercle strongly serrate; origin of dorsal slightly behind origin of pectoral; dorsal fin deeply notched, longest dorsal spine $2\frac{1}{3}$ in head; second anal spine strong, its tip not reaching to tips of soft rays, its length $1\frac{3}{4}$ in head; caudal fin emarginate, the upper lobe the longer; least depth of caudal peduncle $3\frac{1}{4}$ in the head; soft dorsal and anal

FIELD COLUMBIAN MUSEUM.

PLATE XIII, ZÖÖLOGY.



POMADASYS STARRI Meek.



POMADASYS TEMPLEI Meek.

scaly at base; head, except portion in front of nostrils, scaly; scales through ctenoid.

One specimen, $11\frac{1}{2}$ inches in length taken at Perez. Named for Dr. Frederic Starr, who more than any one else has studied the native Indians of Mexico.

190. *Pomadasys bayanus* Jordan & Evermann.

Pristipoma humile Kner & Steindachner, Sitzsber. Akad. Wiss. Münch., 1863, 222; Rio Bayano, near Panama.

Pomadasys bayanus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 1331; name a substitute for *humile*, preoccupied: Gilbert & Starks, Fishes of Panama Bay, 109, 1904; San Jose del Cabo, Lower California.

Pacific coast streams, from Cape San Lucas to Panama.

Head $3\frac{1}{8}$; depth $3\frac{1}{2}$; D. XII, 12; A. III, 7; scales 8-56-20. Body elongate, elliptical, compressed somewhat, elevated at the nape; anterior profile straight from nape to the end of the snout; snout produced, blunt, rounded, its length 3 to $3\frac{1}{4}$ in head; mouth large, the maxillary reaching to anterior third of eye, its length $2\frac{3}{8}$ in head; diameter of eye 5 in head; preorbital $6\frac{1}{3}$; dorsal fin deeply notched, its longest spine about $2\frac{3}{4}$ in head; second anal spine long and strong, its length $1\frac{2}{3}$ in head; soft dorsal and anal scaly at the base.

Color uniform olivaceous above, silvery below; fins plain.

The two specimens mentioned by Gilbert & Starks are probably different species, the smaller one from San Jose del Cabo being apparently closely related to *Pomadasys templei*. The material I have at hand does not indicate that the very long second anal spine is characteristic of the young.

191. *Pomadasys templei* sp. nov.

Type, No. 4504, F. C. M., $6\frac{3}{4}$ inches in length; Valles, San Luis Potosi.

Head $3\frac{1}{8}$; depth $3\frac{1}{3}$; D. XIII-12; A. III, 6; scales 7-57-16. Body elongate, compressed, the ventral outline nearly straight, back arched; profile from tip of snout to the origin of dorsal nearly straight; head pointed; snout bluntish; mouth moderate; the maxillary scarcely reaching vertical from anterior margin of the eye, its length $3\frac{1}{3}$ in head; mouth little oblique, the margin of the upper lip below the level of lower margin of eye; snout 3 in head; eye large, $3\frac{1}{4}$ in head; preopercle strongly serrate; a large toothed scale-like process just above angle of opercle; origin of dorsal over origin of pectoral, its first spine very short, the spines gradually increase in length to the fourth, which is longest, $1\frac{1}{3}$ in head; the next to the last spine is $3\frac{1}{3}$ in head; pec-

torals $1\frac{2}{3}$ in head; ventrals produced in a short filament, $1\frac{1}{4}$ in head; second anal spine very strong, $1\frac{1}{2}$ in head, its tip reaching opposite base of caudal; caudal fin emarginate; least depth of caudal peduncle 3 in head; scales on base of caudal fin, a few on base of anal, but none on dorsal; head, except a portion anterior to nostrils, scaly; scales strongly ctenoid.

Color light brownish, silvery, lighter below; body with a few faint longitudinal bands; opercle with an indistinct black blotch; tips of vertical fins dark. Length about 12 inches.

The longest specimen in the collection of the Museum is 6 inches. This species was taken by me at Valles and Perez. Named for Mr. A. V. Temple, who has played an important part in the industrial and commercial development of Mexico.

Family XX. **Sciaenidae.**

THE CROAKERS.

Body more or less elongate, compressed; scales rather thin, ctenoid; head prominent and covered with scales; bones of the skull cavernous; mouth small or large; teeth conical, in one or more series, those of the outer one being sometimes enlarged; maxillary slipping under the free edge of the preorbital; no teeth on tongue, vomer, or palatines; premaxillaries protractile; nostrils double; gill membranes separate, free from the isthmus; lower pharyngeals broad, with enlarged conical or molar teeth; opercle usually ending in two flat points; spinous portion of dorsal fin smaller than the soft portion; anal fin with 1 or 2 spines; ventral fins thoracic, 1 spine and 5 soft rays.

A large family of fishes mostly inhabiting the sandy shores of all seas, a few species living in fresh water; most of the species reach a large size.

Subfamily **Haploidonotinae.**

80. **Haploidonotus** Rafinesque.

RIVER DRUMS.

Aplodinotus Rafinesque, Jour. de Phys., 1819, 418. (Type, *Aplodinotus grunniens* Rafinesque.)

Body oblong, the back elevated and compressed; mouth rather small, low, horizontal, the lower jaw included; snout blunt; teeth in villiform bands, the outer above scarcely enlarged; no barbels; gill rakers short and blunt; lower pharyngeals very large, united, and with coarse, blunt paved teeth; second anal spine very strong; pyloric coeca 7; vertebrae $10 + 14 = 24$.

192. *Haploidonotus grunniens* Rafinesque. FRESH-WATER DRUM;
GASPERGOU.

Aplodinotus grunniens Rafinesque, Jour. de Phys., 1819, 88; Ohio River.

Ambodon neglectus Girard, Proc. Acad. Nat. Sci. Phila., 1858, 167;
Rio Grande: Girard, Mex. Bd. Sur., 12, pl. v, fig. 6-10, 1859;
mouth of the Rio Grande; Matamoras, Tamaulipas.

Corvina oscula Günther, Cat., 11, 297, 1860.

Aplodinotus grunniens Jordan & Evermann, Bull. 47, U. S. Nat.
Mus., 1896, 1484: Evermann & Goldsborough, Bull. U. S. Fish
Comm., 1902, 154, fig. 4; Rio Usumacinta, Montecristo.

Larger streams and lakes of the Mississippi Valley and Great Lake
region, south to Chiapas.

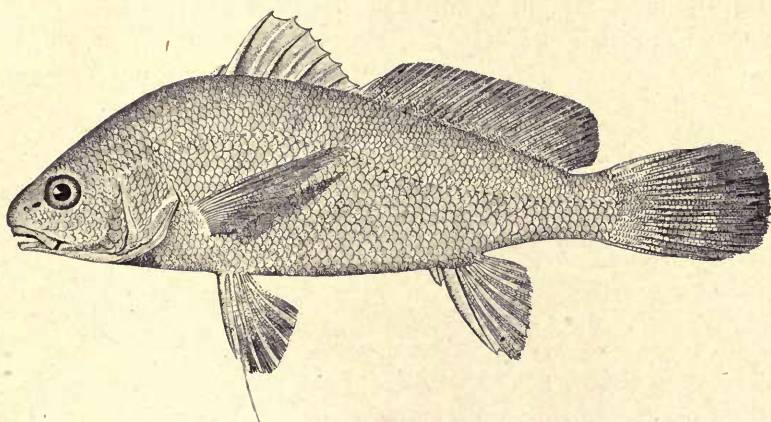


FIG. 65. *HAPLOIDONOTUS GRUNNIENS* Rafinesque.
No. 2364, U. S. Fish Commission.

Head $3\frac{1}{2}$; depth $2\frac{3}{4}$ to $3\frac{1}{5}$; D. x, 30; A. 11, 7; scales 9-55 to 60-12 or 13. Body oblong, the back much elevated and compressed; the profile long, steep, and not much convex; head slightly compressed; mouth moderate, subinferior, low; maxillary reaching to the vertical from the middle of the eye; snout 4 in head; eye $4\frac{2}{3}$; interorbital $3\frac{1}{2}$; dorsal fins connected; ventral with its first ray produced into a filament; caudal fin truncate; gill rakers short, thickish, 20 on the first gill arch.

Color grayish silvery, dusky above, with indications of two or three darker bands over the shoulder; a dark blotch on opercle; dorsal and caudal fins same as the body, the upper half of the membranes darker; other fins pale.

This species is a member of a large family inhabiting the sandy shores of all seas, and is the only member of the family to which it

belongs confined entirely to the fresh waters of North America. It reaches a weight of 50 pounds; as food fish it is of little value north, though of quite good quality south, where it is an important market fish.

Family XXI. **Cichlidae.**

THE CICHLIDS; "MOJARRAS."

Body elevated, oblong or elongate, covered with rather large ctenoid scales; lateral line interrupted, usually ceasing opposite the end of dorsal fin, then recommencing farther down on middle of caudal peduncle; mouth terminal; teeth in jaws usually conical, sometimes lobate or incisor-like; no teeth on vomer or palatines; nostril single on each side; premaxillaries freely protractile; maxillary slipping under the broad preorbital; gill membranes often connected; dorsal fin single, the spinous portion usually longer than the soft portion; anal fin with 3 or more spines, the soft part similar to soft dorsal; lower pharyngeal bones united into a triangular piece with a median suture; branchiostegals 5 or 6; no pseudobranchiæ; air bladder present; caudal fin lunate or rounded.

This family comprises a large number of fresh-water fishes inhabiting the rivers of tropical America and Africa. In form, size, appearance and habits they bear a close resemblance to the sunfishes of the United States. The species known in Mexico are not regarded as first class game fishes, though as food fishes they are very good.

KEY TO THE GENERA OF CICHLIDÆ.

- | | |
|---|------------------------|
| a. Caudal fin rounded, or truncate, its outer rays not produced into filaments; pectoral fin short, rounded, its length $1\frac{1}{4}$ to $1\frac{1}{2}$ in the head; no black blotch on the subopercle. | PAGE |
| b. Teeth of the outer series all conic; anal spines 4 to 11 | <i>Cichlasoma</i> 204 |
| bb. Teeth of the outer series more or less compressed, incisor-like; anal spines 5 to 8 | <i>Neetroplus</i> 221 |
| aa. Caudal fin lunate or slightly forked, some of its outer rays produced into a filament; pectoral fin long and pointed, its length about equal to or longer than the head; a black blotch on subopercle | <i>Thorichthys</i> 222 |

81. *Cichlasoma* Swainson.

Cichlasoma Swainson, Nat. Hist. Class'n Fishes, etc., 230, 1839.
(Type, *Labrus punctatus* Bloch.)

Heros Heckel, Arin. Wiener Mus., 1840, 362. (Type, *Heros severus* Heckel, etc.)

Herichthys Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854, 25. (Type, *Herichthys cyanoguttatus* Baird & Girard.)

Body oblong or deep, much compressed; mouth rather small, terminal, low; premaxillary moderately protractile; lower lip with or without a frenum; jaws with a single series of rather stout conical teeth, behind which is a narrow band of villiform teeth; gill membranes slightly connected, free from the isthmus; dorsal spines 14 to 18; anal spines 4 to 11; caudal fin subtruncate or rounded, the outer rays never produced into a filament; pectoral fin short, its length less than that of head.

The species of this genus are very difficult to capture with a seine. They are more skillful in dodging a net, running around the end or jumping over it, than are any other fishes I have ever collected. They live in clear, running water, coming out in shallow places in the sunshine. As any one approaches they hasten at once to deep water, and hide among roots of trees or under overhanging banks. After a few minutes they cautiously come out and again proceed to the shallow water. The adult males are provided with a large hump of adipose tissue between the nape and the spinous dorsal.

KEY TO THE SPECIES OF CICHLASOMA.

