

# A REPORT ON FISHES COLLECTED IN MEXICO AND CENTRAL AMERICA, WITH NOTES AND DESCRIPTIONS OF FIVE NEW SPECIES.

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During the past ten years Messrs. E. W. Nelson and E. A. Goldman, of the Division of Biological Survey, Department of Agriculture, have spent much time in Mexico and Central America making collections of mammals and birds. Incidental to their regular work these gentlemen have been able, from time to time, to make several small collections of fishes, which have been referred to the Commission of Fish and Fisheries for identification. Certain of these collections\* have already been reported upon.

In April and May, 1900, Mr. Nelson and Mr. Goldman made a considerable collection in the State of Tabasco at Montecristo and Teapa. The specimens from Montecristo came from the Rio Usumacinta, and those from Teapa from the Rio Teapa. A few specimens were obtained at Frontera, on the Gulf of Campeche, at the mouth of the Rio Grijalva.

Montecristo is situated on the Rio Usumacinta some 125 miles from the sea. This is the largest river in Mexico, it being about 300 yards from bank to bank at Montecristo. The fishes obtained at this place were secured by means of a seine hauled in a shallow cove behind a sand bar. The seine was hauled at night, and several species obtained. The fishermen say that in the daytime the fish remain in the deeper water of the river, coming out into shallow water only during the night. The collection from this place contains 21 specimens, representing 10 species, the most interesting of which are 2 specimens of a new species of bagre or cat-fish belonging to a genus (*Comorhynchus*) not previously known to be represented in waters north of Brazil, and a specimen of the fresh-water drum (*Aplodinotus grunniens*).

Teapa is at the base of the mountains on the Rio Teapa, a tributary of the Rio Tapijulapa, about 125 miles inland. Eight specimens of fishes were obtained here, representing 6 species, among them a new species of *Cichlasoma*.

In February and March, 1901, another interesting collection was made by Messrs. Nelson and Goldman in Yucatan, chiefly at Chichen Itza, Progreso, Puerto Murelos, Mujeres Island, and Cozumel Island.

Chichen Itza is an interesting hacienda in the interior of Yucatan, about 140 miles from the sea. In this region, as well as elsewhere over the greater part of Yucatan and northern Campeche, there are no streams or surface water of any kind,

\*Notes on Fishes collected by E. W. Nelson on the Tres Marias Islands, and in Sinaloa and Jalisco, Mexico, by Barton Warren Evermann. <Proc. Wash. Biol. Soc., XII, pp. 1-3, 1898 (January 27).

Notes on a collection of Fishes from Mexico, with description of a new species of *Platyplatichthys*, by Barton A. Bean. <Proc. U. S. N. M., XXI, 1898, 539-542.

except occasional natural surface tanks in which some water is found. The entire country is, however, underlaid by water approximately at sea level. At various places over the country are natural wells, called "cenotes." These are natural excavations in the limestone rock, usually with more or less water at the bottom. The distance from the surface of the country down to that of the water in the cenotes seems to vary with the elevation of the country above sea level. Near the seashore, where the elevation of the country is but a few feet above the sea, the water in the cenotes will be only a few feet beneath the land surface. The elevation of the country increases toward the interior and the depth at which the water stands in the cenotes becomes correspondingly greater. These wells are usually approximately circular and vary from a few feet to 50 to 75 yards in diameter. The walls are more or less perpendicular, and it is difficult to reach the water; however, it is usually possible to find irregularities or steps in the wall, on at least one side, by means of which the water may be reached. Frequently the wells are wholly inaccessible. Sometimes the well is in a sink or cave.

In some wells the water is quite shallow, while in others it is of unknown depth. The water usually appears green, as in all limestone regions, but in some shallow wells it seems to be somewhat muddy. There is usually a thin coating of fine dust on the surface of the water which becomes readily noticeable on throwing any object into it. The water is said to be pure and sweet, but strongly charged with lime. There is a belief prevalent among the natives that these wells are connected. However this may be, the presence of fish in them is a most interesting fact for which it is not easy to account. How old the cenotes are can, of course, be known only approximately, but they have certainly been in existence a long time.

The well at Chichen Itza from which fishes were obtained is nearly circular, probably 60 yards across, and very deep, the water surface being about 90 feet below the land surface. Mr. Goldman states that he has seen fishes in several different wells on the east coast near Puerto Morelos, and that the natives say there are fish in all the larger ones. The only species thus far obtained from these wells is *Heros urophthalmus*, 7 specimens of which were obtained by Mr. Nelson from the Chichen Itza cenote. Mr. Goldman thinks the fish he saw were of this species. Mr. Nelson heard that cat-fish occur in a well at Chichen Itza, but did not see any specimens.

