
THE FRESH-WATER FISHES OF WESTERN CUBA.

By C. H. EIGENMANN,
Professor of Zoology, University of Indiana.



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During March, 1902, the writer, accompanied by one of his students, Mr. Oscar Riddle, as assistant and interpreter, made a series of collections in the fresh waters of western Cuba, in the streams accessible by the Western Railway and the United Habana Railways. Attempts to reach waters remote from the railways were abandoned on account of the expense, both in time and money. Sumidero was reached by horse from Pinar del Rio, and the caves about Cañas on foot and by volante. The original and chief object of the visit to Cuba was to secure material for a study of the eyes of the blind fishes, *Stygicola* and *Lucifuga*. In this I was successful. The fresh-water fishes proved also of considerable interest. As might have been expected, many of the more abundant and larger species had been previously described by Poey. Nothing, however, was known about the distribution of fresh-water fishes, and there were found a surprising number of new species.

I wish here to express my thanks to Mr. A. P. Livesey and Mr. J. E. Wolfe, the managers of the Western and United Habana Railways, who did all in their power to make the available time profitable from a scientific standpoint. I am also under obligations to Mr. Philip Hammond, the chief engineer of the United Habana Railroads, for suggestions and various favors. Mr. Pascual Ferreiro, of the Cuban railway postal department, kindly acted as guide to the Pedregales caves, and Mr. Francisco Martinez and his brother to the caves about Cañas. The success of the expedition was largely due to my companion, Mr. Oscar Riddle, whose previous stay in Porto Rico and trip to Trinidad and the Orinoco had familiarized him with the language of the country and enabled him to deal with the natives.

The drawings illustrating this paper were made by Mr. Clarence Kennedy.

In his "Memorias sobre la Historia Natural de la Isla de Cuba," tomo 2, pp. 95-114, 1856, Poey describes two species of blind fishes, *Lucifuga subterraneus* and *Lucifuga dentatus*, from caves on the southern slopes of the jurisdiction of San Antonio, Guanajay, and San Cristobal.^a They were first brought to notice by the surveyor, D. Tranquilino Sandalio de Noda. Specimens were secured for Poey by Dubroca, Fabre, and Layunta.

^aJordan & Evermann, in their Fishes of North and Middle America, III, p. 2501, give a number of localities for which I can find no authority in Poey. Thus "San Antonio, Cuba (Coll. D. Tranquilino); Sandalio de Noda (Coll. D. Juan Antonio Fabre)" and cave at the "Castle of Concord." I can not find the authority for the locality San Antonio, Cuba; the collector given as D. Tranquilino is probably D. Tranquilino Sandalio de Noda; the second locality Sandalio de Noda is probably the latter section of the name of the man who first called attention to them. Castle of Concord should probably read "Coffee plantation La Concordia."

The localities from which Poey secured *Lucifuga subterraneus* are (1) Cave of Cajio, 5.2 miles south of La Guira de Melena (Noda, 1831); (2) cave of the coffee plantation La Industria, halfway between Alquizar and Guanimar (Dubroca); (3) cave of Ashton, near San Andres (Fabre); (4) cave of the Dragon, on the cattle farm San Isidro, near Las Mangas (Fabre); (5) cave on the coffee plantation La Concordia, 5.2 miles from Alquizar (Layunta); (6) cave near the beehouse of the coffee plantation La Paz (Dubroca); a well near the tavern Frias (Fabre).

Lucifuga dentatus was secured in Nos. 1, 2, and 3. Those from Nos. 1 and 2 were said to be without the least vestiges of eyes; those from No. 3 with vestiges.

I visited a number of the caves from which Poey secured his specimens, intending to obtain specimens from as many of Poey's localities as possible, but especially from those from which he secured both species of the blind fishes. The towns Guira de Melena, Alquizar, San Andres (now Cañas), mentioned by Poey, are successive stations along the Western Railroad, and Las Mangas is a town a short distance off the railroad beyond Cañas. We made our first stop at Alquizar, hoping to be in the middle of the cave region. The driver we engaged at Alquizar to take us to La Industria showed his independence and originality by taking us over a rough road during a half day's drive parallel to the railroad to Frias and Ashton near the station Cañas, but we were not inclined to quarrel with him, as we at once secured fishes in Ashton, and caves were reported to us as very abundant in the whole region south of Cañas. Many of these caves were visited by us, as well as that at Cajio (by Mr. Riddle) and others in a widely distant part of the island. Those from which we secured specimens I propose briefly to describe here. The cave on La Industria we did not visit, and in fact, except while we were engaging our volante, no one about Alquizar seemed to know the plantation La Industria. It is possible that the name has been changed in recent years. Bearing in mind our experiences with the volante-men at Alquizar we made no attempt to find La Concordia, which is also reached from Alquizar.

The "caves" about Cañas can best be described after a few words concerning the country in general in which they occur. The territory about Cañas is entirely drained by underground streams. The streams rising in the hills and mountains forming the watershed between north and south drainage run above ground for a distance and then disappear underground. The Ariguanabo River thus runs into a bank at San Antonio de los Baños and disappears among fallen rocks. A few yards away from its "sumidero" the water can be seen running in its underground channel through an opening in the thin roof of the channel. A few yards farther on a dry channel leads down to the water which at the end of the channel disappears among fallen rocks. Other rivers disappear in a similar manner. Their waters reappear, in part at least, in a number of "ojos," some near the coast south of San Antonio. The region drained by underground streams is flat, with frequently no indications of surface streams and their erosion, and extends westward to near San Cristobal, where the first permanent surface stream is observed. At Artemisa and Candelaria stream beds contained pools of water at the time of our visit.

From San Cristobal to Pinar del Rio there were many small but perennial streams. Eastward from Cañas the cave region has an unknown extent. Poey limited it to the jurisdiction of Guanajay, but it certainly extends as far east as the

meridian of Matanzas, and from reports probably beyond Cienfuegos. East of Rincon there are, however, frequent river beds, dry during the time of our visit. This main region, belonging to the southern slope, sends a point northward from Rincon to the Almendares River in the northern watershed. Aside from the "Ojos de agua" along the edge of the cienegas skirting the southern coast there are two notable places where underground rivers find an exit. One at Vento supplies the entire city of Habana with its water, the other serves to make the region about Guines a garden, its waters being used for irrigation. Others in all probability have a subaqueous exit to the south.

The large spring at Vento, sufficient to supply the city of Habana with its water, is the only one which issues on the northern slope, so far as I know. The origin of the supply from the Vento spring has not been traced. It issues but a few feet from the Almendares River, and it is very remotely possible, though not at all probable, that it derives its water from the upper courses of the Almendares. At the time of our visit the water of the spring was 1 degree warmer than that of the Almendares River. The region north of that river, across the river from Vento, being shut out from a possible contributing source, it undoubtedly derives its water from the system of underground streams mentioned above. An examination of the best available map and the levels of the Western and United Habana Railroads makes it seem quite certain that the Vento springs derive their water from the region immediately south of Vento and north of Rincon and Bejucal—that traversed by the two railroads mentioned. This region contains various sinks without surface outlets, as well as dry sink-holes, and is the northward-projecting point of the cave region mentioned above. A notable sink-hole in this region is that at Aquada, on the United Habana Railroad. This is very broad, shallow, and dry during the dry season, but the water rises to stand over 10 feet deep on the railroad track during some of the wet seasons.

THE CAVES VISITED.

The soil over the region under consideration is thin, the surfaces of the very irregularly corroded rocks jutting out in numerous places. This, together with the fact that the water of the underground streams is but a few feet underground, gives the region an entirely different aspect from the sink-hole and underground-stream region in Indiana, Kentucky, etc. It is, in the first place, impossible to enter the underground streams, and there are no funnels on the surface to indicate the location of an underground stream or its tributary. In places the thin limestone roof of an underground chamber has given way and enables one to get to the water, which in all the numerous places we visited was stationary, not flowing. With one or two exceptions the water was covered with a continuous crust of carbonate of lime, due to the evaporation and discharge of carbon dioxide from the surface of the perfectly quiet lime water. When the water is disturbed flakes of variable size break loose and gradually sink to the bottom. All of the so-called caves about Cañas, with one possible exception, were sink-holes formed by the breaking of the thin roof of a larger or smaller underground chamber. In all of the caves where stalagmites and stalactites were noticed these extended for 3 feet or more into the water. Inasmuch as they could not have formed under water, the latter must have risen since their

formation. Usually the walls of the sink-hole retreat downward and sidewise, suggesting that a channel filled with water extends down and out from the sink-hole. The impression is irresistibly made that there exists here an extensive series of drowned caves. As our visit to the caves occurred near the end of the dry season, this excess of water could not have been due to recent excessive rains. The water in the caves was, however, still falling and fell several inches during March.

The condition could have been brought about (1) by the rising of the southern coast of Cuba, resulting in a changed incline in the underground streams and a consequent drowning of the caves; (2) by a blocking of the outlets of the streams; (3) by an increase of the rainfall above that provided for in the past. I was at first inclined to favor the first view, since caves as widely different as those of Cañas and Alacranes showed the same characters; but a cave at Matanzas, on the northern slope, showed exactly the same conditions. A local blocking of the outlets is scarcely conceivable on account of the wide separation of caves showing the same conditions. Concerning the rainfall I am not able to speak, but any other cause, since the caves are above the level of the ocean, does not occur to me.

The detailed description of various caves may begin with Modesta No. 1. The caves, for the most part, do not have distinctive names, but are called after the Finca on which they occur. I have added the numbers 1, 2, etc., for convenience. Modesta No. 1 is an ideal cave of which all the rest are modifications. There is nothing on the surface to distinguish it when one is a few feet away. The cave is bell-shaped, with an opening 10 to 15 feet at the top. A tree growing at its margin sends vertical roots down to the bottom. On these roots notches have been cut, and the descent is made by means of them. At the water level at the time of our visit the cave was oval in section, 30 by 45 feet in extent. In the middle of the bell, and immediately under the opening, there was a large pile of rocks, cemented together in places by stalagmitic material and rising but a few inches above the water. The water, beautifully clear, became rapidly deeper in all directions and could be seen to extend out in at least two directions in deepening channels filled to their top with water. The roots descending from the opening at the top to the island, a distance of about 15 feet, here divided suddenly into a tuft of innumerable rootlets, most of them in the water. Such roots were found in almost all the caves, and the young blind fishes were always found in among the rootlets; the big ones among the rocks.