- | | PAGE |
|---|----------------|
| a. Mouth large, terminal, the lower jaw very strong. | |
| b. Anterior teeth in outer series much enlarged, canine-like; lower lip with a frenum; anal spines 5. | mento 207 |
| bb. Anterior teeth in outer series not canine-like, scarcely, if at all, larger than the lateral ones. | |
| c. Anal spines 7 to 9; preorbital 4 in head; post-orbital 2 $\frac{1}{10}$. | |
| d. Lower jaw strong, mandible 2 in head; anal spines 7 or 8; lower lip without trace of a frenum. | salvini 207 |
| dd. Lower jaw less strong, mandible 2 $\frac{1}{2}$ in the head; anal spines 9; lower lip with an incomplete frenum. | hedricki 208 |
| cc. Anal spines 4 to 6. | |
| f. Body elongate, depth 2 $\frac{1}{3}$ to 2 $\frac{3}{4}$. | |
| g. Sides with 4 to 7 ocellated, vertically expanded black spots below dorsal fin; depth 2 $\frac{2}{3}$ | pavonaceum 209 |

gg.	No ocellated black spots on sides.	PAGE
h.	Lower lip without trace of a frenum, sides without dark vertical bars.....	<i>beani</i> 210
hh.	Lower lip with a frenum, or the anterior portion not as free as the lateral.	
i.	Lower lip with a well developed frenum; tips of ventral fins not reaching first anal spine.	
j.	Sides with 9 or 10 dark vertical bars; dorsal spines low, the eighth $3\frac{1}{3}$ in head, the last one $2\frac{3}{4}$; bases of vertical fins with a few dark spots.....	<i>steindachneri</i> 210
jj.	Sides with about 6 dark vertical bars; dorsal spines higher, the eighth $2\frac{1}{2}$ in head, the last one $2\frac{2}{3}$	<i>bartoni</i> 211
ii.	Lower lip without developed frenum, the lip not as free anteriorly as laterally; tips of ventrals reaching second anal spine; sides with 7 dark vertical bars.....	<i>istlanum</i> 212
ff.	Body deep, its depth 2 to $2\frac{1}{4}$ in the length.	
k.	Lower lip without a frenum; dorsal rays 13 to 15; sides with about 6 dark vertical bars.....	<i>evermanni</i> 214
kk.	Lower lip with a frenum.	
l.	Head $3\frac{3}{4}$ in body; depth 2; dorsal spines 14 or 15; teeth in outer series dissimilar, some being bluntly conic.....	<i>heterodontum</i> 215
ll.	Head 3 to $3\frac{1}{4}$; D. xvi; teeth in outer series similar, pointed.	
m.	Anal spines 5, soft rays 8 or 9, dorsal fin with 10 or 11 soft rays.....	<i>cyanoguttatum</i> 215
mm.	Anal spines 4; soft rays 11; dorsal rays 13.....	<i>rectangulare</i> 216
aa.	Mouth smaller, low or subinferior; lower jaw moderate or weak; maxillary 3 to 4 in head.	
n.	Mouth terminal, the jaw oblique; jaws subequal.	
o.	Anal spines 8; tip of ventrals reaching 4th anal spine.	
p.	Lower lip without a frenum; a few anterior teeth canine-like; preorbital $4\frac{1}{4}$ in head.....	<i>mojarra</i> 217

pp.	Lower lip with a frenum; preorbital 6 in head	<i>octofasciatum</i>	218
oo.	Anal spines 5 or 6; lower lip with a frenum, or its anterior margin slightly free.		
q.	Body deep, its depth 2 to $2\frac{1}{4}$; sides with 7 dark vertical bars; lateral band faint or none	<i>parma</i>	218
qq.	Body elongate; depth $2\frac{1}{2}$ to $2\frac{3}{4}$; sides with 7 dark vertical bands, and a conspicuous dark lateral band	<i>melanurum</i>	219
nn.	Mouth very small, subinferior; maxillary $3\frac{5}{8}$ to 4 in head; lower lip with a broad frenum; tips of ventral fins not reaching anal fin; depth $2\frac{2}{3}$.		
r.	Preorbital $3\frac{2}{3}$ in head; soft dorsal of 14 rays ..	<i>eigenmanni</i>	220
rr.	Preorbital $2\frac{4}{5}$ in head; soft dorsal of 10 or 11 rays	<i>nebulifer</i>	220

193. *Cichlasoma mento* (Vaillant & Pellegrin).

Heros mento Vaillant & Pellegrin, Bull. Mus. Hist. Nat. Paris, 1902, 87; Rio Negro, Southern Mexico.

Head 3; depth $2\frac{1}{2}$ to $2\frac{3}{4}$; D. XVI-10; A. v, 7 or 8; scales 6-29-12. Body rather elongate; lower jaw very strong and prominent; the outer series of teeth in each jaw large, the anterior ones forming true canines; lower lip without frenum; eye small, $4\frac{1}{2}$ in head, $1\frac{1}{2}$ in interorbital area; eye nearer snout than posterior margin of opercle; 6 or 7 rows of scales on the cheeks; dorsal spines increase to the fifth; middle rays of dorsal and anal produced; the fifth anal spine longer and stronger than the last dorsal; base of median fins scaly; caudal rounded; pectoral rounded, $\frac{2}{3}$ length of head.

Color olivaceous, traces of dark punctulations on soft parts of unpaired fins. Length about 7 inches. (Vaillant & Pellegrin.)

Known only from the type locality.

194. *Cichlasoma salvini* (Günther).

Heros salvini Günther, Cat. iv., 294, 1862; Rio de Santo Isabel, Guatemala: Günther, Fish. Cent. Amer., 460, pl. 73, fig. 3, 1869; Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 1528.

Southern Mexico and Guatemala. (Motzorongo; Refugio; El Hule; Perez; Obispo.)

Head $2\frac{2}{3}$; depth $2\frac{1}{5}$ to $2\frac{1}{3}$; D. xvii, 10 or 11; A. vii or viii, 9; scales 6-29-10. Body rather deep, compressed; anterior half of

profile concave, the rest convex; snout rather pointed, the lower jaw very strong and longer than the upper; mouth large, maxillary $2\frac{1}{2}$ in head; a few of the teeth very strong and canine-like; lower lip without trace of a frenum; preorbital 4 in head; postorbital $2\frac{1}{10}$ in head; diameter of eye $4\frac{1}{3}$ in head; mandible 2 in head; eighth dorsal spine 4 in head, the last 3 in head; middle rays of dorsal and anal produced, nearly reaching tip of caudal fin in specimens 6 inches long; about to middle of caudal in specimens 3 inches in length; pectoral $1\frac{2}{3}$ in head; ventral with tips somewhat produced, about reaching base of 4th anal, $1\frac{1}{4}$ in head; soft dorsal and anal, scaly at the base; cheeks with 5 rows of scales; caudal fin rounded; caudal peduncle $2\frac{2}{3}$ in head, its length $1\frac{1}{2}$ in its depth.

Color light brownish, side with a dark lateral band, more or less broken into blotches on posterior half; about five indefinite dark bars on posterior half of body, the region just below dorsal fin somewhat reticulated; a dark blotch on middle of base of caudal fin; two indefinite bars across profile between nape and dorsal; a dark streak at upper and one at lower margin of interorbital area; a dark streak under eye forward to mouth; a few small dark dots on soft dorsal, anal and caudal fins; a black blotch on middle of side above end of pectoral and where the first definite bar on side crosses lateral band. Length about 8 to 10 inches.

Two specimens from Motzorongo have the cheeks reticulated with blue lines and spots. The dorsal fin is very much produced on a specimen 5 inches long from Obispo, tip of dorsal fin almost reaching tip of caudal. In a few smaller specimens (2 to 4 inches) the dorsal rays are little produced, scarcely reaching past base of anal; individuals from El Hule are the lightest in color, those from Motzorongo the darkest. Specimens less than 3 inches deep have a black blotch on middle of side.

195. *Cichlasoma hedricki* sp. nov.

Type, No. 4673, F. C. M., 6.25 inches in length; Obispo, Vera Cruz.

Abundant in the large rivers of Mexico south of Vera Cruz. (Vera Cruz; El Hule; Obispo; Perez.)

Head $2\frac{2}{3}$; depth $2\frac{2}{3}$; D. XVII or XVIII, 10; A. IX, 8; scales 7-34-12. Body rather elongate, compressed; profile nearly straight to nape, from nape to first dorsal spine evenly convex; interorbital convex, $2\frac{2}{3}$ in head; lips thick, the lower with a frenum, not quite reaching the margin of the lip; lower jaw slightly projecting; outer series of teeth not much enlarged, far apart; preorbital 4 in head; postorbital $2\frac{1}{10}$ in head; cheeks with 5 rows of scales; diameter

of eye $4\frac{1}{4}$ in the head; dorsal spines rather low; eighth spine $3\frac{5}{8}$ in head, the last spine $2\frac{3}{4}$ in head; middle rays of soft dorsal produced, their tips in specimens 3 inches in length reaching about $\frac{1}{3}$ from base of caudal, in specimens 7 inches in length to or past middle of caudal;

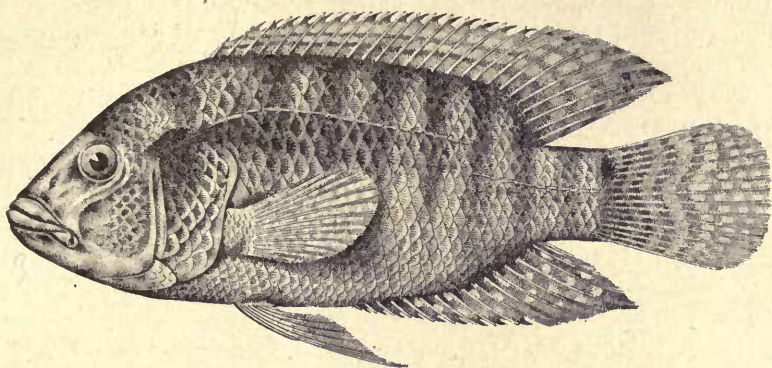


FIG. 66. *CICHLASOMA HEDRICKI* Meek.

few scales on base of soft dorsal and anal fins; pectoral fin $1\frac{2}{5}$ in head; ventral with the tips produced, reaching to base of fifth anal spine; ventral $1\frac{2}{5}$ in head; caudal fin much rounded; least depth of caudal peduncle $2\frac{1}{5}$ in head, its length $1\frac{1}{2}$ in depth.

Color dark greenish olive, sides with 8 dark vertical bars, the first at front of spinous dorsal, the first three bars with indefinite outlines; middle of opercle black; a dark lateral band little wider than eye on side, seldom extending beyond end of pectoral fin; a dark bar from eyes across snout, one on interorbital region, and 2 others between nape and origin of dorsal fin; soft dorsal and anal and caudal fins profusely spotted with black; a dark band along middle of spinous dorsal, a second band above this from tenth spine to soft dorsal; ventrals dusky, a black ocellated spot at base of caudal above lateral line. Length about 12 inches.

Named for Mr. D. W. Hedrick, who superintended the construction of the large railroad bridges between Vera Cruz and Santa Lucretia, in recognition of the favors received through his courtesies.

196. *Cichlasoma pavonaceum* (Garman).

Heros pavonaceus Garman, Bull. Mus. Comp. Zoöl., 1881, 93;
Spring near Monclova, Coahuila: Jordan & Evermann, Bull.
47, U. S. Nat. Mus., 1896, 1538.

Known only from the type locality.

Head $2\frac{2}{3}$; depth $2\frac{2}{3}$; D. xvi, 12; A. v, 8; scales 5-32-12. Body rather elongate; head as deep as long; eye large, wider than pre-

orbital, its front behind tip of maxillary; jaws equal; 5 rows of scales on the cheek; fifth dorsal spine the highest; soft dorsal and anal reaching caudal; tip of pectorals reaching vent.

Color dark brown flecked with pale; 4 to 7 ocellated, vertically expanded black spots on side below dorsal fin; an ocellated black spot on base of tail above lateral line; side with 10 or 12 faint dark cross bands. (Garman.)

197. *Cichlasoma beani* (Jordan).

Heros beani Jordan, Proc. U. S. Nat. Mus., 1888, 332; Rio Presidio, near Mazatlan: Jordan, Proc. Cal. Acad. Sci., 1895, 473; Rio Presidio: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 1539; Evermann, Proc. Biol. Soc. Wash., 1898, 2; Rosario, Sinaloa.

Lowland streams of Sinaloa and Jalisco.

Head 3; depth $2\frac{1}{3}$; D. xv, 11; A. v, 8; scales 5-29-11. Body oblong, compressed; head small, profile depressed at interorbital area, which is flat or slightly concave, its width $2\frac{2}{3}$ in head; snout rather pointed; lower jaw the longer; mouth moderate, maxillary 3 in head; outer series of teeth enlarged, those in front on upper jaw canine-like; preorbital 4 in head; postorbital $2\frac{1}{5}$; lips rather thin, the lower without a frenum; scales on cheeks in about 5 rows; spinous dorsal low, the eighth spine $3\frac{1}{3}$ in head, the last $2\frac{3}{4}$; middle rays of dorsal and anal much produced, their tips reaching nearly to tip of caudal fin; pectorals $1\frac{1}{3}$ in head; ventrals with rays produced, their tips reaching base of third anal spine; caudal fin rounded; least depth of caudal peduncle $2\frac{1}{4}$ in head, its length $1\frac{1}{4}$ in its least depth.

Color light olive, the scales with light margins, giving the fish a spotted appearance; round brownish spots on dorsal, caudal, and anal fins; ventrals dusky, the pectorals pale; a light line obliquely downward and forward to maxillary. Length about 12 inches.

Through the courtesy of Mr. B. A. Bean, I have been permitted to examine 5 specimens of this species, which were taken at Tepic, December, 1902. It is reported to be an excellent food fish.

198. *Cichlasoma steindachneri* Jordan & Snyder.

Cichlasoma steindachneri Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 143, fig. 20; Rio Verde, Rascon, San Luis Potosi: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3173.

Basin of the Rio Panuco. (Forlon; Valles; Rascon.)