According to the natives the fish in these cenotes disappear at intervals and return again. At certain times they can neither be seen nor caught; at other times they may not only be caught, but are seen swimming about at the surface.

At the time of Mr. Nelson's visit, which was during the second week in February, none could be caught, and the natives said they were away. The seven specimens obtained had been secured previously, perhaps a year or two before, and kept in a large masonry water-tank which was supplied with water by a wind pump. They had been caught by means of hook and line baited with pieces of meat. They had apparently bred in the tank, as many very young ones were seen swimming about.

Another lot of fishes, chiefly salt-water species, was obtained at Progreso, which is on the north coast of Yucatan, only a few miles from Merida, the principal town. Some were obtained from fishermen, while others, chiefly Cyprinodonts, were seined in a small lagoon; others were gotten at Puerto Morelos, situated on the east coast of Yucatan. Some five or six species were obtained here from the sea, and a lot of the smaller species from a small lagoon.

Mujeres Island, about 3 miles off the east coast of Yucatan and about 40 miles north of Cozumel Island, is about 6 miles long and one-fourth to 1½ miles wide. It is separated from the mainland by shallow water, and is headquarters for the fishermen of this coast. The fishes obtained here came from a small salt-water lagoon.

At Cozumel Island, some 8 to 10 miles off the east coast of Yucatan and about 40 miles south of Mujeres Island, only a few salt-water fishes were obtained.

Various other small collections from Mexico have come into our hands from time to time, which we have studied in connection with the preparation of this paper. There is, first, a collection of 50 specimens representing 5 species obtained by Mr. Nelson in July and August, 1899, from the Rio Piedras Verdes and Lake Santa Maria, in Chihuahua, and 5 specimens representing 4 species collected at the same time in the Rio Piedras Verdes by Prof. C. H. Tyler Townsend and Mr. C. M. Barber, of Mesilla Park, N. Mex. We have also 2 species of *Chirostoma* obtained in the market at Guadalajara in 1899, 3 species gotten in Lake Lerma at Lerma, State of Mexico, in 1901, and one species bought in the market at Yautepec, State of Morelos, in 1901, all from Dr. J. N. Rose. Then there are a few specimens representing 4 species which we have received through the kindness of Mr. Charles C. Deam, of Bluffton, Ind., who collected them in December, 1898, at Salina Cruz, Gulf of Tehuantepec; and lastly, 2 specimens of the very interesting species *Anableps dowii*, obtained by Mr. Nelson in April, 1896, from the Tehuantepec River at Tehuantepec City.

All of these collections are reported upon in the present paper.

The nomenclature and sequence of species in the following annotated list is that of Jordan & Evermann's Fishes of North and Middle America:\*

1. *Rhinobatus lentiginosus* Garman. *Guitarro*.

One specimen, 18.5 inches long, from Progreso, Yucatan, February 28, 1901. This is the most southern record for the species.

2. *Lepisosteus tropicus* (Gill). *Tropical Gar Pike*.

One specimen, 20 inches long, from Montecristo. Head 3.5; depth 9; eye 10.5; snout 1.75; lower jaw 2; interorbital 4; D. 5; A. 7; V. 6; P. 12; scales 53, 17 rows from base of ventral upward and forward to and including median dorsal row. Body 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 2 lateral rows; enlarged teeth of lower jaw in one row; eye small; fins moderate, origin of dorsal slightly behind that of anal; first dorsal ray about 1.5 in snout, with numerous small, sharp, supporting spines in 2 rows on each side; similar supporting spines on all the fins; anal high, its longest ray 1.3 in snout. Color in alcohol, leaden silvery or plumbeous above, white on belly; no spots on body except a large one at base of caudal fin and 2 or 3 smaller indistinct ones in front of it; rays of dorsal, caudal, and anal dusky, the membranes pale; pectorals and ventrals pale.

3. *Felichthys marinus* (Mitchill). *Gaff-topsail; Sea Cat-fish*.

Two specimens, 10 and 12.75 inches long, from Progreso. Head 3.5 and 3.86; depth 4; eye 5; snout 4.25; interorbital 1.5; D. I, 7; A. II, 20 or 21. The head is larger and the anal has 2 or 3 fewer rays than those heretofore recorded.

4. *Galeichthys felis* (Linnaeus). *Sea Cat-fish*.

Two specimens, 9.5 and 10 inches long, from Progreso. Head 3.5; depth 5.5; eye 6; snout 3; interorbital 2.25; D. I, 7; A. 13 or 14; maxillary barbels reaching base of pectoral.