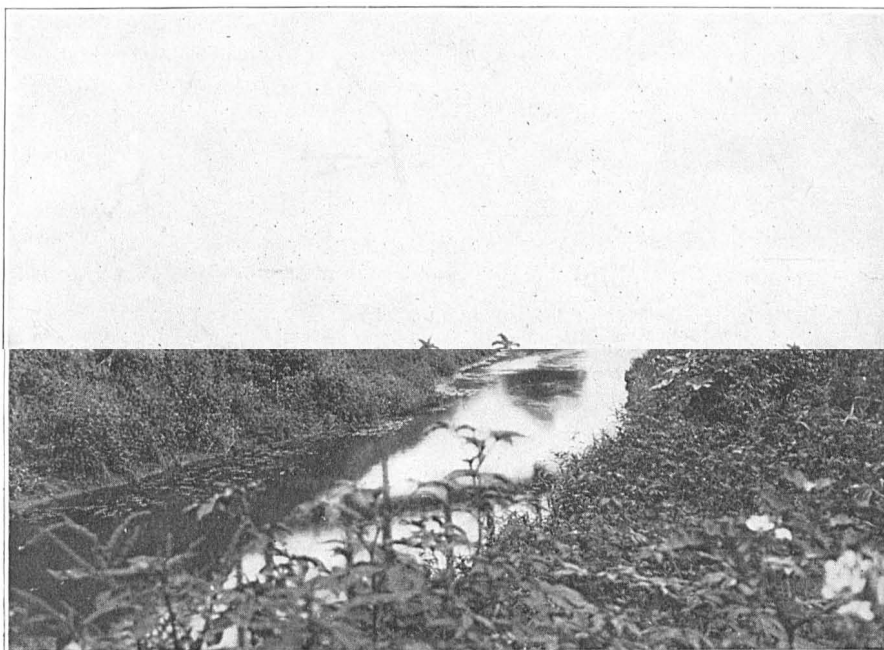
Modesta No. 2, also called Hawey, is a cave of the same type, except that the central mass of fallen rock forms an arch over the water, and that it can be reached from one side by an inclined plane, also formed of fallen material. Rootlets were very abundant here and small blind fishes equally so. The water was probably not more than 10 feet below the surface and at one edge was very deep—how deep we had no means of determining. Part of the opening had at one time been walled in and the cave was used as a well. It is possible that this is the well mentioned by Poey as being near Frias and containing blind fishes. But a number of other wells in the neighborhood reach caves.

Modesta No. 3 contained no blind fishes.

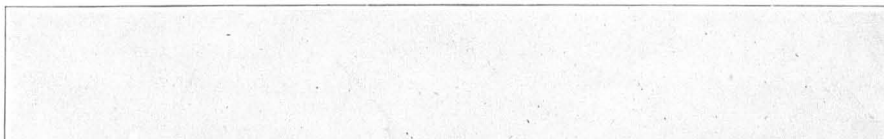
San Isidro No. 2 is a duplication of Modesta No. 1, but with different proportions. The central mass is higher and holds a number of stalagmites. It is only partially surrounded by water. The entrance is by roots.



RIO SAN DIEGO AT PASO REAL, LOOKING UPSTREAM FROM BELOW WESTERN RAILROAD BRIDGE.



RIO SAN DIEGO AT PASO REAL, LOOKING UPSTREAM FROM BELOW WESTERN RAILROAD BRIDGE.



San Isidro No. 1 is an underground chamber containing 2 to 3 feet of water in places and muddy in the bottom. It is reached by an inclined plane from the side and is more like a cave as ordinarily understood than the caves of the Modesta type.

La Frias No. 1 is a cave of the Modesta type, but larger and with the roof of one side fallen, so that the descent to the water is made by an inclined plane, and the water forms a crescent about 15 feet wide under the retreating walls of the side opposite to the entrance.

La Frias No. 2 is another cave of the Modesta type, 100 feet across at the bottom and with the water 40 feet from the surface. The roof has fallen in at one side and the central mass of rocks rises nearly to the level of the surrounding region, so that the descent can be made by a winding inclined plane. Part of the roof, very thin and worn through in places, is still standing, supported by stalagmite-stalactite columns. The roots of trees wind about stalagmites or descend as straight and unsupported stems 15 and more feet through the cave to the water, where there is the usual breaking up into rootlets.

Ashton No. 1 is a cave of the Modesta type, with a large amount of fallen material at one side, where one can descend to the water by means of steps. The diameter of the cave is possibly 100 feet. A large tree grows in the center of the fallen material. At the deeper part of the cave, opposite the entrance, the walls retreat downward. Stalactites and stalagmites are present, and there is a crescent of pools of water of variable width and depth. Channels filled with water are seen to lead off from the bottom of the pools. This is one of the rare places where green plants are growing in the water. They are confined to the dextral pools as one enters.

Ashton No. 2 differs from all the other caves. It is more open; the roof has fallen in, so that there are no retreating walls, as in the other caves. The fallen material slopes gradually to the water, which is shallow and densely covered with duckweed. A channel leads off from the left end of the water as one enters, and we went into this with our canoe, but the walls soon came down to the water. The place was sultrily hot and smelled disagreeably of decaying plants, so that we were very glad to get out. This was one of the few caves we visited in which there were no fishes. This cave practically joins Ashton No. 1, the dividing wall being but a few yards wide.

Ashton No. 3, called Los Baños, differs from the others in that considerably more of the roof of the original chamber remains standing and the amount of territory covered by the water is also considerably larger. The depth of the water differs from a few inches to "overhead." This cave is occasionally used as a bath. At the time of our visit the water was covered with the usual crust of lime.

Cajio, Jaiguan, and La Tranquilidad were visited by Mr. Riddle.

Cajio, 6 or 8 miles southeast of La Guira de Melena, differs considerably in one particular from all the other caves. The water lies at a much greater distance from the entrance than in the others. The entrance is an ordinary sink-hole 10 to 12 feet deep. Instead of finding the water at the bottom of this sink, as in the Modesta type, it is perfectly dry. Leading from this, however, there is a dark, narrow passageway, 100 feet long, which leads to a very large chamber with a crescent-shaped body of water. This long channel is not an inclined plane, but runs parallel to the

surface. The thin roof of the main chamber has a hole blasted into it, through which light reaches the water. The floor is of fallen rock, as in other caves.

The cave of Jaiguan, 2 or 3 miles east of Cajio, is a chamber 100 feet long by 40 or 50 feet wide. It probably contains more water than any other cave visited, with the possible exception of Pedregales. There is an opening in the center of the roof affording considerable light. The entrance is a small sink-hole at the edge of the cave, which is provided with steps cut in the rock. The roots of a tree reach from the central opening down to the water, a distance of 18 feet. The rootlets, very abundant here, were found to shelter many of the young blind fishes. In this cave is a central, rocky islet, formerly completely surrounded by water, as in Modesta No. 1. A narrow bridge of rocks has been built, which unites it with the entrance to the cave.

La Tranquilidad No. 1, in the Cañas region, 3 miles west of Ashton, is of the Modesta type. It is a large cave, entered only by means of a rope from an opening in the roof 4 feet in diameter. The water here presents an extensive surface, but nowhere is it deep. Large specimens were taken here. Side channels allow one to follow the water farther in this cave than in any other visited. The greater part of the cave is very dark.

La Tranquilidad No. 2 is a small cave with much light. It is in the center of a large sink probably 600 feet in diameter. The water is not deep and is easily accessible to cattle and swine. The bottom is formed of very soft, deep mud.

The number and species of fishes taken in these caves are listed under the head of the various species. In many of the cases 2 blind crustaceans, both of them new species, were found to be abundant. One of them is a very graceful *Palæmonetes*, the other, a *Cirolana*, is much more abundant and forms a large part of the food of the blind fishes.^a

My attention was called by Messrs. Wolfe and Hammond to the Pedregales caves near Alacranes in Matanzas Province, 60 miles east of the easternmost of the caves from which Poey recorded blind fishes. They were visited more for the sake of visiting all the caves that might possibly contain blind fishes than with the expectation of finding any. When near these caves we inquired whether any of them contained fishes and were told "yes, but they don't amount to anything; they don't have any eyes." After this remark we felt thoroughly comfortable in a place where certainly nothing else contributed to comfort.

Pedregales cave, about 3 miles from Alacranes, differs in some respects from the caves of the Cañas region. The cave slopes down as steeply as can conveniently be descended from a narrow opening, but once inside it widens out, descending continually. The floor was formed of a section of a cone that recalls the central masses in the bell-shaped caves of Cañas. The floor and the roof were elaborately decorated with stalagmites and stalactites, some of them united and ranging from 3 feet in diameter to a fraction of an inch. These were pure white when broken, but tinted a red on the outside by the coral earth. When struck they gave out a clear bell-like tone, and the striking of various-sized columns by different members of the party produced a pleasing chime-like effect. Among the caves that I have visited this is approached in elaborateness of decoration only by the cave of the fairies in Colorado.

^aSee W. B. Hay, in U. S. Nat. Mus., xxvi, pp. 429-435.

At a vertical depth, judged by the depth of a near-by well to be about 75 feet, water was encountered in the form of the usual crescent. There was no indication that we had reached the bottom of the cave and it is not known how deep the water is, for roof and floor continue to slope down with the same incline and stalagmites rise from a depth of at least 3 feet beneath the level of the water at the time of our visit, when it was about 3 feet below its maximum height. The water was covered with a crust of lime and no fishes were seen.

An account of the Pedregales caves will soon be issued by Mr. Pascual Ferreiro, of the Cuban railway postal service, a member of the international copyright commission.

About half a mile beyond Pedregales is the M cave, so called from the M-shaped path that leads from the surface to the water. The descent in this cave is much steeper than in Pedregales and the stalagmitic decorations much less elaborate. A dim light penetrates to the water. Here, as in Pedregales, the cave floor continues to descend for an unknown distance below the level of the water. Fishes were more abundant here than in any other cave visited. They were all of one species.

We visited another cave in Matanzas Province, about 20 miles north of the Pedregales, at the edge of the city of Matanzas. It was essentially like the M cave, but contained no fishes.

THE STREAMS VISITED.

Between the western end of the island and Unión, south of Matanzas, a number of streams run by independent courses from the watershed to the sea. Those west of San Cristobal are perennial. Those immediately east of San Cristobal consisted at the time of our visit of a series of independent pools. East of Artemisa the streams run above ground only part of their course, then enter caves and continue their course to the sea underground, or reappear as "ojos de agua" a short distance from the ocean. In the western part of this region, from Cañas to at least Guira de Melena, there are no dry beds or other surface indications of drainage. Farther to the west dry beds of streams, narrow and crooked, were seen, but with one exception there is no perennial stream between San Cristobal and Union except along the coast. The one exception is the stream formed by the large springs near Guines. East of Union we did not go.

The Rio Sabanalamar at San Cristobal is about 20 feet wide and varied from 1 foot to 2 inches in depth in cross-section. The water is in places very swift and shallow; in others "over head" and in pools. The banks of the river are clay; the bottom is grass-grown except in the deep pools and over riffles. We seined up and down from the railroad bridge and also in an old channel of the river containing a muddy pool entirely cut off from the river. The water of the river was clear and at 10 a. m. had a temperature of 23° C.

The Rio Palacios at Los Palacios varied from 5 to 40 feet in width. The water was clear, the bottom alternately gravel, mud, and weed-grown. Temperature of the water 23° C. We seined up and down the ford at the end of the main street. Between Los Palacios and Paso Real the country is in part swampy, with lily ponds.

The Rio San Diego at Paso Real de San Diego is 15 to 40 feet wide with steep banks about 20 feet high. The water was clear, in pools and riffles, and 23° C. We

seined near the railroad bridge. There are several dry beds of tributaries in the neighborhood. At Herradura a small creek, 5 feet across and with banks 20 feet deep, was crossed. No fishing was attempted.

Between Las Ovas and Golpe were ponds with white water-lilies. No fishing was attempted here.

The Rio del Pinar is, at the town of the same name, a broad shallow stream with alternating riffles, pools, and weedy patches. Collections were made above and below the wagon road near the ice factory.

The Rio Cuyaguaje is the most western river of any size that flows to the south. Collections were made near Sumidero. The river near this town tunnels twice through rocky walls several hundred feet high, and in one instance probably not much more than 200 feet thick, and in the other probably several times as thick.

The Almendares River is a deep and swift stream about 40 feet wide emptying into the ocean near Habana. It was scarcely possible to seine in the river itself. Collections were made above and below a dam at Calabazar and in a small tributary just above the dam at Calabazar. The temperature was not taken at the time of seining. A few days later it was 25° at Vento.