Head $2\frac{2}{3}$; depth $2\frac{1}{3}$; D. xv or xvi, 10; A. v, 7; scales 6-32-11. Body rather elongate, compressed; profile convex, not steep; head

pointed, upper jaw slightly the longer; lips thick, the lower with a well developed frenum; outer series of teeth enlarged, canine-like; mouth rather large; maxillary $3\frac{1}{3}$ in head; mandible 2; preorbital $3\frac{1}{2}$ to 4; postorbital $2\frac{1}{2}$; snout $2\frac{1}{3}$; interorbital very convex, $3\frac{3}{4}$ in head;

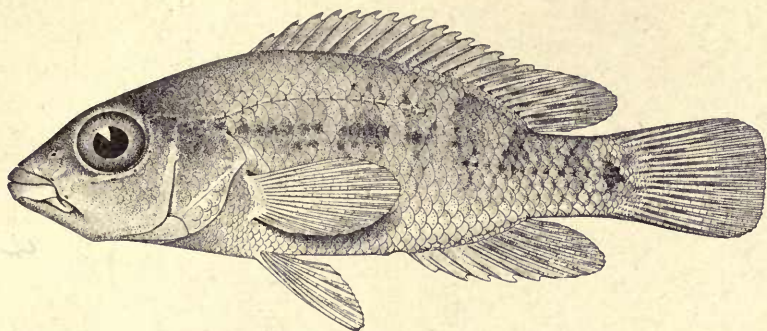


FIG. 67. *CICHLASOMA STEINDACHNERI* Jordan & Snyder.
No. 6164, Leland Stanford Jr. University.

cheeks with about 7 rows of scales; dorsal spines rather low, the eighth $3\frac{1}{3}$ in head, the last $2\frac{3}{4}$; dorsal and anal rays not produced, their tips scarcely reaching past base of caudal fin; pectoral fin $1\frac{1}{2}$ in head; ventral with rays not produced, their tips not reaching first anal spine; no scales on base of soft dorsal and anal fins; caudal fin slightly rounded; least depth of caudal peduncle $2\frac{1}{2}$ in head, its length equal to its depth.

Color light brownish; sides with about 9 or 10 vertical dark bars; a dark, irregular band from upper edge of opercle to base of caudal; this band more or less broken between the bars; a black spot on middle of base of caudal; sides of head usually profusely speckled with dark dots; a few of these dots on the lower half of the body; an indefinite oblong blotch on middle of spinous dorsal; base of vertical fins with a few dark spots. Length about 8 inches.

199. *Cichlasoma bartoni* (Bean).

Acara bartoni Bean, Proc. U. S. Nat. Mus. 1892, pl. XLIV, fig. 3, 286; Huasteca Potosina, San Luis Potosi, Mexico.

Cichlasoma bartoni Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 1515.

Heros labridens Pellegrin, Bull. Mus. Hist. Nat. Paris, 1903, 120; Huasteca Potosi.

Basin of the Rio Panuco. (Rio Verde.)

Head $2\frac{3}{4}$; depth $2\frac{1}{2}$; D. xv or xvi, 19 or 11; A. v, 9; scales 7-30-11. Body elongate, rather deep, compressed; profile convex, not very

steep, snout pointed; jaws equal; lips thick, the lower with a distinct frenum; mouth rather small, maxillary $3\frac{1}{2}$ in head; mandible $2\frac{3}{8}$; snout $2\frac{1}{2}$; preorbital 4 in head; postorbital $2\frac{1}{10}$ in head; interorbital convex $3\frac{1}{8}$ in head; diameter of eye 4 in head; eighth dorsal spine

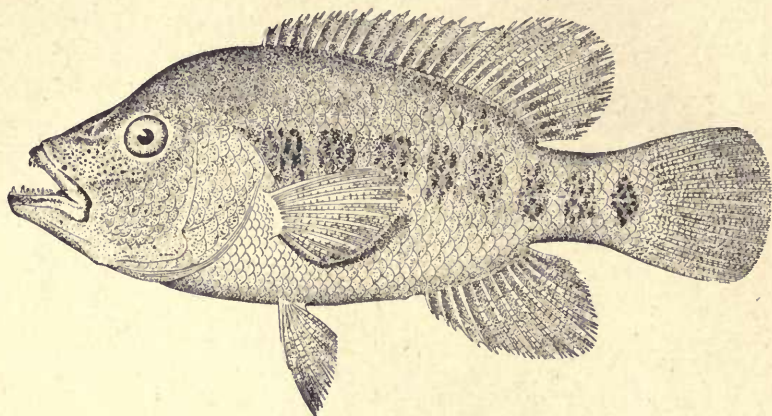


FIG. 68. *CICHLASOMA BARTONI* Bean.

$2\frac{4}{5}$ in head, last dorsal spine $2\frac{2}{3}$ in head; middle rays of dorsal fin not produced, their tips reaching slightly beyond base of caudal fin; pectoral fin $1\frac{1}{4}$ in head; ventral rays not produced; length of ventral $1\frac{1}{3}$ in head, tips not reaching first anal spine; caudal fin rounded; least depth of caudal peduncle $2\frac{1}{8}$; its length $1\frac{1}{8}$ in its depth.

Color dark brownish, sides with about 6 dark indistinct vertical bars; no lateral band, or a very faint one; a dark caudal spot, sides of head usually with small dark dots, these sometimes forming reticulations on sides of head and above it; very few or no dark dots on soft dorsal, anal, or caudal fins. Length about 8 to 10 inches.

This species is more robust and has a less pointed snout than *Cichlasoma steindachneri*, which it most resembles. It has coarse, blunt pharyngeal teeth. A number of specimens examined by me were taken in the Rio Verde at Rio Verde by Dr. W. L. Tower of the University of Chicago.

200. *Cichlasoma istlanum* (Jordan & Snyder).

Heros istlanus Jordan & Snyder, Bull. U. S. Fish Comm. 1900, 144, fig. 21; Rio Ixtla, at Puente de Ixtla: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3174; Meek, Field Col. Mus. Pub. 65, 1902, 120; Rio Ixtla; Puente de Ixtla, Morelos; Rio Balsas, Balsas Guerrero.

Basin of the Rio Balsas. (Yautepec; Jojutla; Chietla; Papayo, Guerrero, collected by E. W. Nelson.)

Head $2\frac{4}{5}$; depth $2\frac{1}{2}$ to $2\frac{3}{4}$; D. xv or xvi, 10 or 11; A. v or vi, 7 or 8. Body elongate, compressed; head large, mouth large and strong; maxillary $2\frac{2}{3}$ in head; the lower jaw the longer; teeth in the outer series of both jaws enlarged, not numerous; lips thick, no frenum

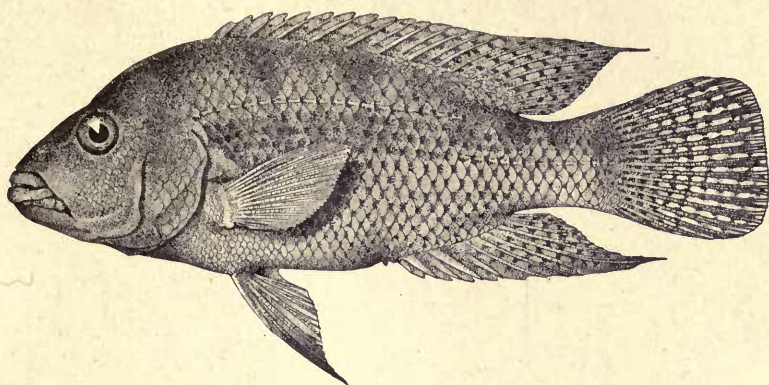


FIG. 69. *CICHLASOMA ISTLANUM* (Jordan & Snyder).
No. 6150, Leland Stanford Jr. University.

in some specimens, a partial one in others; mandible $2\frac{1}{3}$ in head; snout $3\frac{2}{3}$; interorbital convex, $2\frac{4}{5}$ in head; preorbital $3\frac{1}{2}$; postorbital $2\frac{1}{4}$; diameter of eye $4\frac{1}{2}$; cheeks with about 6 rows of scales; eighth dorsal spine $3\frac{1}{3}$ in head; the last spine $2\frac{2}{3}$ to 3; middle rays of dorsal and anal produced, sometimes reaching past middle of caudal fin; pectoral fin $1\frac{2}{3}$ in head; ventral fins with rays produced into a filament in larger specimens, the tips reaching second anal spine; in specimens where the rays are not produced the tips of the caudal fin do not reach origin of the anal; caudal fin rounded, the least depth of caudal peduncle $2\frac{1}{3}$ in head, its length slightly less than depth.

Color nearly black to a light brownish, each scale with an oblong dark spot in the center; traces on the smaller and lighter individuals of about 7 dark vertical bars; smaller individuals (less than 4 inches) have a black spot on middle of the side, one at base of caudal and one at upper edge of gill opening; dorsal, caudal, and anal fins spotted with black; in some specimens the spots on scales very prominent, forming longitudinal lines on lower half of the body. Length about 12 inches.

This species is very abundant in the Balsas Basin, and at present is the only member of the family known from it. It is quite variable in color, some specimens from Yautepec being nearly black on the lower half of the body, or with scattered black blotches. The nuchal hump is developed quite well in males 7 inches in length. In the specimens from Yautepec the ovaries are little developed and give no

evidence of approximate spawning time. This species and the large catfish found in the Balsas Basin are the most important food fishes of that region.

201. *Cichlasoma evermanni* sp. nov.

Type, No. 4227, F. C. M., 5.25 inches in length; Tehuantepec, Oaxaca. (Tehuantepec.)

Rio Tehuantepec. (Tehuantepec.)

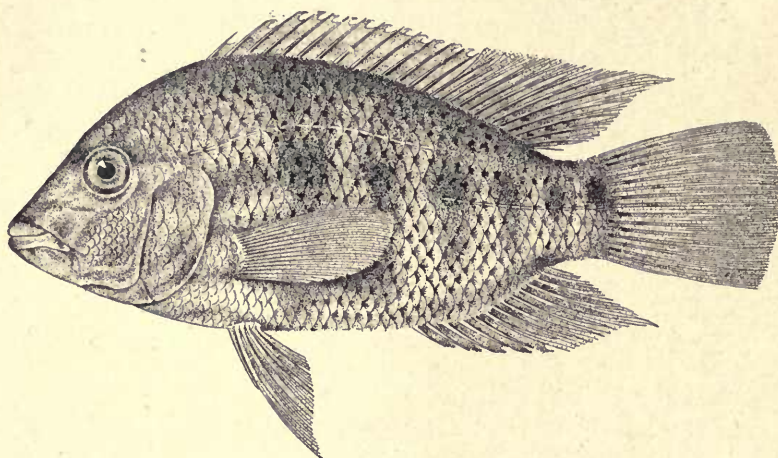


FIG. 70. *CICHLASOMA EVERMANNI* Meek.

Head $2\frac{2}{3}$; depth $2\frac{1}{6}$; D. XIV or XV, 13 to 15; A. V, 8 or 9; scales 7-32-12. Body deep, compressed; the profile rather steep, its anterior half slightly concave, the posterior half convex; mouth rather large, the maxillary $3\frac{1}{6}$ in head, its tip not quite reaching vertical from anterior margin of the eye; jaws equal; teeth in each jaw in a band, the anterior row slightly enlarged; lips moderately thick, the lower with no distinct frenum, though not quite so free at the symphysis as laterally; preorbital broad, $3\frac{1}{6}$ in head; postorbital $2\frac{2}{3}$; interorbital $2\frac{3}{4}$; diameter of eye $3\frac{3}{4}$ to 4 in head; cheeks with 5 rows of scales; origin of dorsal to tip of snout $2\frac{1}{3}$ in the body; dorsal spines gradually increasing in size to about fifth, longest (eighth) 3 in head; in the largest specimens (5 inches in length) the middle rays of the dorsal are produced, their tips reaching past the middle of the caudal fin; in smallest specimens (4 inches in length) tips of dorsal and anal rays reach slightly past base of anal; pectoral fin $1\frac{1}{2}$ in head; ventral with the tips produced in the larger individuals; tips in the young scarcely reaching base of first anal spine, in adults to fourth anal spine; caudal fin truncate; caudal peduncle deep, its least depth 2 in head, its length $1\frac{1}{2}$ in its least depth.

Color dark olivaceous, sides with 6 dark vertical bars, each wider than the interspaces, the first bar across opercle, the second one begins at base of fourth anal spine; no lateral band, or a very indistinct one; no definite blotches on sides; a small black caudal spot just above lateral line; vertical fins with some small black spots, or none on darker specimens; fins all dusky; no bars on profile; many scales have dark centers. Length about 8 inches. Several specimens taken at Tehuantepec.

Named for Dr. Barton W. Evermann, in recognition of his services to American Ichthyology.

202. *Cichlasoma heterodontum* (Vaillant & Pellegrin).

Heros heterodontus Vaillant & Pellegrin, Bull. Mus. Nat. Hist. Paris, 1902, 85; Isthmus of Tehuantepec.

Isthmus of Tehuantepec.