\*The Fishes of North and Middle America: A Descriptive Catalogue of the Species of Fish-like Vertebrates found in the Waters of North America, north of the Isthmus of Panama, by David Starr Jordan and Barton Warren Evermann; issued as Bulletin No. 47, U.S.N.M., 4 vols., pp. I-XXIV+1-1240, 1896; I-XXX+1241-2183, 1898; I-XXIV+2183a-3136 1898; and I-CI+3137-3313, plates I-CCCXII, 1900.

5. *Conorhynchos nelsoni*, new species. *Bagre*.

Type, No. 50001, U.S.N.M., a male, 16 inches long, collected May 8, 1900, by E. W. Nelson and E. A. Goldman, in the Rio Usúmacinta, Montecristo, Yucatan. Cotype, No. 2382, U. S. F. C. reserve series, a male 13.5 inches long, collected at same time and place.

Head 3.2; depth 5; eye 8; snout 2.1; interorbital 3; D. 1, 6; A. 17; gillrakers 10+4, short and weak, longest scarcely greater than diameter of pupil; gill-arches very convex. Body nearly terete, gradually tapering and becoming somewhat compressed posteriorly; width above pectorals not quite equal to depth; head conic, about as wide as deep at any point, a granular saddle over occipital region extending anteriorly to posterior portion of eye; a small granular saddle at base of dorsal in front, posterior edge concave; fontanelle long and narrow, beginning an eye's diameter in front of eye and extending an equal distance behind eye, a narrow transverse bridge equal to diameter of pupil just back of posterior border of eye; snout very long, pointed; mouth small, nearly circular, upper jaw the longer; barbels all very short; maxillary barbel not nearly reaching eye, its length about 2 in snout; other barbels shorter; no teeth on vomer and palatines; teeth on upper jaw confluent in one broad patch, concave posteriorly; teeth of lower jaw very weak; buccal cavity very large; roof of mouth dome-shaped; eye high, its lower edge on a line with upper part of gill-opening, its distance from end of snout equal to distance from center of pupil to gill-opening; origin of dorsal midway

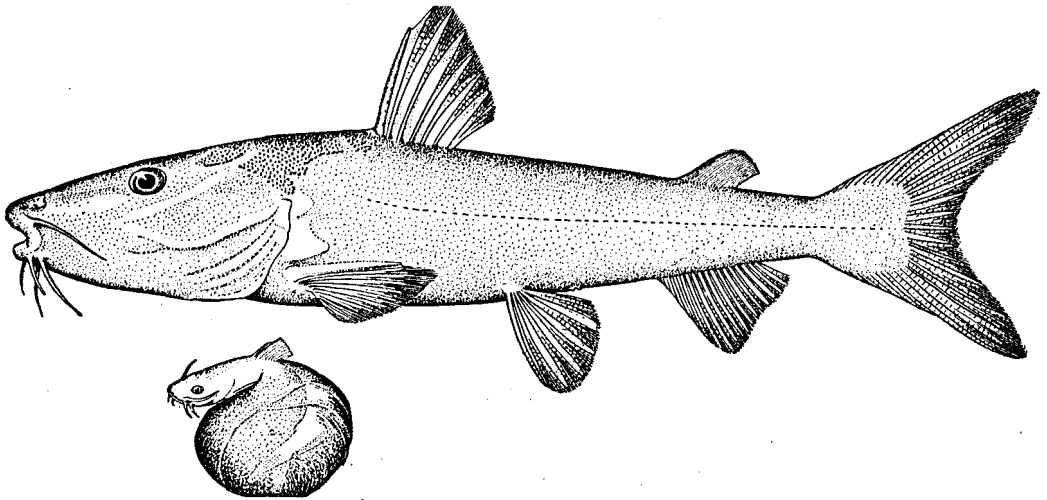


FIG. 1.—*Conorhynchos nelsoni*, new species. The smaller figure is nearly natural size, the other one-third natural size.

between tip of snout and posterior base of anal; dorsal spine of moderate strength, 2.16 in head, slightly granulated along its lower front for half its length, upper posterior third roughly serrated; the first soft dorsal ray about as high as body; distance between dorsal and adipose fins 1.4 in head; adipose fin large, its height 2.25 in that of dorsal fin, its base equal to that of soft portion of dorsal; caudal deeply forked, the upper lobe the longer, equal to snout and eye; ventral rays shorter than pectoral rays; pectoral fin moderate, its longest ray more than half head, its spine stouter than dorsal, 2.5 in head, its posterior edge very strongly serrate; anal large, its longest ray 2.75 in head.