The Ariguanabo is of special interest, inasmuch as it is one of the rivers that disappears in a cave. Collections were made just above its entrance to the cave. It is a clear, swift stream running through the town of San Antonio de los Baños. Above the town a dam at the ice factory has deepened the water so that a small steamer can run up to Laguna Ariguanabo. At the time of our visit the river was for a long distance above the town blocked with water hyacinths and other water plants. A much smaller though similar brook which runs through Guanajay also disappears in the ground several miles below the town. No attempt was made at seining.

Collections were also made in the outlet of the Yumuri at Matanzas, but we did not succeed in ascending to fresh water, and no fresh-water fishes were secured.

We ascended the San Juan River from Matanzas to the head of tide water, where a shallow ford occurs. Collections were made in the ford, above and below the ford, and in pools of spring water. Immediately above the ford the surface of the stream was covered with water hyacinths, and the stream was 4 and more feet deep. At the ford the water had a maximum depth of about 18 inches, and in places formed shallow riffles. Below the ford the banks become steep and the water is too deep for a collecting seine.

PECULIARITIES AND ORIGIN OF THE CUBAN FISH FAUNA.

There are recorded in the present paper 36 species and subspecies. These belong to 25 genera and 13 families. A number of other species have been taken in the same region, notably *Lepisosteus tristachus*. Of the 37 species and subspecies (including the last-named species) but 4, aside from members of the *Gobiidae*, are found in fresh water elsewhere. They are the species of *Lepisosteus*, *Symbranchus*, *Agonostomus*, and *Anguilla*. *Lepisosteus tristachus* is found in the fresh waters of Mexico and the southern United States. *Symbranchus marmoratus* is generally distributed through the fresh waters of the tropics of America, *Anguilla chrysypa* is also found

in the streams of eastern North America, and *Agonostomus monticola* is found in the fresh waters of the West Indies and Mexico. Of the remaining species only those of the genus *Heros* belong to a strictly fresh-water family. The genus *Heros* is generally distributed in South and Central American waters, one of its members entering the United States. The members of the marine family of *Gobiidæ* are found in the streams and brackish water of tropical America generally, and their presence in Cuba is not so significant as their absence would be. A number of the species enumerated are marine, and their presence in the rivers may be looked upon as purely fortuitous; these are *Tarpon atlanticus*, *Doryrhamphus lineatus*, *Centropomus undecimalis*, *Lutianus jocu*, *L. griseus*, *Eucinostomus meeki*, *Gobius saporator*, *G. boleosoma*, and *Lophogobius cyprinoides*.

Two species, in many ways the most interesting fishes found in the region examined, are members of the deep-sea family *Brotulidæ*; they are the blind-fishes *Stygicola dentatus* and *Lucifuga subterraneus*. These have evidently worked their way up the underground streams and are now becoming readapted to the light in the upper courses of the streams. No other members of the family are found in fresh water anywhere. *Atherina* is a marine genus with the peculiar Cuban species as its sole fresh-water representative. The remaining species are all members of the *Paciliidæ*, a family inhabiting brackish water and coastwise streams. Of the *Paciliidæ* 2 genera, *Girardinus* and *Toxus*, are peculiar to Cuba.

The origin of the Cuban fauna is then not far to seek. We have, as mentioned above, a number of marine species, more or less regular visitors of the fresh water. We have species widely distributed in the brackish water and coastwise streams whose presence is predicable (*Gobiidæ*), and we have local modifications of families with a wide distribution in the brackish and fresh waters of the tropics of America (*Paciliidæ*). We have, furthermore, local adaptations of marine species to fresh water (*Brotulidæ* and *Atherina*). The origin of all the above is simple of explanation. The species whose presence is of greatest interest are the strictly fresh-water species of *Lepisosteus*, evidently belonging to the North American fauna, and *Symbranchus* and *Heros* as evidently members of the South American fauna. The presence of the eel in the fresh waters of Cuba is to be expected, inasmuch as it very probably breeds in the ocean near Cuba. The presence of *Symbranchus*, *Heros*, and *Lepisosteus tristachus* and *Agonostoma monticola* shows that the fresh-water fauna of Cuba has a greater affinity for that of Mexico than for that of Florida, and that these forms probably reached Cuba by way of Yucatan.

SYSTEMATIC LIST OF FISHES COLLECTED, WITH DETAILS OF DISTRIBUTION.^a

SYMBRANCHIDÆ.

Symbranchus marmoratus Bloch. T. Pinar del Rio.

ANGUILLIDÆ.

Anguilla chryssypa Rafinesque. San Juan, near its first ford; Paso Real.

ELOPIDÆ.

Tarpon atlanticus (Cuvier & Valenciennes). M.

Pinar del Rio, 4 specimens, 20, 119, 182, and 192 mm., from a deep pool beneath the wagon bridge, many miles from the sea. They are locally known as "sadina," and we had been told that we should find them in this spot.

PÆCILIIDÆ.

The members of this family are everywhere abundant, especially in streams bordering the cave region.

Key to the genera of Cuban Pæciliidæ.

- a. Anal fin of male similar to that of female, oviparous; intestinal canal short, little convoluted; teeth little movable; dentary bones firmly connected; lower jaw strong and usually projecting beyond upper.
- b. Teeth all pointed, in villiform bands.
- c. Air-bladder well developed; no caudal ocellus; gill-openings not restricted above; opercles free from shoulder-girdle; dorsal and anal nearly equal; origin of dorsal in advance of anal.....*Fundulus*.
- c. Air-bladder wanting; a black ocellus at root of caudal in male; dorsal smaller than anal, its origin behind that of anal.....*Rivulus*.
- b. Teeth tricuspid in one row; no villiform band of teeth; body short and deep, compressed; dorsal short, of 10 to 12 rays, first ray slender and rudimentary.....*Cyprinodon*.
- aa. Anal fin in male placed well forward and modified into a sword-shaped intromittent organ.
- d. Intestinal canal short, little convoluted; teeth all pointed, in bands; eye normal; jaws not produced; dorsal short, of 6 to 10 rays, behind origin of anal; mouth wide, chin low.....*Gambusia*.
- dd. Intestinal canal elongate, much convoluted.
- e. Teeth compressed, entire, without lateral cusps.
- f. Anal process in male very long, serrate behind near tip and with finger-like claspers (the prepuce being modified into a pair of clasps); dorsal in both sexes behind origin of anal.
- g. Dentaries and intermaxillaries firmly united; teeth of outer row fixed, a band of minute teeth behind them.
- h. Teeth of outer row much expanded at tip, broadly spade-shaped in upper jaw, close-set, their margins overlapping; teeth near middle of lower jaw asymmetrically expanded, lateral lobes prolonged and ending in a point.....*Glaridichthys*.
- hh. Teeth of outer row wide-set, scarcely expanded, spear-shaped, those near middle of lower jaw in two irregular series.....*Toxus*, ^b nov.
- gg. Dentaries and intermaxillaries loosely joined; teeth of outer row movable, inserted on lips, a few teeth behind them or none, those of outer row wide-set, scarcely expanded, spear-shaped; those of middle of lower jaw in two irregular series.....*Girardinus*.
- ff. Anal process comparatively short, a leaf-shaped prepuce attached to the anterior surface covers the tip; tip without claspers; dorsal in female in advance of origin of anal.
- i. Tip of anal process in male ending in a simple antorse hook, no serræ on its posterior surface....*Pacilia*.
- cc. Teeth all pointed: origin of dorsal behind that of anal.....*Heterandria*.

Fundulus cubensis Eigenmann, new species. *

I am somewhat in doubt as to the generic position of this species. Its short intestine, double row of teeth, unrestricted gill-openings, and position of its dorsal in relation to its anal, and similarity of sexes (at least one of the three specimens is a male) seem to indicate that it is a species of *Fundulus*.

Type: No. 9667, Ind. Univ. Mus., 29 mm. long; Pinar del Rio.

Cotypes: Two specimens, 26½ mm. long; Pinar del Rio, at the ford just above wagon bridge.

Head 3.6, about equal to depth; D. 11 or 12; A. 10 or 1, 10; scales 24. Origin of dorsal very slightly nearer tip of snout than base of middle caudal rays and over the eighth scale of lateral line; origin

^aThe following characters are used to indicate the general distribution of the genera and species enumerated; †, genus peculiar to Cuba; *, species peculiar to Cuba; T, generally distributed in tropical fresh waters; M, marine species. ^bτοξον—a quiver full of arrows.

of anal under eleventh scale. Dorsal and anal high, angular behind, last ray somewhat produced, 4.3 in length to base of caudal; tip of last anal ray reaching base of caudal, tip of last dorsal ray nearly so; ventrals reaching to origin of anal; pectorals about to middle of ventrals; mouth very small and very oblique; eye longer than snout, 3 in head, very little less than interorbital; profile straight in front, slightly convex toward dorsal. Teeth all conical, in at least two series, those of outer series enlarged.

Coloration brilliant. Ventrals and anal without pigment, caudal with two or more cross-series of spots; a dark humeral spot just above origin of pectoral; dorsal dusky; a dark band through lower part of eye forward below chin; a dark band from eye to tail, its median half much darker than edges, bordered above and below by pigmentless bands bright orange in life, the upper one beginning below origin of dorsal; back above upper light band thickly covered with pigment spots; below lower light band a dusky band of equal width consisting of a series of contiguous V-shaped markings from axil of pectoral to tail; below this another pigmentless band extends from axil of pectoral to just behind anal; below this is a narrower band of dusky from axil to last anal ray; below this another short pigmentless band; edge of branchiostegal membranes and a line forward from their union to chin black; ventral surface otherwise without pigment except a faint line between ventrals.

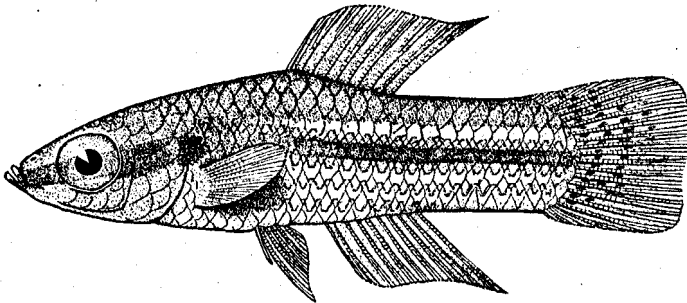


FIG. 1. *Fundulus cubensis* Eigenmann, new species.

Gambusia punctata Poey. *

Everywhere abundant. The following specimens were collected: San Antonio, 3 females, the largest 92 mm. long; Modesta No. 2, 3 females, the largest 84 mm.; Modesta No. 3, 4 females 37 to 72 mm.; San Cristobal, 50 females 31 to 84 mm.; 11 males 40 to 53 mm.; Palacios, 18 females 54 to 88 mm.; 5 males 50 to 61 mm.; Paso Real, 2 females 50 to 55 mm.; Sumidero, 3 females and 1 male; Pinar del Rio, 9 females, the largest 84 mm.; San Juan near Matanzas, 30 females, the largest 70 mm.; 5 males, the largest 42 mm.; Calabazar, 7 females, the largest 75 mm.

Gambusia puncticulata Poey. *

This species is shorter and deeper than *Gambusia punctata*, which it greatly resembles. The dorsal in the specimens taken counts 8 to 10, not 11, as Garman found in his specimens.

San Antonio, 3 females, the largest 58 mm., D. 9; San Cristobal, 4 females, the largest 48 mm., D. 8, 9, and 10; Palacios, 1 female 39 mm., D. 9; Pinar del Rio, 4 females, the largest 47 mm., and 3 males, the largest 35 mm.