Head $3\frac{3}{4}$; depth 2; D. XIV-XV, 12; A. V, 9; scales 6-28-14. Body deep; jaws subequal; lower lip with a frenum; the teeth in outer series dissimilar, few cylindro-conical, the others simply cylindrical, with worn tips, being intermediate between this genus and *Neetroplus*; eye $3\frac{1}{2}$ in the head, $1\frac{1}{4}$ in interorbital space, $1\frac{1}{2}$ to $1\frac{2}{3}$ in the length of the snout; cheeks with 5 rows of scales; dorsal spines gradually increase to the fifth; the last anal spine is as long and stronger than the last dorsal spine; caudal fin rounded; base of soft parts of unpaired fins scaly; pectoral more than $\frac{3}{4}$ length of the head.

Color brownish, with traces of 6 dark transverse bands and a dark caudal spot; the fins dark with some darker punctulations. Length about 5 inches (Vaillant & Pellegrin).

203. *Cichlasoma cyanoguttatum* (Baird & Girard).

Herichthys cyanoguttatus Baird & Girard, Proc. Acad. Nat. Sci. Phila., 1854, 25; Rio Grande, Brownsville, Texas: Girard, Mex. Bd. Sur., 30, pl. IV, figs. 9-12, 1859; Laguna, Ft. Brown, Texas; Matamoras, Mexico; Rio San Juan, near Cadereita and Cadereita, Nuevo Leon.

Heros cyanoguttatus Jordan & Evermann, Bull. 47, U. S. Nat. Mus. 1896, 1537; Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 144; lagoons at Tampico.

Heros temporatus Fowler, Proc. Acad. Nat. Sci. Phila., 1903, 321; Victoria, Tamaulipas.

Atlantic coast rivers from Texas to the Rio Panuco and Tabasco. (Monterey; Montemorelos; San Juan; Linares; La Cruz; Garza Valdez; Santa Engracia; Victoria; Forlon; Rascon.)

Head 3; depth $2\frac{1}{4}$; D. XVI, 10 or 11; A. V, 8 or 9; scales 7-33-12.

Body deep, compressed; profile with a quite even curve, except in males with the nuchal hump; mouth moderate; maxillary $2\frac{3}{4}$ in head; mandible $2\frac{1}{2}$; jaws equal, or the lower the longer in males; outer series of teeth conical, enlarged; lips moderately thick, the lower with a frenum; preorbital $2\frac{5}{8}$ in head; postorbital $2\frac{1}{4}$; interorbital very convex, $2\frac{1}{4}$ in head; diameter of eye $4\frac{1}{4}$ in head; cheeks with 5 rows of scales; eighth dorsal spine $2\frac{2}{3}$ in head; last dorsal spine $2\frac{1}{10}$; the middle rays of dorsal and anal produced, reaching in the male slightly past the middle of the caudal fin, in female to about middle of caudal fin; pectoral fin $2\frac{1}{3}$ in head; ventral with their rays produced, their tips reaching third anal spine; ventrals slightly longer than the head; caudal fin rounded; least depth $1\frac{5}{8}$ in head; length of caudal peduncle $1\frac{3}{8}$ in the depth.

Color olivaceous, 5 indistinct dark bars on the posterior half of the body; a black caudal spot, slightly more than half above the lateral line; many small white spots on sides, being most numerous on head ventral surface, head and caudal peduncle; white spots on vertical fins, being most numerous on the base of soft dorsal and anal, and on caudal fin; ventrals black or very dark; pectorals light. Many half grown and adult individuals with posterior half of body and ventral region below base of pectoral fin black. Males of this species, 7 inches long and over, have a well developed nuchal hump. Length about 12 inches.

At La Cruz I succeeded in catching a large number of adults of this species. Many of the smaller males and all of the females had no nuchal hump. All of the larger males had the hump more or less developed. The sexual organs of the males were undeveloped. The ovaries of the females of some specimens were a little more developed than in others, but none were at all near the spawning period, and there was no evidence that would indicate the approximate time of spawning.

204. *Cichlasoma rectangulare* (Steindachner).

Acara rectangularis Steindachner, Chromiden Mexico, 1864, 1; Mexico.

Cichlasoma rectangulare Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 1515.

Distribution unknown.

Head $3\frac{1}{4}$; depth $2\frac{2}{3}$; D. XVI, 13; A. IV, 11; scales 21-33. Body moderately elongate, the back considerably arched; profile depressed before the eye, which is in the middle of the head; maxillary reaching front of eye; outer teeth large, somewhat canine-like; lower lip with a frenum; eye $4\frac{2}{3}$ in head; preorbital $3\frac{1}{3}$ in head; 7 rows of scales on

the cheek; dorsal spines rather low and strong; soft dorsal and anal moderately high and pointed; ventrals longer than pectoral, $1\frac{1}{10}$ in head; soft dorsal and anal with small scales at base; caudal fin rounded.

Color dark brown; a narrow brown vertical streak on each scale posteriorly; a broad blackish band beginning behind eye running backward along body to opposite first soft ray of anal, then turning abruptly to base of caudal; soft dorsal and caudal with alternate rows of yellow and dirty blue spots on the membranes; fins mostly bluish, dotted with black. Length $7\frac{1}{2}$ inches (Steindachner).

Known only from the above account.

205. *Cichlasoma mojarra* sp. nov.

Type, No. 4718, F. C. M., 2.35 inches in length; San Geronimo, Oaxaca.

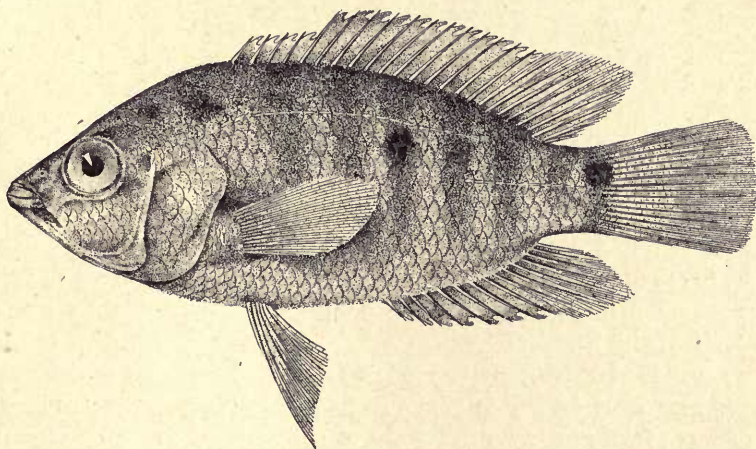


FIG. 71. *CICHLASOMA MOJARRA* Meek.

Head $2\frac{2}{3}$; depth $2\frac{1}{3}$; D. XVI, 10; A. VIII, 7; scales 8-32-12. Body elliptical, compressed; profile with a slight angle between eyes, and slightly convex from nape to dorsal fin; mouth moderate, maxillary 3 in head; snout $3\frac{1}{4}$ in head; lips rather thick, the lower without trace of a frenum; jaws equal; mandible $2\frac{1}{4}$ in head; teeth conical, a few in front canine-like; preorbital narrow, $4\frac{3}{4}$ in head; postorbital $2\frac{1}{6}$ in head; interorbital $3\frac{1}{3}$ in head; cheeks with 5 rows of scales; opercles scaly; diameter of eye $2\frac{5}{8}$ in head; origin of dorsal to tip of snout $2\frac{1}{3}$ in the body; the first four dorsal spines low, the fourth about $\frac{2}{3}$ the length of the fifth, longest (eighth) dorsal spine $2\frac{5}{8}$ in head; dorsal rays not produced, the longest $1\frac{5}{8}$ in head; tip of dorsal opposite tips of anal when the fins are deflexed; the dorsal and anal rays reaching about $\frac{1}{4}$ distance to base of caudal fin; pectorals $1\frac{2}{3}$ in head; ventrals

$1\frac{1}{3}$ in head, their tips slightly produced and reaching base of fourth anal spine; caudal fin rounded; caudal peduncle deep, its least depth $2\frac{1}{3}$ in head; length of caudal peduncle about $1\frac{1}{2}$ in its least depth.

Color light brownish, sides with 7 dark vertical bars, each wider than the interspaces, the first bar across nape ending in a dark humeral spot about $\frac{2}{3}$ size of eye, the second bar at base of first four dorsal spines, the last bar on caudal peduncle; a dark ocellated spot at base of caudal slightly above middle; a dark spot on fourth caudal bar below lateral line; tips of ventrals and anal blackish; interorbital area dark; a dark bar on nape in front of the one ending in a humeral spot.

206. *Cichlasoma octofasciatum* (Regan).

Heros cyanoguttatus Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 157; Montecristo, Tabasco.

Heros octofasciatus Regan, Ann. Mus. Hist. Nat. Geneva, 1903, 417, pl. 13, fig. 1; Mexico.

Southern Mexico to Honduras.

Head $2\frac{3}{5}$; depth 2; D. xvii to xix-8 to 10; A. viii to x-8 to 10; scales 5-29-12 to 14. Body deep, compressed; snout short, about as long as diameter of eye; lower lip with a frenum; eye large, 3 (young) to $4\frac{1}{3}$ in head, and equaling interorbital width; preorbital straight, its width $\frac{1}{2}$ to $\frac{3}{5}$ diameter of eye; dorsal spines gradually increasing to the seventh, the others subequal; pectoral $1\frac{1}{4}$ in head; tips of ventrals reaching fourth anal spine; caudal peduncle short, its depth $1\frac{3}{4}$ to $2\frac{1}{4}$ times its length.

Color, seven obscure dark bands on sides, another at base of caudal fin; a black spot on third band just below lateral line; a similar but smaller spot on upper half of base of caudal; soft parts of unpaired fins obscurely spotted; usually some light blue spots on the head, and one on each scale of side of body. Length 5 inches. (Regan.)

207. *Cichlasoma parma* (Günther).

Heros parma Günther, Cat., iv, 285, 1862; Mexico and Guatemala: Günther, Fishes Cent. Amer., 449, 1869; Guatemala.

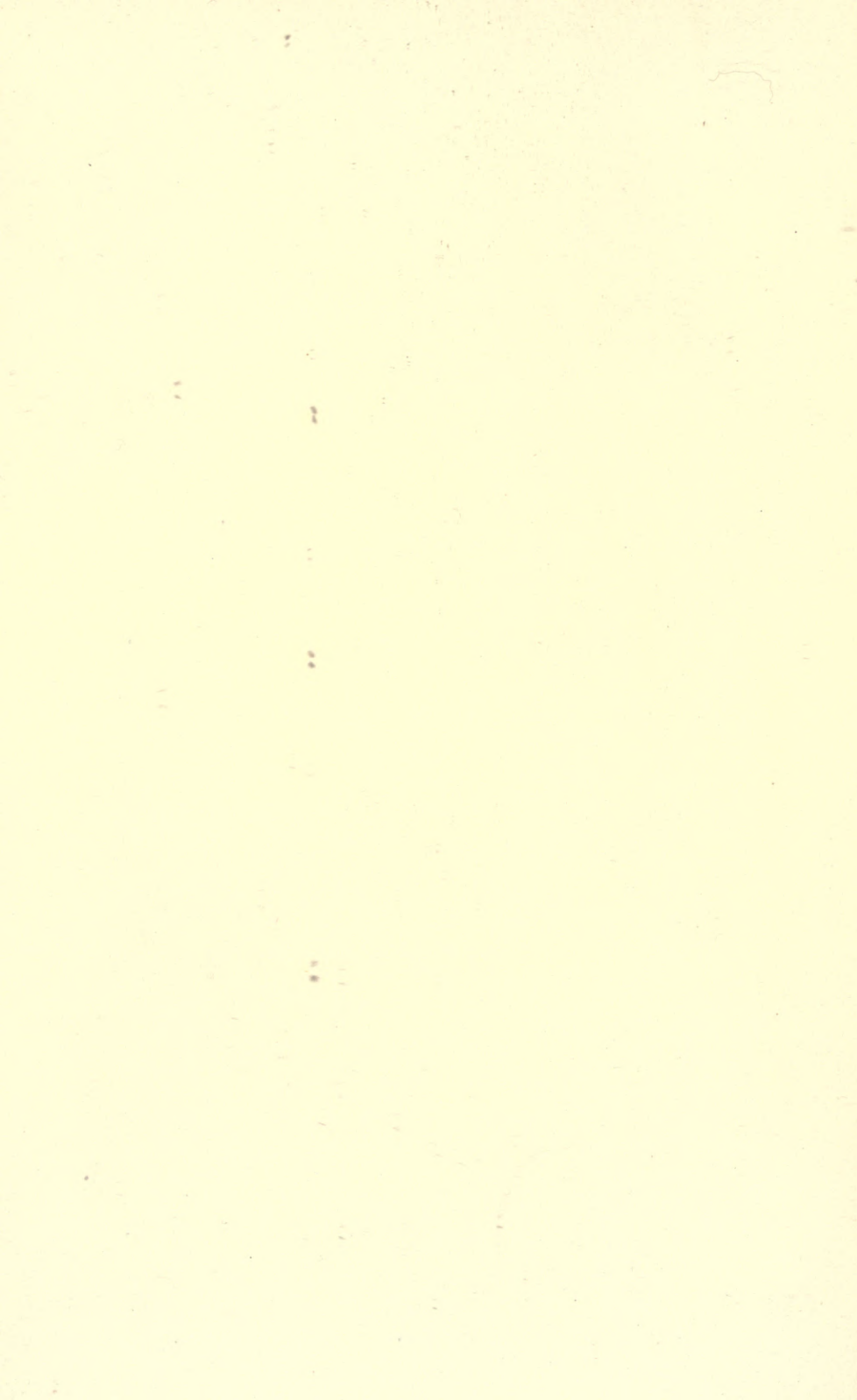
Cichlasoma parma Jordan & Evermann, Bull. 47, U. S. Fish Comm., 1896, 1519; Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 156; Montecristo: Meek, Field Col. Mus. Pub. 65, 1902, 120; La Antigua.