General color in alcohol, light brown above lateral line, with bluish reflections; silvery below, becoming pale on belly; dorsal pale dusky, spine darker in front; adipose fin color of its dorsal region; caudal pale with some indications of yellow at its base and sides, inner edge of lobes tipped with black; anal pale; ventrals pale, slightly dusky inside; pectoral pale, dusky on inner side.

When the type specimen was obtained by Mr. Nelson there were found in its mouth 39 well-developed eggs. The cotype, also a male, contained one egg in its mouth.

This habit of certain cat-fishes of carrying their eggs in the mouth is a curious and very interesting one, a habit about which more or less has been known for many years.

The first and most complete account of this habit of cat-fishes carrying their eggs in their mouths is that by Dr. Jeffries Wyman, which he communicated to the Boston Society of Natural History at its

meeting of September 15, 1857. In 1859, in a paper entitled "On some unusual modes of gestation,"\* Dr. Wyman published a full account of his observations as follows:

"Among the Siluroid fishes of Guiana there are several species which, at certain seasons of the year, have their mouths and branchial cavities filled either with eggs or young, and, as is believed, for the purpose of incubation. My attention was first called to this singular habit by the late Dr. Francis W. Cragin, formerly United States consul at Paramaribo, Surinam. In a letter dated August, 1854, he says:

"The eggs you will receive are from another fish. The different fishermen have repeatedly assured me that these eggs in their nearly mature state are carried in the mouths of the parent till the young are relieved by the bursting of the sac. Do you either know or believe this to be so, and, if possible, where are the eggs conceived and how do they get into the mouth?"

"In the month of April, 1857, on visiting the market of Paramaribo, I found that this statement, which at first seemed to be very improbable, was correct as to the existence of eggs in the mouths of several species of fish. In a tray of fish which a negro woman offered for sale, I found the mouths of several filled with either eggs or young, and subsequently an abundance of opportunities occurred for repeating the observation. The kinds most commonly known to the colonists, especially to the negroes, are *jara-bakka*, *njinge-njinge*, *koepira*, *makrede*, and one or two others, all belonging either to the genus *Bagrus* or one nearly allied to it. The first two are quite common in the market and I have seen many specimens of them; for the last two I have the authority of negro fishermen but have never seen them myself. The eggs in my collection are of three different sizes, indicating so many species, one of the three having been brought to me without the fish from which they were taken.

"The eggs become quite large before they leave the ovaries, and are arranged in three zones corresponding to three successive broods, and probably to be discharged in three successive years; the mature eggs of a *jara-bakka* 18 inches long measure three-fourths of an inch in diameter; those of the second zone, one-fourth; and those of the third are very minute, about one-sixteenth of an inch.

"A careful examination of eight specimens of *njinge-njinge* about 9 inches long gave the following results.

"The eggs in all instances were carried in the mouths of the males. This protection, or gestation of the eggs by the males, corresponds with what has been long noticed with regard to other fishes, as, for example, *Syngnathus*, where the marsupial pouch for the eggs or young is found in the males only, and *Gasterosteus*, where the male constructs the nest and protects the eggs during incubation from the voracity of the females.

"In some individuals the eggs had been recently laid, in others they were hatched and the foetus had grown at the expense of some other food than that derived from the yolk, as this last was not proportionally diminished in size, and the foetus weighed more than the undeveloped egg. The number of eggs contained in the mouth was between twenty and thirty. The mouth and branchial cavity were very much distended, rounding out and distorting the whole hyoid and branchiostegal region. Some of the eggs even partially protruded from the mouth. The ova were not bruised or torn as if they had been bitten or forcibly held by the teeth. In many instances the foetuses were still alive, though the parent had been dead for many hours.

"No young or eggs were found in the stomach, although the mouth was crammed to its fullest capacity.

"The above observations apply to *njinge-njinge*. With regard to *jara-bakka*, I had but few opportunities for dissection, but in several instances the same conditions of the eggs were noticed as stated above; and in one instance, besides some nearly mature foetuses contained in the mouth, two or three were squeezed apparently from the stomach, but not bearing any marks of violence or of the action of the gastric fluid. It is probable that these found their way into that last cavity after death, in consequence of the relaxation of the sphincter which separates the cavities of the mouth and the stomach. These facts lead to the conclusion that this is a mouth gestation, as the eggs are found there in all stages of development, and even for some time after they are hatched.