GLARIDICHTHYS Garman.

Intestinal canal elongate; males with anal fin modified into a very long intromittent organ; jaws much more firmly united than in *Girardinus*, each with a series of close-set, broad-tipped, entire or but slightly crenulate teeth, these teeth not movable, a narrow band of smaller, broad-tipped, conical or tricuspid teeth behind them; fins small, anal in advance of dorsal in both sexes.

Most nearly allied to *Goodea* and *Girardinus*, and differing from them in character of teeth, *Goodea* having tricuspid teeth, *Girardinus* having movable loosely-set, and *Toxus* having hastate teeth.

Glaridichthys uninotatus Poey. *

Abundant. Fifty specimens preserved from San Cristobal, 47 to 84 mm. long; a number of specimens have, in addition to the lateral spot, a spot on either side of anus and sometimes a black streak connecting the two; in one instance the lateral spot on one side is entirely replaced by the anal spot; males (13) 38 to 47 mm.

At Palacios 24 specimens were preserved, 50 to 81 mm. Fluctuations in the lateral spots of female as in San Cristobal specimens; in one specimen only a small spot on one side, none on other.

Paso Real, 2 females; Pinar del Rio, 4 females.

Inner series of teeth in upper jaw small, with sharply triangular or tricuspid teeth in 4 or 5 rows; inner series of lower jaw little expanded at tip. Teeth of outer row near middle of jaws irregularly expanded, lateral lobes prolonged into a point; lateral teeth of lower and of upper jaw equally expanded.

***Glaridichthys falcatus* Eigenmann, new species. ***

Type, No. 9664, Ind. Univ. Mus., a female, 82 mm. long, from San Cristobal.

Cotypes: Eight females from an old river channel at San Cristobal, the smallest 60 mm. long, the largest 85 mm.; 4 females 50 to 53 mm., from Palacios, taken in a muddy pool in the river bed at the ford; 8 females and 2 males from Rio del Pinar, the females 38 to 47 mm., the males 29 and 37 mm. This species reaches its maximum size and is most abundant in warm, muddy pools.

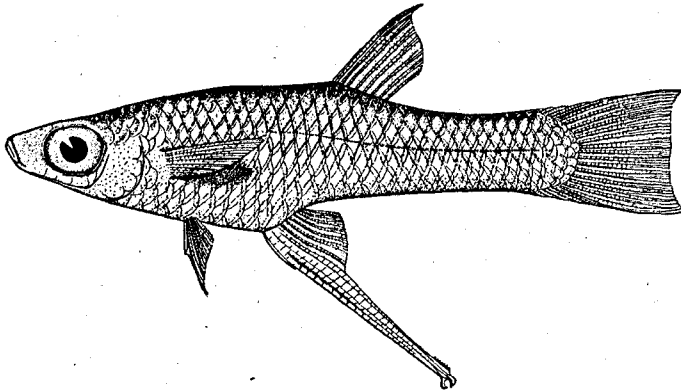


FIG. 2. *Glaridichthys falcatus* Eigenmann, new species. Male.

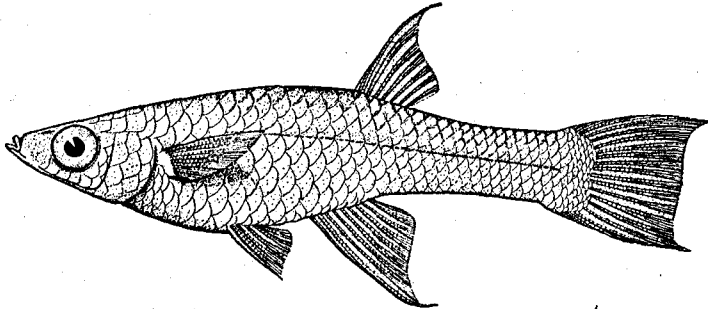


FIG. 3. *Glaridichthys falcatus* Eigenmann, new species. Female.

Body long, slender, little compressed; head 4; depth 4 (in pregnant females 3.5); D. 9; A. 11; scales 29; head broad, wedge-shaped in profile, with lower jaw very oblique, projecting; eye very large, longer than snout, 2.6 in head, 1.4 in interorbital; mouth very oblique, small; interorbital divided into 3 distinct regions by longitudinal grooves, central portion convex; origin of dorsal equidistant from base of middle caudal ray and origin of pectoral; dorsal and anal falcate; second rays sickle-shaped, each extending for one-third its total height beyond tip of last ray when folded back, little less than length of head; caudal emarginate, some of outer rays prolonged; origin of anal in female about equidistant from base of middle caudal ray and anterior margin of eye, its seventh ray under origin of dorsal; ventrals usually reaching to anal; pectorals about to middle of ventrals in female, to base of anal in male.

San Cristobal specimens very pale; a dusky streak from nape along middle of back to caudal,

scales above lateral line faintly edged with black; a black line along middle of sides composed of a single series of chromatophores; a black streak along ventral surface from anal to caudal; otherwise colorless.

Palacios specimens colored like those from San Cristobal, except one in which each scale of the side below lateral line is edged with a series of chromatophores and there is a faint hint of 8 dark spots along median black line; region above lateral line dusky.

Pinar del Rio specimens colored like the darker Palacios specimen, sometimes a black streak on either side of anus and forward to ventrals. Male with modified portion of the anal very long, with retrorse spines behind and a little clasper on tip of longest rays.

***Glaridichthys torralbasi* Eigenmann, new species. ***

Type, No. 9662, Ind. Univ. Mus., male, 45 mm. long, from Pinar del Rio, represents apparently a new species. In general appearance it very greatly resembles the males of *Girardinus metallicus* and *Glaridichthys unnotatus*. From the former it differs in possessing bands of teeth in jaws behind spatulate row, first row of teeth fixed, and dentary and premaxillaries much more firmly united; from the second it differs in coloration, having no lateral spot and a conspicuous dorsal band. There are no other species which it resembles.

D. 9; A. 10; scales 28; head 3.6; depth 3.3; body compressed, elongate; mouth small, subterminal, lower jaw not prominent; eye greater than snout, less than 3 in head, equal to interorbital; teeth in outer series overlapping, those of lower jaw more pointed; a band of minute teeth behind at least the front row in upper jaw; dorsal small, its first ray equidistant from base of middle caudal rays

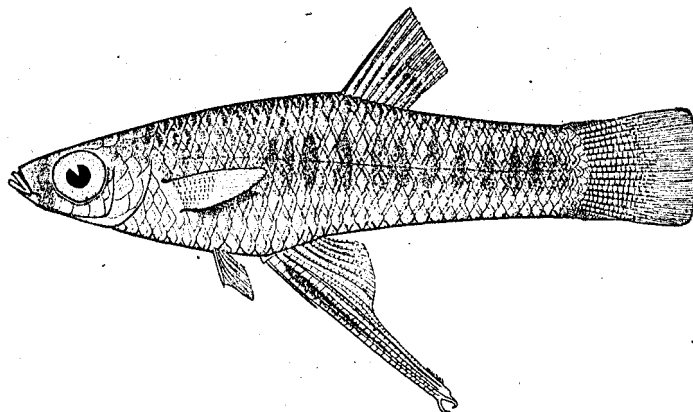


FIG. 4. *Glaridichthys torralbasi* Eigenmann, new species.

and from eye; its highest ray nearly equal to distance of pectoral from anterior margin of eye; caudal truncate, equal to distance of pectoral from tip of snout; anal process long, with serrae behind, and a clasper at end of anterior rays; ventrals small, not much longer than eye; pectoral reaching to anal; dorsal with an arched band reaching from full length of first ray to base of last; caudal, ventral, and pectoral colorless; first ray of anal process largely black; sides with about 10 dark cross-streaks; all scales margined with black, dorsal ones not heavily so; a dark dorsal streak, a black ventral line behind anal, a dusky band around head just in front of eyes.

I take pleasure in naming this species for Prof. José I. Torralbas, of the chair of zoology in the University of Habana.

Girardinus metallicus* Poey. †

San Cristobal, very abundant; largest female, 77 mm. long; largest male, 45 mm. A few females with black on anal.

Palacios; largest female, 69 mm.; largest male, 41 mm.; ventral band from chin to tail black in one male; one male blotched with black.

San Antonio; largest female, 79 mm.

Ashton; females usually with black on anal; largest female, 51 mm.; largest male, 38 mm.

Pinar del Rio; largest female, 68 mm.; largest male, 41 mm.; a number of males with a black streak of varying intensity and width along the ventral surface.

Girardinus garmani Eigenmann, new species. †*

Type, No. 9661, Ind. Univ. Mus., one male, 35 mm., Pinar del Rio. Cotypes, one male, 35 mm., Pinar del Rio; one male, 38 mm., Palacios.

D. 9; A. 9; scales 29; depth 3.4 to 3.6; head 3.6 to 3.8. Body compressed; head truncated, lower jaw nearly vertical; mouth very small, lips thick, teeth in a single series in each jaw, sloped as in *G. metallicus*, very movable, intermaxillaries and dentaries not united; eye as long as snout, 2.5 in head, equal to interorbital; origin of dorsal a little nearer pectoral than base of middle caudal rays; dorsal rounded, small; dorsal, caudal, and pectoral of about equal height, equal to distance of pectoral from eye; anal process 2.5 in length, serrate near its tip behind and with a clasper at its end; ventrals very small, reaching to the anal; ventral surface colorless except a black line from anal to caudal; scales of side with a dark margin of increasing width toward back; a dusky dorsal streak; head in front of eye dark above and below; region below eye colorless; a well-defined black spot on base of last 5 dorsal rays; first dorsal ray black; anal process blackish on basal half, a small indistinct black spot on distal half of last anal membrane and extending at times on neighboring regions; sides without streaks or bars.

This species differs from *G. metallicus* and *G. denticulatus* in being entirely without streaks or spots or bars on the sides, in the number of anal rays, and in other characters.

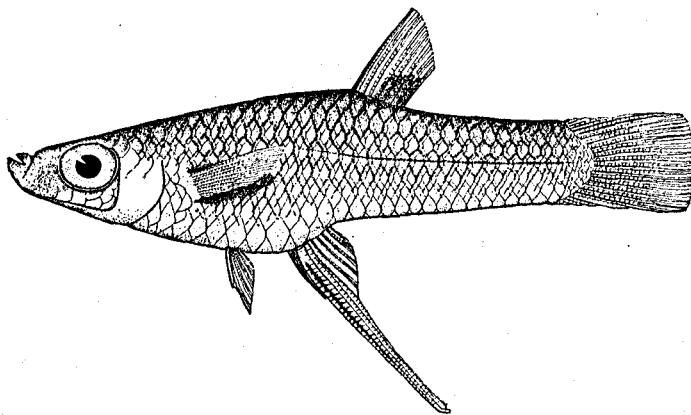


FIG. 5. *Girardinus garmani* Eigenmann, new species.

TOXUS Eigenmann, new genus. †

Toxus Eigenmann, new genus of *Peciliidae* (*riddlei*).

This genus differs from *Glaridichthys* in its narrow teeth, from *Girardinus* in having its jaws firmly joined.

Toxus riddlei Eigenmann, new species. †*

Type, No. 9656, Ind. Univ. Mus., a female, 59 mm. long, from San Cristobal.