Large rivers of Mexico which empty into the Gulf south of Vera Cruz. (San Francisco; Vera Cruz; Boca del Rio; Obispo; Perez.)

Head 3; depth 2 to $2\frac{1}{4}$; D. xvi or xvii, 12 or 13; A. vi, 8 or 9; scales 7-33-12. Body rather deep, compressed, profile steep; mouth rather small, the maxillary not reaching vertical from anterior margin of the



CICHLASOMA PARMA (Günther).
No. 4570, Field Columbian Museum.



orbit; maxillary $3\frac{2}{3}$ in head; mandible $2\frac{2}{3}$ to 3; jaws equal; lips moderately thick, the lower with a frenum in large specimens (in small specimens, 5 inches or less, the frenum not complete); preorbital 4 in head; postorbital $2\frac{1}{2}$; diameter of eye $4\frac{1}{4}$; dorsal spines rather high, the eighth spine $2\frac{1}{4}$ in head, the last one 2; anal and dorsal rays not much produced, their tips reaching slightly beyond base of caudal fin; pectoral fin $1\frac{1}{4}$ in head; ventral $1\frac{1}{4}$, its rays slightly produced, the tips of longest reaching to first anal spine; least depth of caudal peduncle $2\frac{1}{4}$ in head, its length $1\frac{1}{3}$ in its depth; caudal fin rounded.

Color olivaceous with 7 dark vertical bars; an indistinct longitudinal band from opercle to base of caudal, ending in a dark spot at base of caudal fin; fins dusky. Length about 14 inches.

This species resembles *C. melanurus*. It is deeper and does not have a prominent lateral band. One of the most abundant species of Cichlids in southern Mexico.

208. *Cichlasoma melanurum* (Günther).

Heros melanurus Günther, Cat., IV, 1862, 228; Lago de Peten, Guatemala: Günther, Fish. Cent. Amer. 450, pl. 72, fig. 3, 1869; Lago de Peten, Guatemala.

Heros fenestratus B. A. Bean, Proc. U. S. Nat. Mus. 1892, 541; Santa Maria, Vera Cruz.

Cichlasoma melanurum Jordan & Evermann, Bull. 47, U. S. Nat. Mus. 1896, 1523; Evermann & Goldsborough, Bull. U. S. Fish Comm., 1902, 157; Montecristo, Teapa: Meek, Field Col. Mus. Pub. 65, 1902, 120; Cuicatlan.

Large rivers of tropical America south of the city of Vera Cruz and Tehuantepec. (Vera Cruz; Otopa; Motzorongo; Obispo; Perez; San Geronimo.)

Head $3\frac{1}{4}$; depth $2\frac{1}{4}$ to $2\frac{1}{2}$; D. XVIII, 10; A. VI or VII; scales 6-34-11. Body elongate, moderately compressed, profile rather steep; head short; mouth moderate, the maxillary not reaching to vertical from anterior margin of the pupil, $3\frac{1}{2}$ in head; lips thick, a broad frenum in adult specimens, a shallow groove in young; upper jaw slightly the longer; preorbital $3\frac{1}{2}$ in head; postorbital $2\frac{1}{3}$; snout $2\frac{1}{2}$; mandible $2\frac{2}{3}$ to 3; diameter of eye $4\frac{1}{2}$; seventh or eighth dorsal spine $3\frac{1}{2}$ in head, last spine $2\frac{2}{3}$; dorsal and anal rays not much produced, their tips scarcely reaching past base of caudal; pectoral fin $1\frac{1}{3}$ in head; tips of ventrals not reaching anal, $1\frac{1}{3}$ in head; caudal fin rounded; least depth of caudal peduncle $2\frac{1}{4}$ in head, its length $1\frac{1}{4}$ in its least depth.

Color dark olivaceous; sides with about 7 black vertical bars, each narrower than the interspaces, sometimes the bands are not all dis-

tinged; a broad lateral band running from just above pectoral to middle of caudal peduncle; no black caudal spot; fins dusky, unicolor. Length about 15 inches.

This species resembles *Cichlasoma parma*, but it is more slender, and the dark lateral band is much more prominent.

209. *Cichlasoma eigenmanni* Meek.

Cichlasoma eigenmanni Meek, Field Col. Mus. Pub. 65, 1902, 119; Venta Salada.

Upper tributaries of the Rio Papaloapam.

Head $3\frac{1}{3}$; depth $2\frac{2}{3}$; D. XVII, 14; A. V, 10; scales 6-33-11. Body elongate; profile convex, not very steep; mouth small, low, terminal; jaws subequal; maxillary not reaching anterior margin of orbit; its length $3\frac{3}{8}$ in head; mandible $3\frac{1}{3}$ in head; preorbital $3\frac{2}{3}$ in head; postorbital $2\frac{1}{2}$; snout $2\frac{1}{3}$; lips thin, the lower with a broad frenum; eighth dorsal spine $2\frac{2}{3}$ in head, the last spine $2\frac{1}{3}$; dorsal and anal rays not produced, their tips scarcely reaching base of caudal; pectoral $1\frac{1}{3}$ in head; ventral $1\frac{2}{3}$, their tips not reaching vent; least depth of caudal peduncle $2\frac{1}{3}$ in head, its length being about $\frac{1}{3}$ greater than its depth.

Color brownish, six indistinct dark bands on sides; a dark lateral band which ends in a black spot at base of caudal; fins all plain. Length 7 inches or over.

210. *Cichlasoma nebulifer* (Günther).

Chromis nebulifer Günther, Proc. Zool. Soc. London, 1860, 318; Mexico.

Heros nebulifer Günther, Cat., IV, 297, 1860; Mexico.

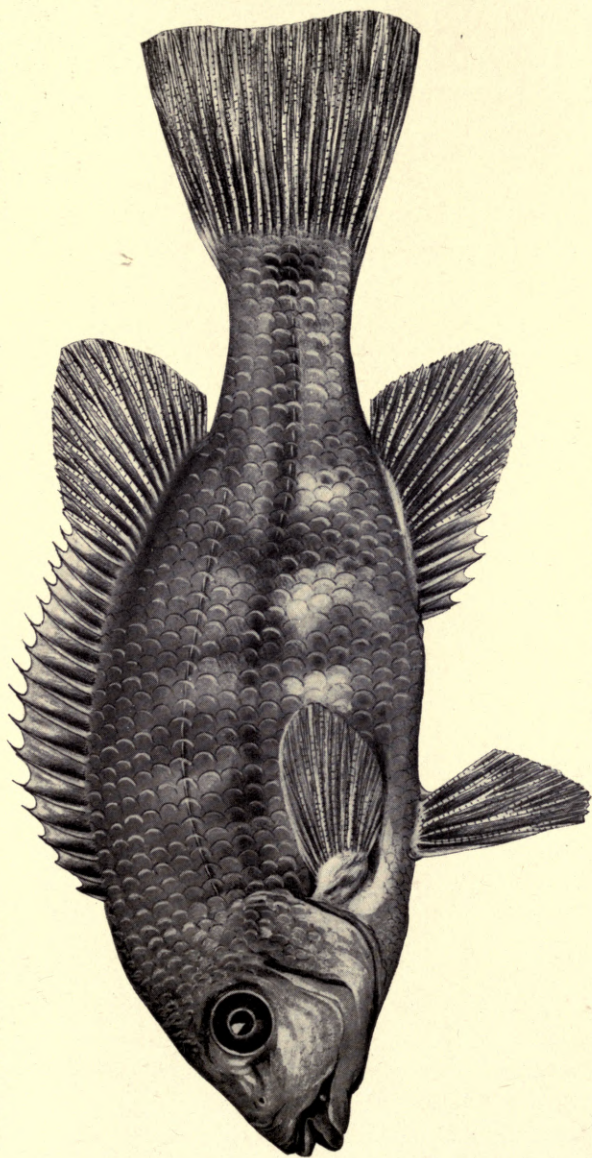
Cichlasoma nebuliferum Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 1524.

Eastern lowland streams of the Isthmus of Tehuantepec. (San Juan Evangelista.)

Head $3\frac{3}{8}$; depth $2\frac{2}{3}$; D. XVII or XVIII, 10 or 11; A. VI, 8 or 9; scales 6-36-11. Body elongate, much compressed; profile much curved, its anterior half very steep; mouth small, subinferior, maxillary 4 in head; mandible $3\frac{1}{2}$; lips moderately thick, the lower with a broad frenum; jaws equal, the anterior teeth rather strong; about 5 rows of embedded scales on the cheeks; preorbital $2\frac{4}{5}$ in head; postorbital $2\frac{1}{4}$; interorbital very convex, $2\frac{1}{2}$ in head; diameter of eye 4 in head; dorsal spines rather high, eighth $2\frac{1}{3}$ in head, the last spine $2\frac{1}{8}$; middle rays of dorsal not produced, their tips reaching base of caudal; pectoral $1\frac{2}{3}$ in head; ventral rays not produced, their tips not reaching to first anal spine; ventral $1\frac{1}{4}$ in head; caudal fin truncate; least depth of caudal peduncle $2\frac{1}{8}$ in head, its length about $\frac{1}{8}$ greater than its depth.

FIELD COLUMBIAN MUSEUM.

PLATE XVI, ZOOLOGY.



CICHLASOMA EIGENMANNI Meek.
No. 3712, Field Columbian Museum.

Color light olivaceous, sides with about 6 indistinct vertical bands; side with a dark lateral band on middle of side, ending in a large black caudal spot; fins rather dark and without spots or any markings. Length about 14 inches.

NOTE.—The two following descriptions are too brief to indicate their position in the preceding list.

Cichlasoma deppii (Heckel).

Heros deppii Heckel, Brasil. Fluss-Fische, 382, 1840; Mexico: Günther, Cat., IV, 29, 1862.

Cichlasoma deppii Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 1524.

Head $3\frac{3}{4}$; depth 3; D. XVII, 10; A. VI, 8; scales 17–30. Lower lip with a frenum; 6 rows of scales on the cheek; dorsal spines 4 in head.

Color brownish; tail with 6 obsolete dark cross bands, the last with a black spot. (Heckel.)

Cichlasoma montezuma (Heckel).

Heros montezuma Heckel, Brazil. Fluss-Fische, 1840, 383; Mexico: Günther, Cat., IV, 296, 1862.

Cichlasoma montezuma Jordan & Evermann, Bull. 47, U. S. Fish Comm., 1896, 1518.

D. XVI, 11; A. V, ?; scales 30. Lower lip with a frenum; 5 rows of scales on the cheek; body with 6 dark cross bands, the last around root of caudal and marked with a black spot. (Heckel.)

82. *Neetroplus* Günther.

Neetroplus Günther, Fish. Cent. America, 469, 1869. (Type, *Neetroplus nematops* Günther.)

This genus differs from *Cichlasoma* chiefly in having anteriorly a row of flat, incisor-like teeth, behind which is a band of villiform teeth.

In the numerous specimens of *Neetroplus carpintis* examined by me, the incisor-like teeth are not always evident, which indicates some doubt as to the validity of the genus.

211. *Neetroplus carpintis* Jordan & Snyder.

Neetroplus carpintis Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 146, fig. 22; Laguna de Carpinte, Tampico; Rio Verde Rascon: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3175.

Lowland streams of northeastern Mexico, Rio Panuco to the Rio Grande, abundant. (San Juan; Linares; Garza Valdez; La Cruz; Santa Engracia; Victoria; Forlon; Valles.)

Head 3; depth $1\frac{1}{2}$ to 2; D. XVI, 10; A. V, 8 or 9; scales 7–33–12. Body deep, much compressed; profile convex, quite steep; interorbital convex, $2\frac{1}{3}$ in head; mouth moderate, maxillary $3\frac{1}{4}$ in head; mandible $2\frac{1}{4}$; preorbital $2\frac{3}{8}$; postorbital $2\frac{1}{3}$; snout $2\frac{1}{3}$; diameter of eye $4\frac{1}{4}$ in head; jaws equal; outer series of teeth enlarged, some being more or less incisor-like; lips thick, the lower with a narrow, well developed frenum; cheeks with about 5 rows of scales; eighth dorsal spine

2 in head, the last spine $1\frac{3}{4}$; middle rays of dorsal and anal fins produced, their tips in females reaching about middle of caudal, in the larger males to within $\frac{1}{4}$ of tip of caudal; pectoral fin $1\frac{1}{2}$ in head; ventral fins produced, their tips reaching base of third anal spine, the fin being slightly longer than the head; caudal fin rounded; least depth of caudal peduncle 2 in head, its length $1\frac{3}{4}$ in its depth.