"The question will be very naturally asked, how under such circumstances these fishes are able to secure and swallow their food. I have made no observations bearing upon such a question. Unless the food consists of very minute particles it would seem necessary that during the time of feeding the eggs should be disgorged. If this supposition be correct, it would give a very probable explanation of the only fact which might be considered at variance with the conclusion stated above, viz, that we

\* Am. Jour. Science and Arts, second series, xxvii, May, 1859, 5-13. This paper was communicated to the Boston Society of Natural History September 15, 1857.

have in these fishes a mouth gestation. In the mass of eggs with which the mouth is filled I have occasionally found the eggs, rarely more than one or two, of another species. The only way in which their presence may be accounted for, it seems to me, is by the supposition that while feeding the eggs are disgorged, and as these fishes are gregarious in their habits, when the ova are recovered the stray egg of another species may be introduced into the mouth among those which naturally belong there."

One of the earliest accounts of this curious habit which we have seen is that by Dr. Gunther\* in which he says, referring to specimens of *Arius fissus* from Cayenne received from Prof. R. Owen:

"These specimens having had the cavity of the mouth and of the gills extended in an extraordinary manner, I was induced to examine the cause of it, when, to my great surprise, I found them filled with about twenty eggs, rather larger than an ordinary pea, perfectly uninjured, and with the embryos in a forward state of development. The specimens are males, from 6 to 7 inches long, and in each the stomach was almost empty.

"Although the eggs might have been put into the mouth of the fish by their captor, this does not appear probable. On the other hand, it is a well-known fact that the American Siluroids take care of their progeny in various ways; and I have no doubt that in this species and in its allies the males carry the eggs in their mouths, depositing them in places of safety, and removing them when they fear the approach of danger or disturbance."

The following extract is from an interesting article "On the air-breathing fish of Ceylon" by Rev. Principal Boake, published in the Journal of the Ceylon Branch of the Royal Asiatic Society for 1865-66 (1866) pages 128-142, the extract occupying pages 138-142:

"Having occasion to visit Caltura periodically, I was told on one of my visits of a fish which is caught at certain seasons in very large quantities, and which has the singular habit, when held up by the tail, of emitting from the mouth a quantity of eggs. So great is the number thus emitted that when many fish are captured the eggs are eagerly collected from the bottoms of the boats and carried away to be fried, and are greatly relished by the villagers when so prepared, while the fish themselves, being too numerous to be consumed in their fresh state, are salted and dried, and often form an ingredient in the curries which appear at our tables.

"The description which I received of the manner in which the eggs are procured seemed to point to the conclusion, universally believed by the natives, that the regular mode of bringing forth their young is, in the case of these fish, through the mouth; a fact which seemed to me to be so singular that I determined to stay a day or two longer at Caltura when I next visited it, for the purpose of investigating the circumstances which seemed to indicate so singular a conclusion.

"The result of my investigation was, as might have been expected, that I ascertained that the circumstances had not been fully or accurately observed, and consequently that the conclusion to which they pointed was erroneous; but I, at the same time, satisfied myself of a fact in the natural history of those fish, which will perhaps be regarded as but little less extraordinary than their novel mode of parturition would have been, if it had been established as true, and which, as Ceylon has acquired some notoriety for marvelous stories respecting its zoology, I should feel some hesitation in stating, were it not that, in addition to the abundance of unexceptionable testimony, I was able to procure specimens illustrating the whole extraordinary process.

"These fish produce their eggs in the first instance very much in the same manner as other inhabitants of the waters do, with this exception, that the eggs seem to come to maturity in batches of ten or twelve. Bottle No. 1 will illustrate this. It contains the roe of one out of a large number of fish that I examined. You will perceive that, besides eight or ten large eggs, there is a whitish mass, which, on being closely examined, will be found to consist of other eggs of very minute size; the difference in size between those which are ready for emission and the others which are immature being very remarkable. The strange fact, however, is that the large eggs on being emitted are immediately taken up, either by the fish that has laid them or by another of the same species, and, not swallowed, but kept in the mouth until they are hatched and the fry are able to take care of themselves, a period of some weeks, during which it is impossible that the fish, which is swimming about with so extraordinary a mouthful, can swallow any food except such small nutritious particles as may be floating about in the water. When these fish first make their appearance at Caltura, in the beginning of the

\* Catalogue of the Fishes in the British Museum, by Albert Günther, v, 1864, p. 173.

season, they are said to be so fat that the curry made with them resembles that made with pork; but after swimming about for a few days, with their mouths full of eggs, they become dry and insipid. In bottle No. 2 you will see thirteen eggs, which I shook out with my own hands from the mouth of a fish 8 or 9 inches long, each egg being about the size of a small grape. Preserved in that manner, viz, in glycerin, the eggs retain their natural color and transparency, whereas in spirit they soon become opaque. In the same bottle are some other eggs which were obtained by pressure, and which present the same remarkable difference in size as those in No. 1. You will perceive that these latter are perfectly transparent, the smaller ones being scarcely visible, whereas those which were shaken out of the mouth of the fish contain a perfectly formed embryo and have a system of blood vessels spreading over their surface on one side. In bottle No. 3 you will see one of the eggs in a more advanced stage of development. Both the head and tail of the embryo have escaped from the egg, which, very little diminished in size, remains appended to the middle of the fish, giving it a very distorted appearance.