Cotypes: 1 female 66 mm. long, and 2 males 33 and 34 mm. long, from San Cristobal. Head 4; depth 3.4; D. 9; A. 10; scales 28; origin of dorsal midway between base of middle caudal rays and origin of upper pectoral ray and over thirteenth scale of lateral line; origin of anal below eleventh scale; fins moderate; longest dorsal ray equaling length of head without snout; eye equaling snout, little more than 3 in head; interorbital convex, equaling snout and eye; profile slightly curved; outer row of teeth movable, spear-shaped, not very closely set, brown-tipped, a band of minute teeth behind them; a dark lateral band crossed by about 6 indistinct dark crossbands; scales of sides with a light center and a narrower or broader margin of dark, forming reticulations; a dark streak extending down between eye and angle of mouth; rest of lower side of head and belly white; pectoral colorless; caudal faintly dusky; anal with a faint dark band through the middle, the tips and base colorless; dorsal dusky.

Male much smaller, the color contrasts sharper; about 7 well-marked dark crossbands in the larger specimen; dorsal tipped with dusky, a black band from base of last dorsal rays forward toward basal third of fourth dorsal ray; in the larger specimen a series of dark spots on dorsal rays on a level

with tip of first one; a black band through middle of anal, most intense upon and entirely covering last rays; first fully developed ray black in the large specimen, colorless in the smaller; origin of anal under eighth scale.

I take pleasure in naming this species for Mr. Oscar Riddle, to whom much of the success of the expedition to Cuba is due.

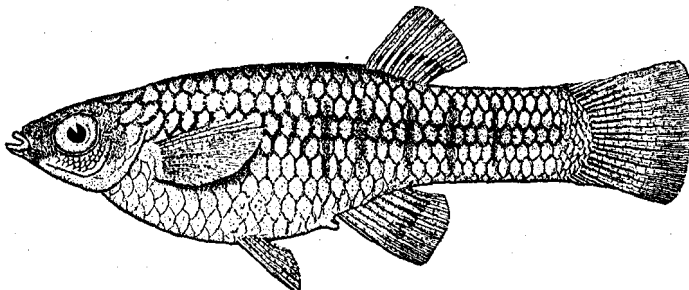


FIG. 6. *Torus riddlei* Eigenmann, new species. Female.

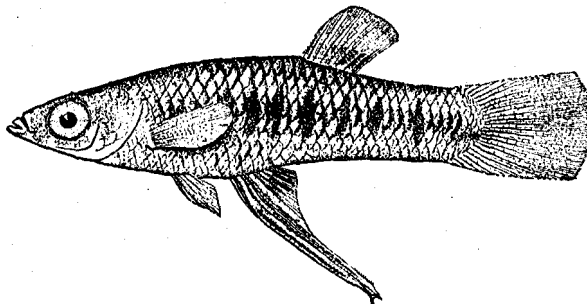


FIG. 7. *Torus riddlei* Eigenmann, new species. Male.

***Poecilia vittata* Guichenot. ***

San Cristobal, over 50 females, the largest 94 mm. long; a number of them with peculiar black blotches; the small ones with 3 yellow stripes below the lateral line and frequently with one or more series of black dots along lower part of side; 32 males, the largest 70 mm.

San Antonio, 5 females, the largest 110 mm.; 2 males, the largest 73 mm.

Los Palacios, 70 females, the largest 100 mm., showing great variability in the intensity of coloration; 35 males, the largest 65 mm.

Calabazar, 9 females, the largest 102 mm.; 4 males, the largest 70 mm.

Paso Real, 3 females, the largest 80 mm.; 1 male, 53 mm.

Pinar del Rio, 17 females, the largest 83 mm.; 9 males, the largest 63 mm.

Sumidero, 2 females.

***Heterandria cubensis* Eigenmann, new species. ***

Type, No. 7663, Ind. Univ. Mus., a female, 59 mm., from Los Palacios.

Cotypes, one female with young, 53 mm., from Los Palacios, and one female, 38 mm., from Pinar del Rio. These specimens agree well with the characters of the genus *Heterandria*, as restricted by Garman, except that the outer series of teeth are movable. Head 5 to 5.2; depth 3.3 to 3.7; D. 9; A. 10; scales 29. Body elongate, little compressed, general shape that of *Fundulus*; profile regularly curved from dorsal fin to eyes, flattened over eyes and forward; mouth small, opening upward, the lower jaw projecting; bones of jaw loosely united; eye longer than mouth, 2.5 to 2.7 in head, very little less than interorbital; origin of dorsal a little nearer head than base of middle caudal rays, over first third of anal; dorsal and anal both falcate, the anterior rays extending considerably beyond tip of last when laid back; highest dorsal ray slightly shorter than highest anal ray, about equal to length of head; caudal a little longer than head; ventral reaching to anus; pectoral reaching to ventral.

Scales of the mid-dorsal line with their dorsal halves dusky, those of entire side margined with

black, most distinct above lateral line; a series of 12 narrow dark vertical bands about as wide as pupil and as high as eye; an irregular black streak along middle of side; dorsal tipped with dusky, the first membrane black; a black line and a few chromatophores along each anal ray; a black line from anal to caudal; chin dusky; pectoral, ventral, and belly colorless.

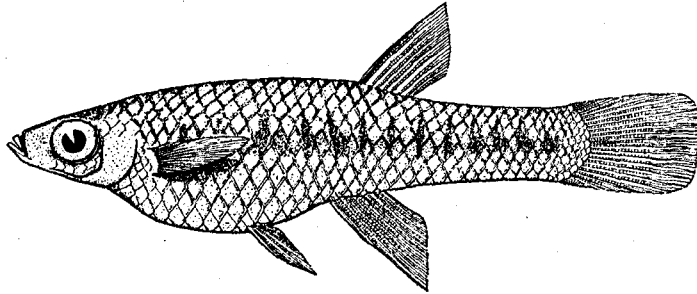


FIG. 8. *Heterandria cubensis* Eigenmann, new species.

SYNGNATHIDÆ.

Doryrhamphus lineatus (Valenciennes). M.

Two specimens from the Rio San Juan below the ford.

ATHERINIDÆ.

Atherina evermanni Eigenmann, new species. *

Type No. 9657, Ind. Univ. Mus., 45 mm., from San Cristobal. Cotypes, 35 specimens, 36 to 50 mm., from San Cristobal, and 5 specimens, 28 to 38 mm. long, from Pinar del Rio.

D. v-1, 9-11; A. 1, 12 to 15; head 3.5 to 4; depth 4.5 to 5; scales 32; head rather pointed; mouth oblique, the lower jaw projecting; maxillary reaching a little beyond front of eye; eye 2.75 in head, equal to distance from tip of snout to anterior margin of pupil; little wider than interorbital; teeth minute; spinous dorsal inserted behind tips of ventrals, its origin equidistant from tip of snout and middle caudal rays, or a little nearer caudal; caudal peduncle very slender, its least depth less than

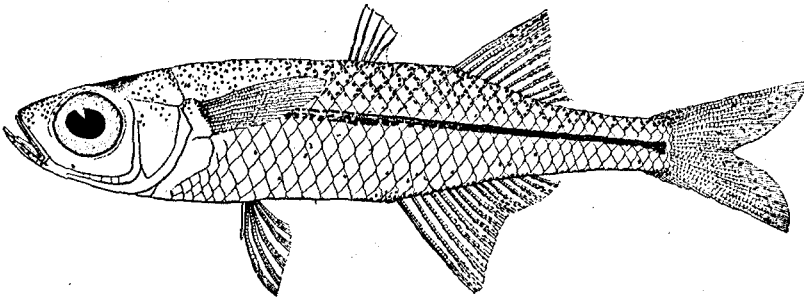


FIG. 9. *Atherina evermanni* Eigenmann, new species.

length of eye; caudal little less than length of head; anal inserted in advance of origin of dorsal; ventrals small, not reaching anal; pectoral reaching tips of ventrals; a conspicuous lateral band most intense on caudal peduncle, gradually fading out under pectoral; region above this in all cases thickly peppered with black cells, most thickly so along median line; region below this in many cases similarly but less intensely spotted; lower side of head and breast white; ventrals nearly free from pigment; all the other fins with pigment, cells of greater or less intensity along the rays. This species is readily distinguishable from the other species of *Atherina* by the smaller number of scales.

I take pleasure in naming this species for Dr. Barton Warren Evermann, in recognition of his valuable work on the fishes of the West Indies, especially his work on the fishes of Porto Rico.

MUGILIDÆ.

Agonostomus monticola (Bancroft). T.

Rio San Juan, near its first ford, abundant, the largest 140 mm. long; Sumidero, abundant, the largest 170 mm.; Pinar del Rio, abundant, the largest 160 mm.

CENTROPOMIDÆ.

Centropomus undecimalis (Bloch). M.

Rio San Juan, at its first ford, abundant, varying in length from 55 to 250 mm.

LUTIANIDÆ.

Lutianus jocu (Bloch & Schneider). M.

Two specimens from the Rio San Juan, just below the ford.

Lutianus griseus (Walbaum). M.

One small specimen from the Rio San Juan, just below the ford.

GERRIDÆ.

Eucinostomus meeki Eigenmann, new species. M.

Type, No. 9660, Ind. Univ. Mus., a specimen 135 mm., from San Juan River, just below its first ford. General appearance of *Utama lefroji*, differing from all other species of the genus *Eucinostomus* in having but 2 anal spines.

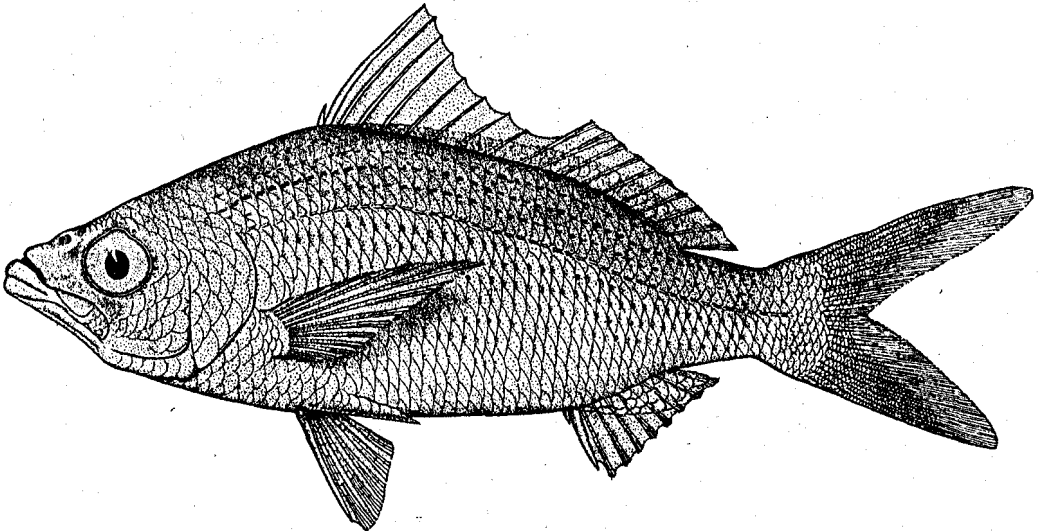


FIG. 10. *Eucinostomus meeki* Eigenmann, new species.