Color dark brownish, about 5 dark vertical bands on posterior half of the body; a black caudal spot about $\frac{2}{3}$ of which is above the lateral line; soft dorsal, soft anal and caudal fin with some transparent blotches; a few dark spots about $\frac{1}{2}$ size of pupil on upper anterior half of body, a few smaller dark dots on cheek and preorbital areas; under side of head, breast, base of pectoral and ventrals nearly black.

The larger males (9 inches in length) have a well developed nuchal hump. Length about 12 inches.

83. *Thorichthys* gen. nov.

Type, *Thorichthys ellioti* Meek.

Body deep, much compressed; mouth rather small; caudal fin lunate, its outer rays produced into a filament; pectoral fin long and pointed, about as long or longer than head; subopercle with a black blotch, otherwise as in *Cichlasoma*. (*θρῶσσω*, to leap, *ἰχθυς*, fish.)

On all specimens of this group collected by me there is no trace of a nuchal hump. Individuals of the two species here listed from southern Mexico are not large, as none of those collected by me exceeds a length of 6 inches. These two species are very variable, though they represent a quite distinct type of Cichlids. The following species from Mexico and Central America apparently belong to this group:

Thorichthys aureus (Günther), Rio Motagua and at Yzabel, Guatemala.

Thorichthys affinis (Günther), Lake Peten, Guatemala.

Thorichthys fredrichsthalii (Heckel), Rio San Juan, Nicaragua.

Thorichthys rostratus (Gill & Bransford), Lake Nicaragua.

Thorichthys longimanus (Günther), Lake Nicaragua.

KEY TO THE SPECIES OF THORICHTHYS.

- | | |
|--|--------------------|
| a. Dorsal spines high, longest $1\frac{1}{2}$ to 2 in head; | PAGE |
| cheeks with small blue spots:..... | <i>helleri</i> 223 |
| aa. Dorsal spines lower, the longest $2\frac{2}{3}$ in head; | |
| cheeks with black spots, some of which are | |
| large as pupil..... | <i>ellioti</i> 223 |

212. *Thorichthys helleri* (Steindachner).

Heros helleri Steindachner, Chromiden Mexico, 1864, 8; Rio Teapa, Tabasco, Mexico.

Cichlasoma helleri Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 1521.

Heros maculipinnis Steindachner, Chromiden Mexico, 1864, 13; Rio Zanopa, Mexico: B. A. Bean, Proc. U. S. Nat. Mus., 1892, 541; Santa Maria, Vera Cruz: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 1529.

Lowland streams of Mexico which empty into the Gulf south of the city of Vera Cruz. (Otopa; El Hule; Obispo; Perez; San Juan Evangelista.)

Head $2\frac{2}{3}$; depth 2 to $2\frac{1}{5}$; D. XVI or XVII, 9; A. VII or VIII—7 or 8; scales 6—30, 12. Body rather deep, much compressed; mouth moderate, maxillary $3\frac{1}{3}$ in head; lips rather thick, the lower with a frenum; jaws equal, outer series of teeth little enlarged; preorbital 3 to $3\frac{1}{5}$ in head; postorbital $2\frac{1}{4}$; interorbital 3; diameter of eye $3\frac{1}{3}$ in head; cheeks with about 5 rows of scales; eighth dorsal spine $2\frac{1}{8}$ in head; last dorsal spine $1\frac{4}{5}$ to 2; middle rays of soft dorsal and anal produced into a filament which extends about to or past middle of caudal fin; pectoral fin long and slender, pointed, its length equal to that of head; ventrals with their tips produced, reaching base of sixth anal spine, their length slightly more than the length of head; caudal fin lunate, the tips of outer rays produced into short filaments; least depth of caudal peduncle $2\frac{3}{5}$ in the head; its length $1\frac{4}{5}$ in its depth; gill rakers short, about 12 on first gill arch.

Color light olivaceous, sides with 6 rather indistinct dark cross-bars; a black blotch on third band below lateral line and at extremity of pectoral fin; a black blotch on opercle in front of pectoral fin; side of head with a few small blue spots, occasionally a few dark dots with blue centers; blue spots on soft dorsal, soft anal, and caudal fin; membrane of spinous dorsal slightly lighter near its tip. Length about 6 inches.

These little fishes are exceedingly numerous in small isolated ponds, especially where there is a considerable amount of vegetation. They are attracted by anything which enters the water and will jump out of it in an apparently playful mood. Where abundant they are easily caught in the hand, for as soon as your fingers touch the water they will come leaping toward you.

213. *Thorichthys ellioti* sp. nov.

Type, No. 4727, F. C. M., $5\frac{1}{2}$ inches in length; Motzorongo, Vera Cruz.

Head $2\frac{4}{5}$; depth $2\frac{1}{5}$ to $2\frac{1}{3}$; D. xvi or xvii, 8; A. vii to ix, 6 or 7; scales 7-30-13. Body rather elongate, compressed; profile nearly straight to nape, more curved from nape to first dorsal spine; mouth rather small, maxillary $3\frac{1}{3}$ in head; jaws equal, outer series of teeth

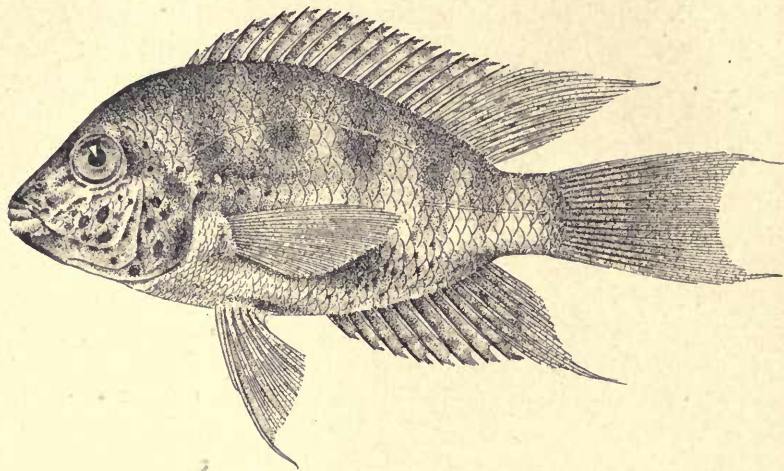


FIG. 72. *THORICHTHYS ELLIOTI* Meek.

little enlarged; lips thick, the lower with a frenum; preorbital 3 in head; postorbital $2\frac{1}{2}$; diameter of eye $3\frac{2}{3}$ in the head; eighth dorsal spine $2\frac{1}{2}$ in head; last spine $2\frac{2}{3}$; middle rays of dorsal produced in adults, their tips reaching to or past middle of caudal fin; pectoral long and rather slender, its length $1\frac{1}{5}$ in head; ventral with its rays produced, their tips reaching sixth anal spine; length of ventral $1\frac{1}{2}$ in head; caudal fin lunate, its outer ray usually produced into a short filament; least depth of caudal peduncle $2\frac{2}{3}$ in head, its length slightly less than its depth; gill rakers very short, about 12 on first gill arch.

Color dark olivaceous, sides with 6 indistinct cross-bars; a black blotch on side below lateral line at extremity of pectoral fin; no black caudal spot; a black blotch on opercle just in front of pectoral fin; cheeks with black spots, some of which have blue centers; some of these spots as large as the pupil; many of the scales on lower half of the sides have dark centers forming lateral stripes along the rows of scales; a few transparent spots on the soft dorsal, soft anal, and caudal fin; a light stripe near tip of spinous dorsal, a similar one on anal.

This species differs from *Thorichthys helleri* chiefly in having a darker color, and in having the large black spots on the side of the head; the dorsal fin is also lower, and the fish is more elongate.

Named for Professor D. G. Elliot, Curator of the Department of Zoölogy, Field Columbian Museum, whose kind interest and coöperation have much aided and encouraged the writer in the preparation of this paper.

Family XXII. **Gobiidæ.**

THE GOBIES; "ABOMAS."

Body oblong or elongate, naked or covered with ctenoid or cycloid scales; teeth usually small; premaxillaries protractile; suborbital without bony stay; opercle unarmed; preopercle unarmed or with a short spine; pseudobranchiæ present; gills 4, a slit behind the fourth; gill membranes united to the isthmus; no lateral line; dorsal fins connected or not; ventral fins close together, separate, or completely united, when united forming a sucking disk, a cross fold of skin at their base completing the cup; no pyloric cœca; usually no air bladder. Carnivorous fishes usually of small size living on the bottoms near shores in warm regions; some live in fresh water.

KEY TO THE GENERA OF GOBIIDÆ.

- | | | |
|-----|---|------------------------|
| a. | Ventral fins separate, the rays 1, 5; body scaly. | PAGE |
| b. | Vomer with a broad patch of villiform teeth;
skull above with conspicuous ridges..... | <i>Philypnus</i> 226 |
| bb. | Vomer without teeth, skull without crests. | |
| c. | Body short, rather deep; scales large, less
than 40 in the lateral series..... | <i>Dormitator</i> 227 |
| cc. | Body long and slender; scales small, more
than 40 in the lateral series..... | <i>Eleotris</i> 228 |
| aa. | Ventral fins united, forming a sort of disk
which is free from the belly. | |
| d. | Maxillary normal, not produced behind the
oval opening; supraoccipital and temporal
ridges continuous; scales ctenoid; dorsal
spines 6. | |
| f. | Inner edge of shoulder girdle without fleshy
dermal flaps; preorbital region short | <i>Gobius</i> 229 |
| ff. | Inner edge of shoulder girdle with 2 or 3
dermal flaps; preorbital region very long. | <i>Chonophorus</i> 232 |
| dd. | Maxillary much produced backward, ex-
tending beyond gill opening in the adult;
supraorbital and temporal crests not con-
tinuous; scales cycloid..... | <i>Gillichthys</i> 234 |

Subfamily **Eleotridinæ**.**84. *Philypnus* Cuvier & Valenciennes.**

METAPIL.

Philypnus Cuvier & Valenciennes, Hist. Nat. Poiss., XII, 255, 1837.

Type, *Gobiomorus dormitor* Lacépède.

Body elongate, terete anteriorly, compressed posteriorly; head elongate, much depressed above; mouth large, lower jaw much projecting; teeth in jaws small, slender, recurved, the outer scarcely enlarged; teeth on vomer villiform, in a broad, crescent-shaped patch; gill openings extending forward to below posterior angle of mouth; the isthmus very narrow; scales ctenoid, covering most of the head; no preopercular spine; ventral fins separate, the rays 1, 5.

214. *Philypnus dormitor* (Lacépède). METAPIL.

Gobiomorus dormitor Lacépède, Hist. Nat. Poiss., II, 599, 1798; Martinique.

Eleotris dormitatrix Günther, Cat., III, 119, 1861; Mexico.

Philypnus dormitor Girard, Mex. Bd. Sur., 29, pl. XII, fig. 13, 1859; mouth of the Rio Grande: Gill, Proc. Acad. Nat. Sci. Phila., 1860, 122; mouth of the Rio Grande: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2194; Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 147; lagoons near Tampico: Meek, Field Col. Mus. Pub., 65, 1902, 120; La Antigua.

Philypnus lateralis Gill, Proc. Acad. Nat. Sci. Phila., 1860, 123; Cape San Lucas: Jordan, Proc. Cal. Acad. Sci., 1895, 493; Rio Presidio and Astillero: Rutter, Proc. Cal. Acad. Sci., 1896, 264; fresh water at San Jose del Cabo, Lower California; Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2195; Rio Presidio, near Mazatlan, Mexico.

Gobiomorus dormitor B. A. Bean, Proc. U. S. Nat. Mus., 1898, 542; Dominica and Santa Maria, Vera Cruz.

Fresh water streams of tropical America, from Tamaulipas and Sonora to Panama, not found on the Mexican plateau. (Santa Engracia; Forlon; Valles; Rascon; San Francisco; Boca del Rio; Motzorongo; Obispo; Perez; Tehuantepec; La Vega, Tamaulipas [Evermann]).

Head $2\frac{3}{8}$ to 3; depth 5 to $5\frac{3}{4}$; D. VI-10; A. I, 9; scales 50 to 60. Body elongate, compressed posteriorly; head long, much depressed; mouth large, lower jaw projecting; interorbital area nearly flat, its width 4 in head; maxillary $2\frac{3}{8}$ to $2\frac{3}{4}$ in head, its tip reaching vertical from pupil; teeth on jaws in a band, depressible; diameter of eye 6 to 7 in head; distance from tip of snout to origin of dorsal $2\frac{1}{2}$ in body; pectoral $1\frac{2}{3}$ in head; ventral $2\frac{1}{6}$ in head; scales on entire body except

end of snout; those on anterior part of the body smaller than those on the posterior part.