"This adherence of the egg to the young fish after it has been hatched is not peculiar to this species. The same thing occurs in the case of the salmon fry, which are being produced, under the auspices of Mr. Buckland and other eminent pisciculturists, in such quantities as to give us some grounds for hoping that that delicious fish may become again so common in the rivers of England that it shall no longer be a luxury accessible only to the wealthy, and that farm laborers may again, as is said to have been formerly the case in the neighborhood of Newcastle, find it necessary to stipulate in their engagements with their employers that they shall not be fed on salmon on more than two days in the week.

"This is the only specimen I was able to procure in that stage of development, the time not having then arrived for the general hatching of the eggs; but an intelligent friend, who is at Cultura at present, has promised to procure me other specimens, which will, I trust, enable me to ascertain a fact which I am inclined to believe, although I am not as yet prepared to assert it positively, namely, that the egg so appended is, in fact, the stomach of the animal in the state of enormous distention, and that, as its contents are absorbed while the other parts of the fish grow in size, it gradually assumes a more natural proportion to the rest of the body. To this conclusion I am led by observing the system of blood vessels, which is perceptible on the side of the egg opposite the embryo, and which certainly looks as if it was intended to form part of the organization of the future fish. I have since ascertained, by the aid of William Ondaatje, esq., assistant colonial surgeon, that the fish which carry the eggs, and subsequently the young fry, for so long a time in their mouths, are all males.

"The name by which these fish are known to the natives is *Anguluwa*. They are regarded by them as all belonging to the same species, nor would an unscientific observer be likely to discover any specific difference between any of the specimens that I have seen; but having sent several specimens to F. Layard, esq., I received a letter from him in August last, in which he informed me that he had submitted the specimens which I sent him to Dr. Günther, of the British Museum, who had ascertained that they belong to two distinct species, both new, of the genus *Arius*. Mr. Layard further tells me that the carrying of the ova in the mouth is not so novel a phenomenon as I supposed it to be, Dr. Günther having described that peculiarity in the propagation of the genus *Arius* several years ago, from South American species."

It appears that the Rev. Bancroft Boake sent some of his specimens to the botanist, Dr. Greville, who in turn transmitted them to William Turner, who published the following account\* concerning them:

"The various plans resorted to by fish of depositing their ova, and protecting them during the period of incubation, have not infrequently attracted the attention of naturalists. One of the most curious and interesting observations made on this subject was brought before the Boston Society of Natural History about nine years ago, by Dr. Jeffries Wyman. He states† that when walking through the market of Paramaribo, in Dutch Guyana, he found the mouths of several species of Siluroid fish belonging to the genus *Bagrus*, or to one closely allied, distended with ova, sometimes between twenty and thirty in number. The eggs were in various stages of development, some recently deposited,

\* On a remarkable mode of gestation in an undescribed species of *Arius* (*A. boakei*), by William Turner, M. B. (Lond.), F. R. S. E., senior demonstrator of anatomy, University of Edinburgh. <Journ. Anat. and Phys., vol. 1, 1867, pp. 78-82. Read before the British Association for the Advancement of Science, August 23, 1866.

† Proceeding of Boston Society of Natural History, Sept. 15, 1857, and American Journal of Science, vol. LXXVI, 1859.

others with the embryo very considerably advanced. The eggs were always in the mouths of males, and were not bruised, and none was found in the stomach. In the fifth volume of his Catalogue of Fishes in the British Museum\* Dr. Günther relates that, whilst examining some specimens of *Arius fissus* from Cayenne, presented to the Museum by Professor Owen, he was surprised to find their mouths and gill chambers distended with about twenty eggs rather larger than an ordinary pea. The eggs were perfectly uninjured, and the embryos in a forward state of development. These specimens were also males.

“Again, Professor Agassiz, writing from the river Amazon, September 22, 1865,† states that he had observed a species of *Geophagus*, *G. pedroinus*, a fish belonging to the family *Chromida*, in which the mouth and a pocket-like pouch, formed by the superior pharyngians, contained a number of ova. How the eggs get into the mouth he is quite ignorant, but there they remain until the young are in a fit state to take care of themselves. In all the above cases the fish are denizens of the South American Continent, and, except the species described by Agassiz, belong to the Siluroid family.