Head 3.25; depth 3; D. ix, 10; A. ii, 8; scales 4-46-9; eye 1 in snout, 3 in head, 1 in interorbital. Body elongate, little compressed or elevated, the dorsal profile but little more elevated than the ventral; snout pointed, the profile from snout to dorsal gently arched; mouth narrow, terminal, but little above the lower margin of the eye; maxillary reaching to vertical from front of eye, 3.4 in head, its exposed part boat-shaped, a trifle more than twice as long as wide, 5 in head; intermaxillary groove entirely naked, its width 5 in the interorbital; preopercle and preorbital entire; dorsal spines slender, the second longest, 6 in the length; ventrals short, reaching half way to anal; pectoral long, 3.5 in the length, reaching beyond tips of the ventrals, but not to vent. First anal spine minute, the second equal to the length of the eye.

Color, ashy gray, with some metallic reflections; dusky lines along the rows of scales; sides and back everywhere punctate with minute dots; vertical fins dusky; ventrals and pectorals lighter.

Named for Dr. Seth Eugene Meek, assistant curator of zoology, Field Columbian Museum, in recognition of his excellent work on Mexican fishes.

CICHLIDÆ.

Individuals of the genus *Heros* are as numerous in the streams of Cuba as individuals of the *Centrarchidæ* are in the streams of equal size in the Ohio valley. They were found by us down to tide water, but not in it. Only a single species has been recorded from Cuba, and nothing has been said either concerning its distribution or its variation. No one, except possibly Poey, has before this compared numbers of specimens from different places or even from the same place. Such a comparison is therefore very desirable, and the material collected far surpasses all other collections made before. We have altogether 236 specimens from various localities. An examination of all of these proves either the presence of several instead of a single species on the island or a remarkable variation with localities. A definition of the variations has proved very elusive. The numbers of fin rays and scales are uniform, so that the differences exist in the proportions and the color. But the coloration also has a certain underlying uniformity. There is a spot near the middle of the side, another at the base of the caudal, and an obscure third above the gill-opening. There are numerous small spots on the fins and on scales of the sides, especially below and on the opercles, and sometimes on the cheeks. There is also a longitudinal streak from the eye through the lateral spot to the caudal spot, and a

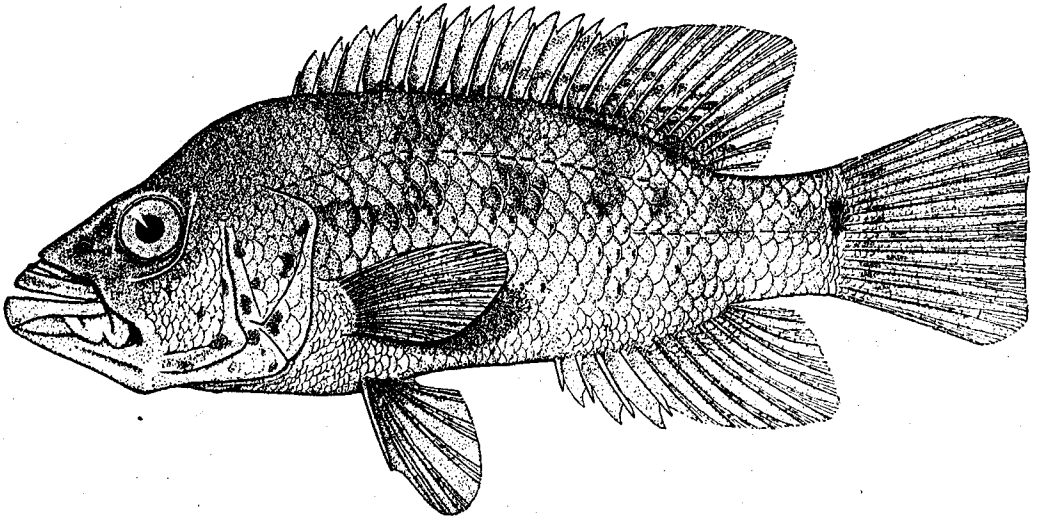


FIG. 11. *Heros tetracanthus torralbasi* Eigenmann, the type of new subspecies. (Type A.)

definite number of crossbars, both streak and bars most conspicuous in the young and in light-colored adult individuals. This uniformity of underlying structure makes defining of species or varieties a difficult proceeding. The polymorphism is further complicated by instances like the following: The specimens from San Antonio are readily referable to a certain form found at Calabazar, although they differ from Calabazar specimens in quite readily distinguishable features; but one of them differs notably from all other specimens collected at San Antonio, and would unhesitatingly be considered a species distinct from the other specimens from the same locality. But at Palacios the same form branching from the Calabazar form approaches the characters of the single specimen from San Antonio.

I venture to describe here certain of the most aberrant forms as new, without, however, feeling sure that they are really distinct varieties or species or that some of the other forms referred to *H. tetracanthus* are not also new.

***Heros tetracanthus* Cuvier & Valenciennes. ***

***Heros tetracanthus torralbasi* Eigenmann, new subspecies.**

(25 specimens, 60 to 181 mm. long, from Calabazar.)

These specimens come from the Almendares River, and as this flows near to Habana it is very probable that the type of *Heros tetracanthus* came from the same river. Cuvier & Valenciennes say that Poey's drawing, on which their *tetracanthus* was based, resembled *Ambloplites* in outline, and possessed spots in the angles of the scales. This very well describes some specimens I have (figs. 12 and 13).

D. xv, 11; A. iv, 9; depth greatest below first dorsal spine, 2.5 to 2.7; depth of caudal peduncle 2.5 to 2.25 in head; scales 27 to 29; pores 17 to 21 + 10 to 13; body heavy forward, tapering from the shoulders to the caudal peduncle; jaws heavy, lips thick; snout 2.75 to 2.5 in head; eye 4.5 to 5 in head (3.5 in young), 1.5 in interorbital; no pore in upper angle of gill-opening (except on one side of one individual.); highest dorsal and anal rays reaching base of caudal; highest dorsal ray 4.5 to 5.3 in

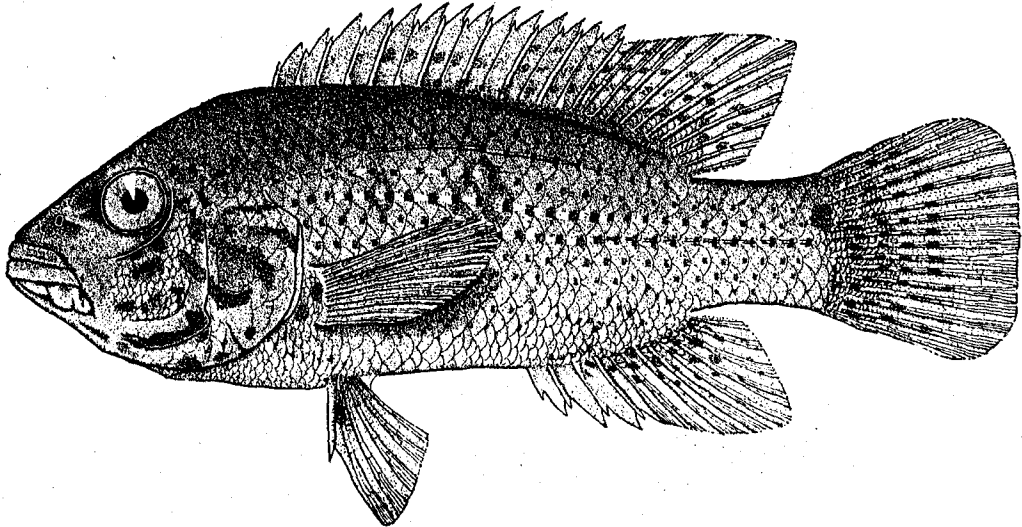


FIG. 12. *Heros tetraacanthus tetraacanthus* Cuvier & Valenciennes. (Type B.)

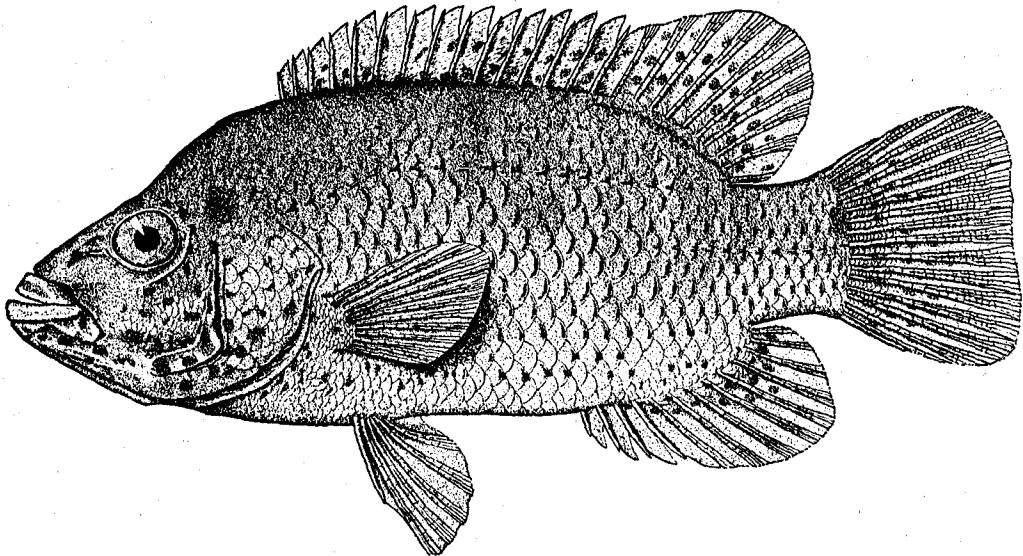


FIG. 13. *Heros tetraacanthus tetraacanthus* Cuvier & Valenciennes. (Type C.)

the length; last dorsal ray 3 in the longest; lateral and caudal spots conspicuous in young, which have a series of light crossbars; two light bars usually confluent over the lateral spot; fins dusky, the vertical ones lighter-edged and with some spots on their bases; no spots on head or body in the youngest; in larger ones spots appear about the base of the pectoral, opercle, angle of preopercle and mandible. There is great variation in the distinctness of the lateral bands.

In the larger specimens there are 2 types of coloration; type A has more or less distinct vertical bars, alternating light and dark; the lateral and caudal spots are distinct, the dark crossbars are darkest in a line between the two; a dark streak extends from the eye to second dark bar, this with the darker areas on the crossbands forming an interrupted lateral band; cheeks unspotted, opercles and mandible with dark spots; ventral surface plain; a few scattered spots along the sides; vertical fins more or less spotted at the base. Type B shows no crossbands, each scale of the side with a dark spot forming longitudinal series; cheeks as well as opercles and mandible spotted or the spots confluent into lengthwise streaks; vertical fins more conspicuously spotted; cheeks in the young of both types unspotted; sides of the young of type B less regularly spotted than in the adult. Figs. 11 and 12 are drawn from males, of the same size and with reproductive organs in the same stage of development. Fig. 12, type B, evidently represents the variety figured by Poey, and is the original *tetracanthus*. Fig. 11, representing type A, may be termed *H. tetracanthus torralbasi* Eigenmann, var. nov. (No. 9672, Ind. Univ. Mus.).

(78 specimens, 44 to 160 mm. long, from San Cristobal.)

Most of these were taken out of a muddy lagoon near the river, and all were very pale in color, the crossbars showing well. In these paler specimens there are no indications of a longitudinal stripe. The largest, which also came out of the lagoon, is nearly uniform light ash, there being but faint indication of crossbars and spots; there are faint spots on fins and opercle. Other smaller specimens are everywhere profusely spotted. In the darker specimens from the river there is a dark lateral band.