Color dark brownish above, lighter below; an interrupted dark lateral band, in specimens a foot or more in length obsolete; anal and ventral fins pale, the other fins dusky and distinctly mottled; spinous dorsal margined with blackish; head often with dark spots. Length 2 feet or more.

Philypnus lateralis is said to differ from *Philypnus dormitor* in brighter color and the more distinct lateral band; young specimens in our collection from La Antigua have as distinct a lateral band as do specimens of the same size from Tehuantepec.

85. *Dormitor* Gill.

PUNECAS.

Dormitor Gill, Proc. Acad. Nat. Sci. Phila., 1862, 240. (Type, *Dormitor gundlachi* Gill.)

Body robust, somewhat compressed; head broad and flat above; mouth little oblique, lower jaw little projecting; teeth in jaws, none on vomer; lower pharyngeal teeth stiff and blunt, the bones with a broad, flexible, and lamelliform rudimentary gill filament; scales large, ctenoid; no preopercular spine; supraoccipital crest low.

215. *Dormitor maculatus* (Bloch). GUAVINA; PUNECAS; PARGETA; LA PAPEQUE.

Sciæna maculata Bloch, Ichth., pl. 299, fig. 2, 1790, West Indies.

Eleotris sima Cuvier & Valenciennes, Hist. Nat. Poiss., 232, 1837; Vera Cruz.

Eleotris maculata Günther, Cat., III, 112, 1861.

Eleotris somnolentus Girard, Proc. Acad. Nat. Sci. Phila., 1858, 169; near the mouth of the Rio Grande.

Dormitor maculatus Jordan, Proc. Cal. Acad. Sci., 1895, 493; Rio Presidio, near Mazatlan: Rutter, Proc. Cal. Acad. Sci., 1896, 265; Rio San Jose, San Jose del Cabo, Lower California: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2196.

West Indies, both coasts of America from South Carolina and Cape San Lucas to Panama and Para. (Boca del Rio; El Hule; Obispo; Perez.)

Head $3\frac{1}{2}$; depth $3\frac{1}{3}$; D. VII-1, 8; A. I, 9 or 10; scales 10-30. Body robust, somewhat compressed, profile much decurved; head broad, interorbital nearly flat, $1\frac{1}{2}$ in head; snout bluntish; mouth terminal, oblique, maxillary reaching vertical from anterior margin of orbit; teeth in jaws villiform, in bands; no teeth on vomer; eye 4

in head; origin of dorsal fin slightly nearer last ray of soft dorsal, $2\frac{1}{2}$ in body; pectoral nearly equaling length of head; ventral $1\frac{1}{3}$ in head; caudal fin rounded; least depth of caudal peduncle $1\frac{1}{8}$ in head.

Color brownish; sides with 8 or 9 light irregular bars running downward and slightly forward; a dark humeral blotch; a dark bar on base of pectoral; a dark streak below eye to posterior angle of the mouth; 2 to 4 dark bands from eye and below eye to posterior margin of preopercle; vertical fins more or less spotted with darker; haired fins without blotches. Length 1 to 2 feet.

This species usually inhabits salt or brackish water.

86. *Eleotris* Bloch & Schneider.

Eleotris Bloch & Schneider, Syst. Ichth., 65, 1801. (Type, *Gobius pisonis* Gmelin.)

Body elongate, slender, compressed posteriorly; head long, flattened above, without spines or crests, and almost entirely scaly; mouth large, oblique, the lower jaw projecting; lower pharyngeals rather broad, the teeth small, bluntish; preopercle with a small concealed spine below, its tip hooked forward; eyes small, high, anterior; isthmus broad; ventral fins separate, rays 1, 5; scales moderate, mostly ctenoid, 45 to 60 in the lateral series; vertebræ about 26.

A small group of fishes inhabiting warm seas; a few enter fresh water.

KEY TO THE SPECIES OF ELEOTRIS.

- | | |
|---|--------------------|
| a. Teeth subequal, those of the inner or outer series | PAGE |
| enlarged; scales all ctenoid | <i>pisonis</i> 228 |
| aa. Teeth all equal; scales of dorsal and ventral | |
| regions cycloid, those on sides ctenoid | <i>pictus</i> 229 |

216. *Eleotris pisonis* (Gmelin). GUAVINA TETARD; SLEEPER.

Gobius pisonis Gmelin, Syst. Nat., 1206, 1788 (based on *Eleotris capite plagioplateo* of Gronow; after Marcgrave & Piso, Hist. Brasil., IV, 166, 1648; Brazil).

Eleotris pisonis Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2200.

Streams of the West Indies and of Tropical America, from southern Florida to Brazil. (Vera Cruz; Boca del Rio.)

Head 3 to $3\frac{1}{3}$; depth $4\frac{2}{3}$; D. VI-1, 8; A. I, 8; scales 60. Body elongate, not much compressed; head depressed, flat; interorbital area 3 in head; mouth large, maxillary reaching vertical from the pupil; lower jaw projecting; snout 5 in head; jaws with bands of villiform teeth, none on vomer and palatines; eye $5\frac{1}{2}$ in head; top of head, opercle, and cheeks covered with scales; a stout, concealed spine

projecting downward on edge of preopercle; distance from origin of dorsal to tip of snout $2\frac{1}{3}$ in the body.

Color brownish; fins with dark spots and wavy lines; ventrals dusky; two dark stripes behind orbit. Length 6 or 7 inches.

217. *Eleotris pictus* Kner & Steindachner. GUAVINA.

Eleotris pictus Kner & Steindachner, Abh. Wiss. Wien, 1864, pl. 3, fig. 1; Rio Bayano, near Panama.

Culius æquideus Jordan & Gilbert, Proc. U. S. Nat. Mus., 1881, 461; Rio Presidio, near Mazatlan.

Eleotris pictus Rutter, Proc. Cal. Acad. Sci., 1896, 265; fresh waters at San Jose del Cabo, Lower California: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2201.

Streams of the Pacific coast from Sonora to Panama.

Head 3 to $3\frac{1}{2}$; depth 6; D. VI-I, 7 or 8; A. 1, 7 or 8; scales 60. Body elongate, depressed anteriorly; head especially very broad and flat; mouth large, broad, very oblique; the maxillary reaching nearly or quite to opposite posterior margin of the eye, its length $2\frac{1}{3}$ to $2\frac{2}{3}$ in head; lower jaw considerably projecting; teeth in jaws equal, in broad bands, the outer series not all enlarged; eye small, anterior, 6 in head; scales on head mostly cycloid, very small, covering cheek and opercles and upper part of the head to the eyes; scales on dorsal and ventral regions cycloid, those on sides mostly ctenoid; preopercular spine well developed, strong, compressed, directed downward and forward.

Color dark, dull olivaceous brown, paler below; young mottled with bluish and speckled with brown; sides without longitudinal stripes; fins dusky, all of them finely mottled and speckled with darker, the dark markings on dorsal and anal forming undulated dark bars. Length about 18 inches. (Jordan & Evermann.)

Subfamily **Gobiinæ.**

87. *Gobius* Linnaeus.

Gobius Linnaeus, Syst. Nat., Ed. x, 262, 1758. (Type, *Gobius niger* Linnaeus.)

Gobionellus Girard, Proc. Acad. Nat. Sci. Phila., 1858, 168. (Type, *Gobionellus hastatus* Girard.)

Ctenogobius Gill, Fish. Trinidad, 374, 1858. (Type, *Ctenogobius fasciatus* Gill.)

Body oblong or elongate, compressed behind; head oblong, more or less depressed; mouth moderate; teeth conical, on jaws only, in several series, the outer row enlarged; no canines; eyes high, an-

terior, and close together; opercles without spines; isthmus broad; shoulder girdle without fleshy flaps; scales ctenoid, covering the body; cheeks usually without scales; ventral fins completely united, not adnate to the belly; skull depressed, abruptly widened behind the eyes, and without median keel.

A large group of small fishes usually found along the shores in salt or brackish water, few species entering fresh water.

KEY TO THE SPECIES OF GOBIUS.

	PAGE
a. Scales large, less than 45 in the lateral series.	
b. Scales large, 30 in the lateral series; soft dorsal rays 11; anal rays 12.....	<i>parvus</i> 230
bb. Scales smaller, 42 in the lateral series; soft dorsal rays 12; anal rays 13.....	<i>claytoni</i> 231
aa. Scales very small, 62 in the lateral series; soft dorsal rays 13; anal rays 14.....	<i>microdon</i> 231

Subgenus *Otenogobius* Gill.

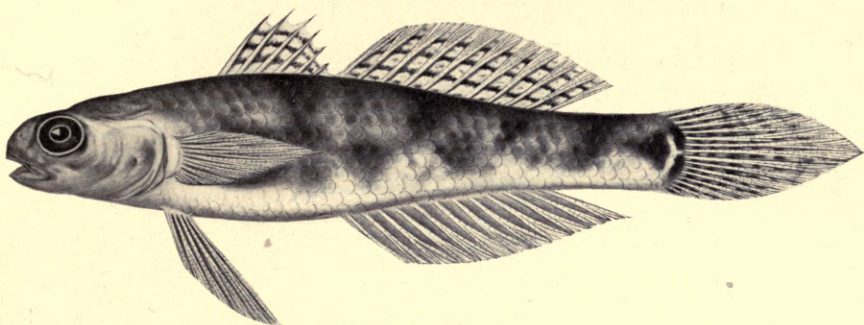
218. *Gobius parvus* Meek. SMALL GOBY.

Gobius parvus Meek, Field Col. Mus. Pub. 65, 1902, 121; La Antigua.

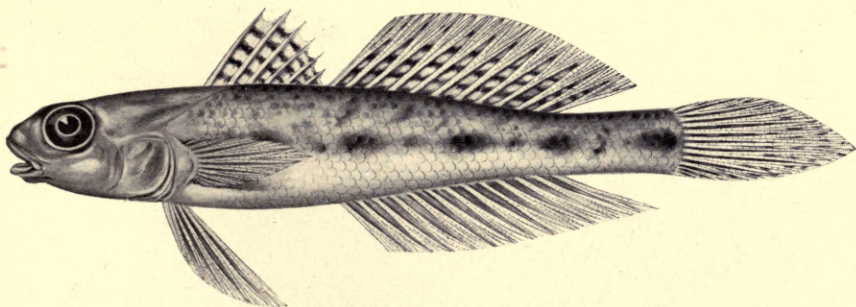
Brackish water near the city of Vera Cruz. (Vera Cruz; Boca del Rio.)

Head 4; depth $4\frac{1}{2}$; D. VI-11; A. 12; scales 30. Body short, robust; head large; snout blunt, rounded, $4\frac{1}{2}$ in head; mouth sub-inferior, little oblique, its gape extending to vertical from pupil; inter-orbital area narrow, its width less than half the diameter of the eye; eye small, partly superior, $3\frac{1}{2}$ in head; dorsal fins not connected, the spinous dorsal of females low, longest spine a little more than half head; in male the dorsal spine $\frac{1}{4}$ to $\frac{1}{2}$ longer than head; caudal fin long and pointed, its length 3 (δ) to $3\frac{1}{2}$ (φ) in body; pectoral slightly less than length of head; ventral $1\frac{1}{2}$ in head; scales ctenoid.

Color dark olivaceous, mottled with darker; a dark bar on dorsal region from base of posterior half of spinous dorsal, followed by three others from base of soft dorsal and one on caudal peduncle; 5 or 6 narrow dark streaks on lower half of sides, extending downward and forward to base of anal; two black spots at base of caudal fin; dorsal fins of both sexes barred; caudal fin of females with narrow dark bars; none on males; anal fin with dark margin. Length about 3.50 inches.



Gobioides parvus Meek.
No. 3738, Field Columbian Museum.



Gobioides claytoni Meek.
No. 3740, Field Columbian Museum.



Subgenus *Gobionellus* Girard.**219. *Gobius claytoni* Meek.** CLAYTON'S GOBY.

Gobius claytoni Meek, Field Col. Mus. Pub. 65, 1902, 121; La Antigua.

Fresh and brackish waters on coast of Vera Cruz. (Vera Cruz; San Francisco; Boca del Rio.)

Head $3\frac{2}{3}$; depth $5\frac{1}{2}$; D. VI-12; A. 13; scales 15-42. Body elongate, subterete, and tapering to caudal; head moderate; snout very blunt; mouth terminal, broad, its gape horizontal; interorbital width less than half diameter of the pupil; diameter of eye equaling length of snout, $3\frac{2}{3}$ in head; no scales on dorsal surface between spinous dorsal and nape; spinous dorsal low, the longest spine about 2 in head; caudal fin long and pointed, its middle rays the longest, about $\frac{1}{4}$ longer than head; pectoral $1\frac{1}{2}$ in head; ventral $1\frac{1}{4}$; scales ctenoid; breast and region under ventrals without scales.