“The observations to which I shall now direct attention prove that this remarkable egg-carrying habit is not confined to certain species of fish dwelling in the New World, but is shared by some of the fish of the Old World also. In the month of April of the present year I received for examination, from the eminent botanist, the late Dr. Greville, some specimens of Siluroid fish, which had been sent him by the Rev. Bancroft Boake, of Ceylon. The specimens were accompanied by a copy of the literary supplement to the Ceylon Examiner, to which Mr. Boake had communicated ‘An account (dated April 20, 1865) of some peculiarities in the habits of certain species of fish that are found in the waters of Ceylon.’ The most interesting portion of this narrative consists of an account of the habit of a fish caught at Caltura, in that island. When held up by the tail it emits from the mouth a quantity of eggs, which, when many fish are captured, are fried and used for food by the natives. The fishermen suppose that the regular mode of bringing forth the young is through the mouth, but Mr. Boake satisfied himself that the fish produce their eggs in the ordinary way, and that after being deposited they are immediately taken into the mouth, either by the fish that has laid them or by another of the same species, where they are kept until they are hatched.

“The specimens given to me were two males and one female. The female had no ova in her mouth; but from the appearance of the abdomen it was evident that the ovaries were distended; and on opening into the cavity I found a large sac-like ovary on each side of the middle line. Each ovary measured  $2\frac{1}{2}$  inches in length and extended forward almost as far as the pectoral fin, where it formed a rounded free end, whilst posteriorly it was somewhat constricted, and opened by an orifice common to it and its fellow immediately behind the anus. The ovisac contained a very large number of eggs in various stages of growth. Some were like minute granules, others, and these were very numerous, like medium-sized shot, whilst a third set equaled in size grapes or small cherries and very materially exceeded therefore the size usually attained by the eggs of osseous fish. These last, only six in number in each ovary, had evidently almost reached the full period of intraovarian growth. Each ovum was attached to the inner wall of the ovisac by an independent pedicle, the atrophy of which would necessarily precede the discharge of the egg.

“The mouth and branchial chamber of one of the male fish were distended with 10 ova as large as those found in the ovarium, which were so closely packed together that water, or minute particles of food, could only pass backward to the gills or the œsophagus by filtering through the narrow interspaces between the eggs. In each ovum the development of the embryo had advanced so far that the eyes, chorda dorsalis, and cerebro-spinal nervous axis could without difficulty be distinguished, and from the ventral surface of the embryo numerous vessels were seen ramifying over the surface of the yolk. The embryos measured from one-half to seven-tenths of an inch in length. Only 1 of the 10 eggs had sustained any injury, its investing membrane being ruptured, so that a portion of its contents had escaped. It is interesting to note that the palatine teeth of the fish are granular, so that their form is well adapted for permitting the retention of the ova in the mouth with a minimum of injury.

“Mr. Boake’s observations show that the eggs are not placed in the mouths of the fish by the natives for purposes of deception, but that the instinct of the animal prompts it to take them into that cavity; and it is, as these specimens show, by the male, and not by the female, that this act is performed. In this respect this Cingalese fish agrees with those already described by Drs. Wyman and Günther.

\* London, 1864.

† Quarterly Journal of Science, p. 302, April, 1866.



"Opinions may differ as to the reason of this remarkable habit. It may be supposed that the male uses the eggs for food, or that he takes them into his mouth for temporary protection, discharging them again when the danger no longer exists, or that their presence in that cavity is connected with the process of incubation. The last of these suppositions seems to me most probable, for the habit of distending the mouth with eggs appears to be so common in this species of fish that it is a matter of ordinary observation amongst the natives. The eggs are not torn or bruised, as they would have been if subjected to the process of mastication, the stomach does not contain any fragments, and in each ovum is situated an embryo in a more or less advanced stage of development. Again, naturalists are acquainted with other fish which play a part in the incubation of their ova; the male pipe-fish, the male *Hippocampus*, and the *Aspredo lavis*, described by Wyman, possess special arrangements for receiving and carrying about the eggs until they are hatched. A close relation apparently exists between the number of eggs which come to maturity at a given time and the number which the male can carry in his mouth. In the female I examined, 12 eggs are evidently reaching their full growth, whilst the male has 10 in his mouth; and from another specimen examined by Mr. Boake as many as 13 were shaken out. This is a smaller number than was observed by Drs. Wyman and Günther in their Siluroids, but the eggs are in this species of much larger size. As the distended condition of the mouth would necessarily materially interfere with the reception of food by the male fish, it may be a question if he does not eject them during feeding, or perhaps during the time he plays the part of a dry nurse the quantity of food he takes may be almost *nil*."