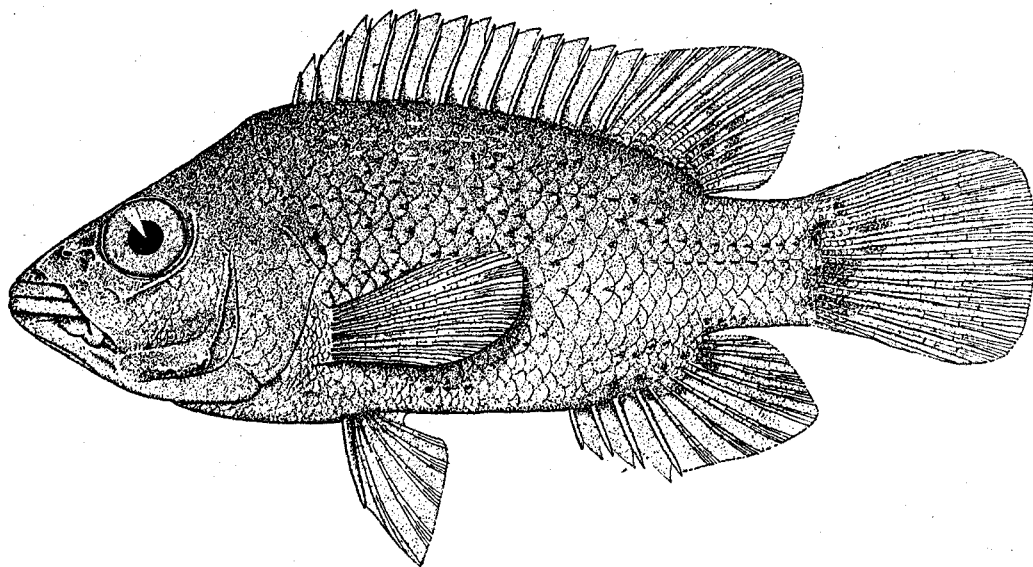


FIG. 14. *Heros tetracanthus griseus* Eigenmann, new subspecies

(70 specimens, 47 to 190 mm. long, from Los Palacios.)

These specimens are of types A and B from Calabazar, with some distinct features. The dark spots (of B) along the rows of scales are, in some of the lighter individuals, nearly faded out; in the darkest ones they spread nearly over entire margin of scales (fig. 13). The cheeks are spotted or streaked in some of the largest specimens and not in others. The lateral band in some specimens of Type A is as well developed as in some San Antonio specimens; vertical bars vary also very much in intensity. One dark specimen resembles in almost all respects *Heros griseus* from San Antonio. Depth, 2.25 to 2.5.

(17 specimens, 62 to 155 mm. long, from Pinar del Rio, are of A and B from Calabazar.)

(4 specimens, 65 to 240 mm. long, from Sumidero.)

All these specimens are dark, the smaller one nearly uniform, with but faint crossbars; lateral and caudal spots distinct. The largest one is a male, very dark above, without distinct markings, and with black streaks and spots on cheeks, opercles, and lower sides. Depth 2; head 2.6; eye 5 in head. These may be referred to *tetracanthus*.

Among 32 specimens from San Antonio there are 3 distinct types, one of which may simply be the adult of one of the others. They are all elongate, the depth being 2.3 to 2.5 in length. There are, in the first place, 4 adults measuring 160 to 190 mm. in length, of type B from Calabazar. They differ from the Calabazar specimens in having the spots along the scales larger and less regular. In two of the specimens the cheeks are spotted, in two others the spots are confluent into vertical or longitudinal streaks. In the largest some of the dorsal rays are prolonged, reaching to near middle of caudal. These are probably the adult of 17 specimens from 92 to 157 mm. long. In all of these, even in the smallest, there are spots on the cheeks, more numerous in the larger, and confluent into streaks in the largest. Sides irregularly spotted; lateral band more or less conspicuous as the fish is lighter or darker; there are traces of the usual light and dark bands in some individuals. All of these are evidently typical *H. tetracanthus*.

There are 11 specimens, 90 to 123 mm. long, evidently modifications of *H. tetracanthus torralbasi* from Calabazar, in which, except one very dark specimen, the lateral band is very conspicuous. Vertical bands quite well marked except in darkest specimens. Cheeks are unspotted except in one individual which has faint spots; sides without small dark spots.

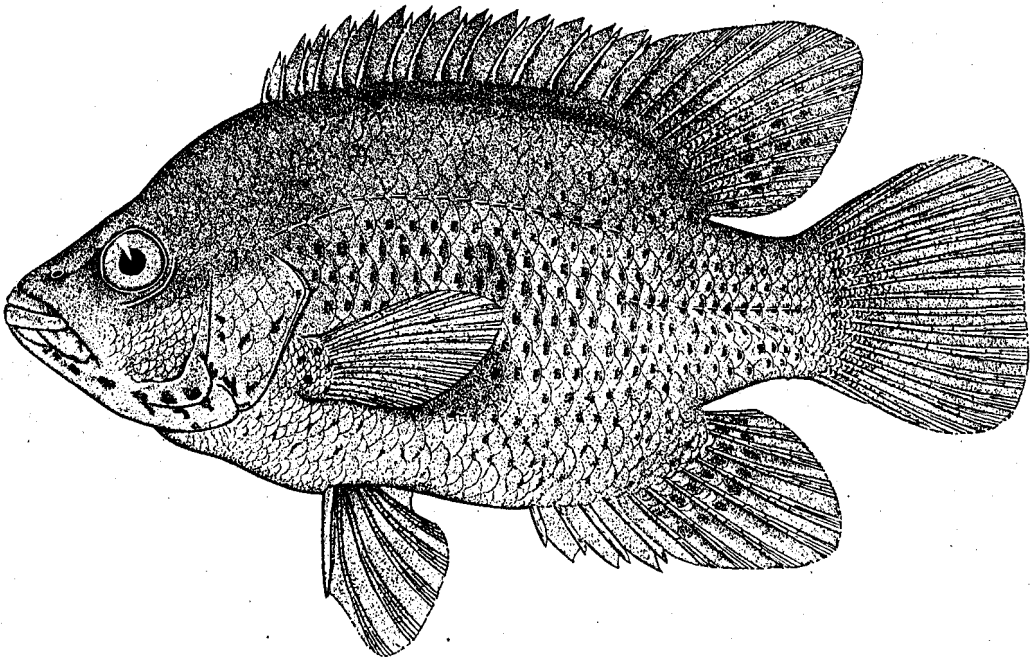


FIG. 15. *Heros tetracanthus latus* Eigenmann, new subspecies.

***Heros tetracanthus griseus* Eigenmann, new subspecies. ***

Type: No. 9670, Ind. Univ. Mus.; a specimen 117 mm. long, from San Antonio.

D. xv, 11; A. iv, 8; scales 27; pores 17+10; depth a little more than 2.5; depth of caudal peduncle 2.5 in head; head 2.7 in the length. Shape and general characters of *Heros tetracanthus* from the same place, differing in the color and the notably larger eye, as compared with specimens of *H. tetracanthus* of the same size. Eye 3.7 in head (4.6 in *H. tetracanthus* of the same size); 1 in inter-orbital (1.5); 1.25 in snout (1.7); preorbital five-sevenths of eye; snout 3 in head; highest dorsal and anal reaching base of caudal; highest dorsal 4.7 in the length; highest anal 5; ventrals reaching to vent. No lateral spot; a faint caudal spot; sides ashy with irregular dark spot; a few whitish streaks through some of the scales above lateral line; cheeks plain, a few spots on opercles; soft portions of vertical fins spotted at base; no traces of dark crossbars.

***Heros tetracanthus latus* Eigenmann, new subspecies. ***

Type: No. 9669, Ind. Univ. Mus., a specimen 160 mm. long, from San Juan.

This is a narrow, deep fish with projecting lower jaw, a pointed snout, and a depression in the profile over eyes. D. xv, 11; A. iv, 9; depth 2; head 2.7; depth of caudal peduncle 2 in head; scales 28; pores, 18 + 12; snout pointed 2.75 in head; eye 4.5 in head, 1.5 in interorbital; no foramen in upper angle of gill-opening; maxillary reaching vertical from front of orbit; highest dorsal and anal rays reaching to end of basal two-fifths of caudal; highest dorsal ray twice as high as last ray, equaling longest caudal ray, equaling length of head without opercle; highest anal ray slightly shorter; ventrals to vent.

Ashy gray, darker above to light below; each scale of lower parts of side with black spot on tip, extending over to next scale and forming distinct series; lower part of opercle, preopercle, lower part of cheek, and lower jaw with dark spots; vertical fins dusky; soft dorsal and anal spotted; ventrals dark, inner ray light; pectorals pale.

***Heros tetracanthus cinctus* Eigenmann, new subspecies. ***

Type: No. 9671, Ind. Univ. Mus., a specimen 129 mm. long, from Paso Real.

Four specimens were taken at Paso Real measuring *a* 68, *b* 72, *c* 129, and *d* 136 mm. long, respectively, and differing in coloration from those taken at any other point. The two larger are very dark, one having very distinct markings.

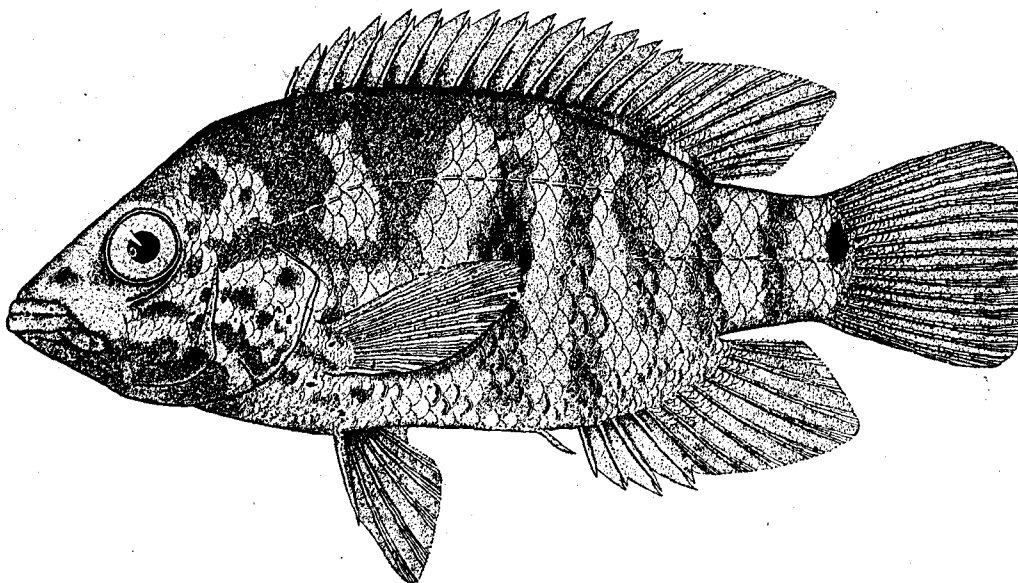


FIG. 16. *Heros tetracanthus cinctus* Eigenmann, new subspecies.

The specimens approach *H. nigricans* but have a normal lateral line: *c* (the type) is most aberrant in its coloration, *d* approaches the coloration of *tetracanthus torralbasi* from the Aluendares, *a* and *b* are indistinguishable from other young except in the band through the lateral spot.

D. xv, 11 (*c*); xvi, 10 (*d*); xv, 10 (*b*); xvi, 11; A. iv, 8; scales 28, pores 15 + 9 (*a*); 16 + 8 (*b*); 15 + 9 (*c*); 19 + 11 (*d*); head 2.6 to 2.7; depth 2.25 to 2.2; depth at end of opercle 2.4 to 2.43; snout pointed, 2.75 to 3 in head; mouth horizontal, maxillary nearly concealed when the mouth is closed; maxillary about reaching vertical from front of orbit; highest dorsal and anal rays reaching little beyond base of caudal 5 in length, last dorsal ray 2.3 in the longest; ventrals reaching vent; gill-opening with a supplementary pouch above, reached by a larger or smaller foramen.