Color light olivaceous, somewhat reticulated above; side with 5 oblong dark blotches, the last and smallest one forming a black caudal spot; spinous and soft dorsals barred; caudal fin barred; the middle portion of the ventrals, except a small central light patch, blackish; some black on posterior half of anal fin; a narrow dark curved streak at base of pectoral fin; a dark stripe on cheek and one downward and forward from eye. Length about 3 inches.

220. *Gobius microdon* Gilbert.

Gobius microdon Gilbert, Proc. U. S. Nat. Mus., 1891, 554; San Juan Lagoon, north of Rio Ahome, Mexico: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 2227.

Known only from the type locality.

Head $4\frac{1}{6}$; depth 5; D. VI-13; A. 14; scales 62. Body and head compressed, everywhere deeper than wide; snout blunt; mouth low, terminal, nearly horizontal; the lower jaw very weak, broadly rounded anteriorly; maxillary reaching vertical from hinder margin of pupil, about 2 in head; teeth minute, those in the upper jaw in a single series; teeth in lower jaw in two series, the outer somewhat enlarged; interorbital space narrow, less than diameter of the pupil; isthmus wide, the gill openings extending but little below the base of the pectorals; scales small, cycloid anteriorly and on belly, becoming larger posteriorly; scales ctenoid on sides behind middle of spinous dorsal; belly wholly scaled; nape scaled forward nearly to orbits, but with a narrow median naked streak running back to front of dorsal; breast and sides of head naked; dorsal fins not connected, first 4 spines filamentous, the longest longer than the head; soft dorsal and anal similar, not high.

Color nearly uniform light olive, with minute darker punctulations, which sometimes form darker margins to the scales; an oblique dusky streak on opercle; 3 or 4 oblique obscure dark cross-bars on spinous dorsal and 4 or 5 on caudal peduncle; ventral with white pigment. Length about 2 inches.

88. *Chonophorus* Poey.

Chonophorus Poey, *Memorias*, II, 274, 1861. (Type, *Gobius taiasica* Lichtenstein.)

Body elongate, compressed posteriorly; head large, preorbital region very long; mouth large, nearly horizontal; inner edge of shoulder girdle with 2 or more conspicuous dermal flaps; premaxillary and maxillary strong; lips thick; scales small, ctenoid; interorbital groove with a conspicuous median crest; ventrals united, not adnate to the belly.

A group of fishes which inhabit the fresh waters of Tropical America and the Hawaiian Islands. Some of the species reach a large size. I recognize with some doubt three species of this genus in Mexico.

KEY TO THE SPECIES OF CHONOPHORUS.

a. Scales large, 60 to 75 in the lateral series.	PAGE
b. About 15 scales in a series between second dorsal and base of anal.	<i>nelsoni</i> 232
bb. About 21 scales in a series between second dorsal and base of anal.	<i>taiasica</i> 233
aa. Scales smaller, 24-76 to 80.	<i>mexicanus</i> 233

221. *Chonophorus nelsoni* (Evermann).

Awaous nelsoni Evermann, *Proc. Biol. Soc. Wash.*, 1898, 3; fresh water pools at Rosaria, Sinaloa: Jordan & Evermann, *Bull.* 47, U. S. Nat. Mus., 1896, 2235.

Streams of Sinaloa.

Head $3\frac{1}{2}$; depth 6; D, VI-11; A, 11; scales about 63. Body oblong, compressed; head large, flat above; maxillary reaching vertical from posterior margin of pupil; teeth on bands in jaws, some of the outer a little enlarged; eyes moderate, $5\frac{3}{4}$ in head; scales small, ctenoid, crowded on anterior part of the body; about 15 scales in a series between soft dorsal and anal fin; caudal fin rounded.

Color grayish; head mottled and blotched with dark; side with 7 or 8 black blotches, the largest under the middle of the pectoral fin; dorsals pale, crossed by several lines of black spots; caudal pale, with

6 or 7 dark cross-bars; ventral, anal, and pectorals pale. Length about 4 inches. (Evermann.)

222. *Chonophorus taiasica* (Lichtenstein). ABOMA DE RIO; LA PUJEUQUE; MUCHURA.

Gobius taiasica Lichtenstein, Berl. Abhandl., 1822, 166; Brazil.

Gobius dolichocephalus Cope, Trans. Amer. Philos. Soc. Phila., 1869, 403; near Orizaba, Mexico.

Awaous taiasica Jordan, Proc. Cal. Acad. Sci., 1895, 494; Rio Presidio, Mazatlan; San Jose del Cabo, Lower California: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2236; Rutter, Proc. Cal. Acad. Sci., 1896, 265; Rio San Jose, San Jose del Cabo, Lower California: Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 147; Rio Ixtla, Puente de Ixtla: Meek, Field Col. Mus. Pub. 65, 1902, 121; La Antigua; Balsas; Puente de Ixtla.

Streams of the West Indies and of the American continent from Vera Cruz and Mazatlan to Panama and Brazil. It does not occur on the Mexican plateau. (Cuautla; Valles; San Francisco; Perez.)

Head $3\frac{1}{2}$; depth $5\frac{1}{2}$; D. VI-11; A. 11; scales 60 to 75. Body elongate, not much compressed; snout much decurved; interorbital very narrow, somewhat convex, its width less than diameter of the eye; preorbital deep, about 3 in head; mouth large; premaxillary scarcely reaching vertical from anterior margin of orbit; teeth small, in bands on jaws; gill membranes broadly united to the isthmus; branchiostegals 4; origin of dorsal to tip of snout $2\frac{2}{3}$ in body; pectorals long, $1\frac{1}{3}$ in head; scales small, ctenoid, those on anterior $\frac{1}{4}$ of body much smaller than on rest of the body; caudal fin rounded.

Color olivaceous, with irregular dark blotches along middle of the sides; rest of body above reticulate with darker; lower third of body nearly plain; dorsal fins and caudal barred; other fins plain; two blue streaks from eye to maxillary and two or more small ones on cheek. Length about 12 inches.

A food fish of considerable local importance.

223. *Chonophorus mexicanus* (Günther).

Gobius mexicanus Günther, Cat., III, 61, 1861; Mexico.

Awaous mexicanus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2237.

Distribution not known.

Head 4; depth $6\frac{3}{4}$; D. VI-11; A. 11; scales 24-76 to 82. Head as broad as deep, flat above; snout elongate, upper profile oblique; mouth horizontal, lower jaw included; maxillary reaching to below anterior margin of the eye; teeth of outer series enlarged; scales small, those

on the nape and on anterior part of the body very small; head naked; dorsal fins lower than depth of body; caudal fins rounded.

Color yellowish olive, back and sides reticulate with darker; head, dorsal, caudal and pectoral fins dotted with blackish; 6 cross series of dots on caudal; an irregular, small blackish spot on upper part of base of pectoral (Günther.)

This species is known only from the above description.

89. *Gillichthys* Cooper.

Gillichthys Cooper, Proc. Cal. Acad. Sci., 1863, 109. (Type, *Gillichthys mirabilis* Cooper.)

Body moderately elongate, compressed, covered with small cycloid embedded scales; belly and head naked; scales in the young more or less ciliated; eyes almost superior; gape wide, the maxillary in the adult inordinately developed, prolonged backward to the base of the pectorals, its posterior part a cartilaginous expansion connected to an expansion of the skin of the lower jaw, thus forming a channel backward from the mouth; teeth small, even, and in broad bands; pectorals large; isthmus broad.

224. *Gillichthys detrusus* Gilbert & Scofield. LONG-JAWED GOBY.

Gillichthys detrusus Gilbert & Scofield, Proc. U. S. Nat. Mus., 1897, 498, pl. 38; Horseshoe Bend, mouth of Colorado River: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2251.

Known only from the lower portion of the Colorado River.

Head $3\frac{1}{2}$; depth 5; D. VI-13; A. 11; scales about 25-75. Body robust, somewhat compressed posteriorly; head large, depressed; mouth very large, the maxillary $1\frac{1}{3}$ in head; mandible $1\frac{2}{3}$; snout 4; interorbital $5\frac{1}{2}$; eye small, 7 in head; dorsal fins not connected, the space between them equaling half length of spinous portion; pectoral $1\frac{3}{4}$ in head; the post frontals small, projecting very little; least depth of caudal peduncle $2\frac{2}{3}$ in head.

Color a very pale olive, some with dark punctulations about the head and fins; the pale coloration probably due to their life in shallow water on the bottom of pale sand. Length about 5 inches.

Family XXIII. *Soleidae*.

THE SOLES.

Body oblong or elongate, usually scaly; mouth very small, more developed on eyed side; teeth in bands, very small or obsolete; edge of preopercle adnate, concealed by the skin and scales; gill openings narrow, the membranes adnate to the shoulder girdle above; paired

fins small or wanting. The species of this family are very numerous in the warm seas, a few enter brackish, and still fewer inhabit fresh waters.

Subfamily **Achirinæ**.

90. Achirus Lacépède.

Achirus Lacépède, Hist. Nat. Poiss., iv, 659, 1803. (Type, *Achirus fasciatus* Lacépède.)

Baiostoma Bean, Proc. U. S. Nat. Mus., 1882, 413. (Type, *Baiostoma brachiale* Bean.)

Body broad, bluntly rounded anteriorly; head small; eyes small, close together; eyes and color on the right side; mouth small, mostly developed on the right side; teeth small, on blind side only; gill openings narrow; scales ctenoid; some scales on head and anterior part of the body enlarged, some of those on blind side with hair-like projections; lateral line straight, simple; dorsal fin beginning on snout; ventral rays 3 or 4, the fin on colored side connected with the anal by a membrane.

KEY TO THE SPECIES OF ACHIRUS.

	PAGE
a. Pectoral fin of right side only present.	
b. Pectoral fin with 4 rays; depth of body $1\frac{1}{2}$ in its length; scales 70 in lateral series.	<i>mazatlanus</i> 235
bb. Pectoral fin with 2 rays; depth of body $1\frac{5}{8}$ in its length; scales 85 in the lateral series.	<i>fonsecensis</i> 236
aa. Pectoral fins wholly wanting; scales 66 to 75.	<i>fasciatus</i> 236

Subgenus *Baiostoma* Bean.

225. Achirus mazatlanus (Steindachner). MEXICAN SOLE.

Solea mazatlana Steindachner, Ichth. Notizen, ix, 23, 1869; Mazatlan.

Solea pilosa Peters, Berliner Monatsber., 1869, 709; Mazatlan.

Achirus mazatlanus Jordan, Proc. Cal. Acad. Sci., 1895; Rio Presidio, Sinaloa: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2698; Rio Presidio, Sinaloa.

Streams of Mexico which empty into the Pacific Ocean.

Head $3\frac{1}{3}$; depth $1\frac{1}{2}$; D. 56; A. 42; scales 70. Body broad, oval; eyes small, the upper in advance of the lower; diameter of eye $7\frac{1}{2}$ in head; interorbital $\frac{1}{2}$ diameter of the eye; nostril in a tube, placed just above the middle of the mouth; pectoral developed on the eyed side only, with about 4 rays; origin of dorsal on tip of snout; scales of right side with numerous black hair-like appendages.

Color brownish, with 8 or 9 narrow vertical black bars; fins dark without distinct markings.

226. *Achirus fonsecensis* (Günther).

Solea fonsecensis Günther, Cat., IV, 475, 1862; Gulf of Fonseca.

Achirus fonsecensis Jordan, Proc. Cal. Acad. Sci., 1895, 230; Rio Presidio, Sinaloa: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2699; Rio Presidio, Sinaloa.

Pacific coast of tropical America, entering rivers.

Head $3\frac{1}{3}$; depth $1\frac{1}{8}$; D. 58; A. 44; scales about 85. Body oval; eyes small, the upper in advance of the lower; interorbital space less than diameter of eye; no trace of pectoral on left side, the one on right side small, of about 2 rays; ventral of right side composed of 5 rays, continuous with anal fin; scales on the nape twice or thrice as large as those on the body; the left anterior part of the head with numerous tentacles; the right lower lip with distinct slender fringes; caudal fin rounded, as long as head.

Color brownish olive, with six pairs of deep brown vertical lines extending on dorsal and anal fins.

Subgenus *Achirus* Lacépède.

227. *Achirus fasciatus* Lacépède.

Achirus fasciatus Lacépède, Hist. Nat. Poiss., IV, 659, 662, 1803; Charleston: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2700.

Solea achirus Günther, Cat., IV, 476, 1862.

Atlantic and gulf coasts from Cape Ann to the Isthmus of Tehuantepec; ascending rivers to a considerable distance above tide-water. (Perez.)

Head 4; depth $1\frac{1}{4}$; D. 50 to 55; A. 37 to 45; scales 66 to 75. Body broad, elliptical; mouth small, reaching past front of lower eye; lower lip on right side fringed; eyes very small, the upper slightly in advance of the lower; interorbital space with scales; head and body covered with strongly ctenoid scales; on blind side many scales on and near head with hair-like appendages; lateral line straight; origin of dorsal fin on tip of snout; no pectoral fins.

Color, eyed side dusky, more or less mottled, with 7 or 8 narrow dark vertical streaks; fins with black spots, blind side white. Length about 5 or 6 inches.

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