Dark; a black lateral and a black caudal spot; side with 7 light crossbars; a light streak across nape from upper angle of gill-opening, another across from behind eye, another between eyes; snout light; spaces between light bars form dark bars of about equal width except first two on body, which are much wider at the top; a black streak from eye across upper angle of gill-opening to the second dark bar; cheeks and opercles with black spots and streaks, ventral surface spotted; vertical fins and ventrals dark; soft dorsal and anal with obscure spots; pectoral pale, unspotted. The dark band in which the lateral spot is located continued to the back.

Young much lighter colored, a few dark spots along opercle and below cheek; ventral surface unspotted, lateral and caudal spots conspicuous.

A fifth specimen, 152 mm. long, from Paso Real, is a typical *tetracanthus*.

Heros nigricans Eigenmann, new species.

Type, No. 9668, Ind. Univ. Mus., a specimen 192 mm. long, from Pinar del Rio.

One specimen was secured. It is the most prominent of the aberrant forms, and I should unhesitatingly describe it as a distinct species if I had obtained more than one specimen.

D. xiv, 11; A. iv, 10; scales 28; pores about 15+0; head 2.6; depth a trifle less than 2 in the length; depth at end of opercle 2 in length $+\frac{1}{2}$ diameter of eye; depth over middle of eye equals length of head, less one ocular diameter; snout pointed, upper and lower profiles nearly equally inclined to behind eye; upper profile gibbous behind eye; maxillary very little exposed when mouth

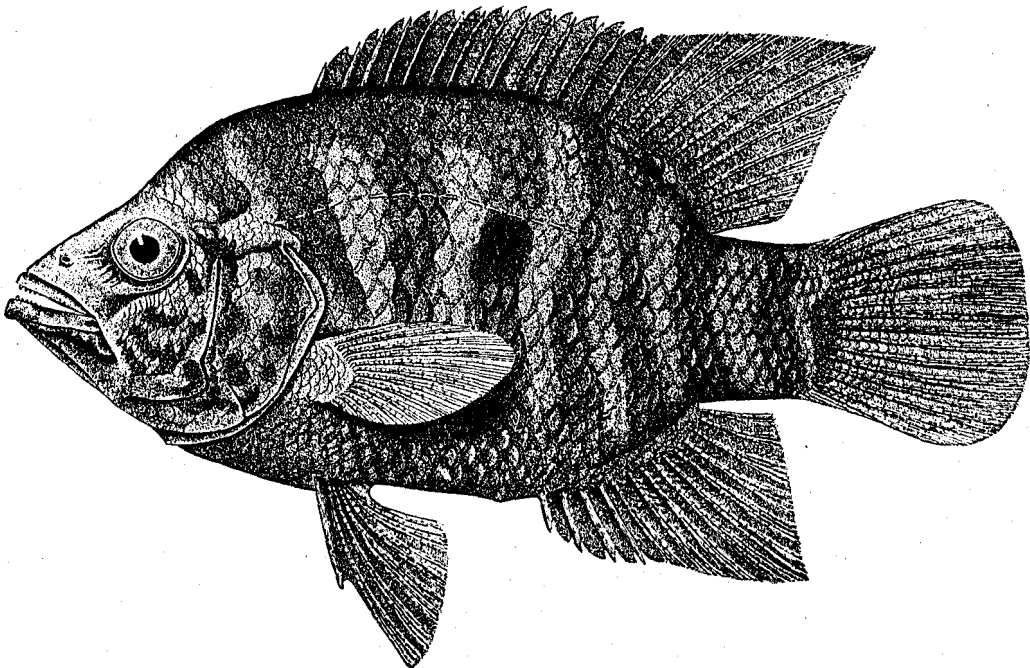


FIG. 17. *Heros nigricans* Eigenmann, new species.

is closed; eye 1.5 in interorbital. Gill-cavity, with a small supplementary pocket at its upper angle, entered by a large foramen; lateral line irregularly developed on left side; no pores on either side of tail; soft dorsal falcate, fifth ray as long as caudal, 3 times as long as last ray, its tip reaching nearly to middle of caudal, 3.6 in length, longer than head, less opercle; caudal broadly rounded; anal falcate, fourth ray longest, equaling head, less opercle; ventrals reaching to vent.

Color everywhere nearly black, with 7 lighter crossbars, 2 of which are on caudal peduncle; an additional light streak from angle of gill-opening across nape; cheeks and opercles with lighter marking; fins nearly uniform black.

GOBIIDÆ.

Philypnus dormitator (Lacépède). T.

Rio San Juan, and seen in Vento springs near Havana; very abundant in the San Juan, where specimens 46 to 256 mm. long were obtained; young with black stripe from tip of lower jaw to caudal.

Dormitator maculatus (Bloch). T.

Rio San Juan, at its mouth and at the first ford; very dark; lagoon at San Cristobal, very light.

Eleotris pisonis (Gmelin). T. Rio San Juan, at its mouth and at the first ford.*Lophogobius cyprinoides* (Pallas). M. Rio San Juan.*Gobius soporator* Cuv. & Val. M. Mouth of Rio San Juan at Matanzas and at its first ford.*Gobius boleosoma* Jordan & Gilbert. M. Mouth of Rio San Juan and at its first ford.*Awaous taiasica* (Lichtenstein). T. Sumidero.

BROTULIDÆ.

Stygicola dentatus (Poey). †*

This blind fish was taken in the M cave near Alacranes, 20 specimens; Jaiguan, 5 specimens; Frias, 2 specimens; Modesta, 4 specimens; and Tranquilidad, 7 specimens; caves near Cañas without specific locality, 5 specimens. In all, 43 specimens were secured, ranging from 60 to 152 mm. long. Poey records this species from Cajio and Ashton, in which it was not found by us. He also records it from La Industria, which is said to be between Cajio and the Cañas caves.

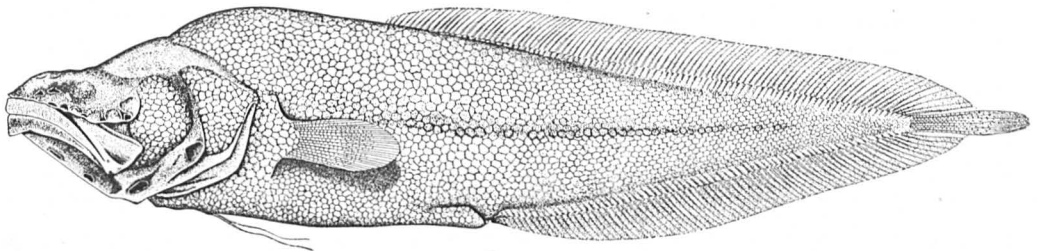
The males of *Stygicola dentatus* are distinctly larger than the females. Average length of the 20 females caught is 97 + mm., the largest one 120 mm. The average size of the 23 males is 113 + mm., the largest one being 152 mm. long. The males were in excess of the females in the ratio of 100 females to 115 males. There is but an appreciable difference in the averages of the fins, as far as these could be counted, the average formula for the females being D. 91.4, A. 74; and for the males D. 91.1, A. 73.6; or the average for the two are D. 91.2, A. 73.6.

Lucifuga subterraneus Poey. †*

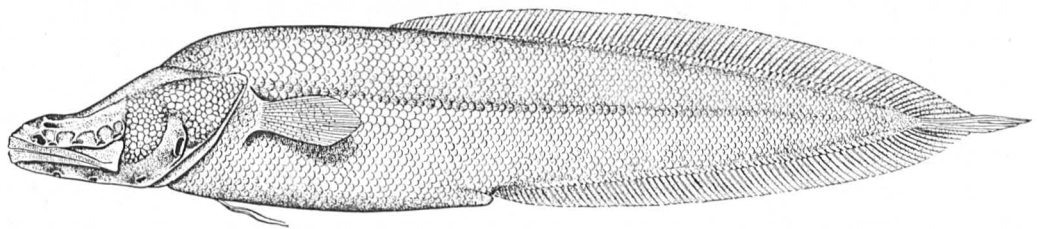
This species was taken in all but one of the caves in which *Stygicola dentatus* was taken, and in several others besides. The localities are Ashton, 13 specimens; Los Baños, 5 specimens; Cajio, 3 specimens; Hawey, 16 specimens; San Isidro, 2 specimens; Jaiguan, 18 specimens; Las Frias, 5 specimens; Modesta, 2 specimens; Tranquilidad, 3 specimens; Cañas, without specific locality, 9 specimens; total, 76 specimens, ranging from 24 to 94 mm. long. The females of *Lucifuga subterraneus* are distinctly larger than the males. In making the average for the size of the sexes individuals less than a year old were not considered, because the differences in the sexes would, if present, be but very slight, and because in such young the sex could not always be determined with certainty. An examination of all specimens makes it probable that at the end of a year after birth the young are about 50 mm. long. In obtaining the average size of the sexes only specimens over 50 mm. were considered. The males above this size measure 59.7 mm. on an average, with a maximum of 94 mm. The females measured 71.1 mm. on an average, with a maximum of 93 mm. Of the specimens over 50 mm. long 23 were males and 22 females, or 100 females for every 104.5 males. The fin formula to the nearest decimal for those of the individuals over 50 mm. which would be counted is, males, D. 82.1, A. 67.4; females, D. 81.9, A. 68. The average formula for those less than 50 mm. long is D. 83, A. 67.2, or for all together, D. 82.6+, A. 67.5.

While the average number of rays differs considerably in the two species, the number in each varies so much that the numbers in individual cases overlap, individuals of *Lucifuga* reaching as high as 88 dorsal rays and individuals of *Stygicola* as low as 87. The same is true regarding the anal.

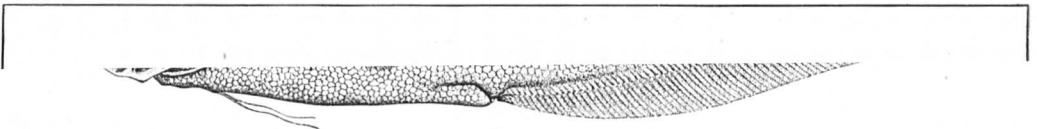
A female of this species (fig. 3, pl. 21), 65 mm. long, contained four young about 20 mm. long.



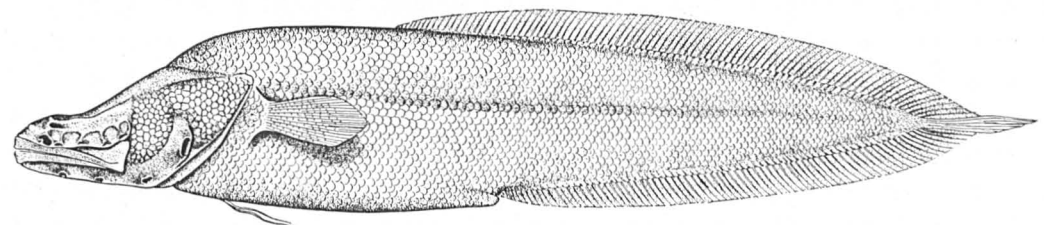
STYGICOLA DENTATUS.



LUCIFUGA SUBTERRANEUS.



STYGICOLA DENTATUS.



LUCIFUGA SUBTERRANEUS.