It also appears that the Rev. Mr. Boake sent some of his specimens to F. Layard, esq., by whom they were submitted to Dr. Günther, who wrote concerning them:\*

"A small collection of fresh-water fishes, made by the Rev. Bancroft Boake in Ceylon, and kindly submitted to my examination by F. Layard, esq., contained two Siluroid fishes of the genus *Arius*, which are of great interest, inasmuch as they prove that the peculiar habit which I have described in an American species, *A. fissus* (Fish, v, p. 173), viz, the mode in which the parent fish takes care of its progeny, is not confined to South American species, but exists also in the East Indian ones. The mature ova are of the same large size in all these fish, and in all it is the male which carries them in the spacious cavity of its mouth. According to Mr. Boake, who has published an account of the habits of these fish, they are called *Angaluwa*."

In Dr. Day's volume on the fishes of British India,† we find the following paragraph concerning this curious habit:

"The breeding of these fishes is peculiar and deserves attention. The eggs of *Arius* are large, averaging about 0.5 to 0.6 of an inch in diameter, and I have found many males of the genus, and also of *Osteogobius*, with from 15 to 20 eggs in their mouths. Some of these eggs were in an early stage of development, others nearly ready to be hatched; while in the mouth of one specimen was a hatched fry having the yolk bag still adherent. The eggs filled the cavity of the mouth and extended far back to the branchiæ.

"In the female organs of generation the eggs seemed to come to maturity in batches of perhaps 50 at a time. On examining the conformation of the ventral fins, those of the females appeared to be larger than those of the males; the rays were thickened by a deposit of fat, whilst the innermost one had a large pad attached to its posterior edge. These fins can be expanded into a cup-like surface, the use of which may be to receive the eggs as extruded, which may be vivified there by the male.

"Whether the male carries about these eggs in his mouth until hatched or only removes them when danger is imminent from some spot where he is guarding them is questionable, but in none of the specimens which I examined did I find a trace of food in the intestines of the males which had been engaged in this interesting occupation.

"This has been observed likewise elsewhere by Mr. Boake in Ceylon, and Dr. Hensel has recorded the same of a Brazil species, *A. commersonii*; Dr. Günther, of *Arius fissus* from Cayenne; and the same facts have been remarked in other Siluroid fishes."

As already stated, when Mr. Nelson examined the specimen which we have taken as the type of the species, he found 39 eggs in its mouth, many of which readily rolled out when he held the fish up by the tail. Unfortunately some of these eggs were lost and only four of them came into our possession.

\* Description of a new Siluroid fish from Ceylon. <Ann. Mag. Nat. Hist., xviii, third series, 1866, pp. 473 and 474.

† Fauna of British India, Fishes, vol. I, 1889, pp. 169-170.

The other specimen, which we have taken as the cotype, contained but one egg in its mouth when it came into our possession, and Mr. Nelson does not recall that any were lost from this fish. He saw 8 or 10 other examples of this cat-fish, but did not observe eggs in the mouth of any but the type specimen. According to his recollection, the eggs were quite uniform in size. The four which came into our possession measure, respectively,  $\frac{1}{8}$  by  $\frac{1}{8}$ ,  $\frac{1}{8}$  by  $\frac{1}{8}$ ,  $\frac{1}{8}$  by  $\frac{1}{8}$ , and  $\frac{1}{8}$  by  $\frac{1}{8}$  of an inch.

The eggs are well developed, the embryo in each showing very distinctly. It lies wrapped around one side of the yolk sac, the head in every case being free. The maxillary barbel is well developed and very long, its length nearly equaling that of the head.

We have not been able to examine critically the single egg in the mouth of our second specimen, as it can not be removed without mutilating it or the fish owing, to the small size of the oral opening. Evidently this particular fish has not yet acquired what the Rev. Mr. Boake calls "the singular habit, when held up by the tail, of emitting from its mouth a quantity of eggs."

It will be noticed that the number of eggs (39) found by Mr. Nelson in the mouth of our type specimen is much greater than hitherto reported by any observer.

The suggestion by Dr. Wyman that the eggs are removed from the mouth when the cat-fish desires to feed is quite plausible, nay, imperative, if the fish ever feeds during the progress of the oral gestation. But it seems to us much more probable that the fish does not feed at all during the period of oral gestation, and begins to take food only when the young have developed sufficiently to leave the mouth. This is evidenced by the greatly constricted condition of the oesophagus, and comports more nearly with the habit of many other species of fishes during the spawning season.

Mr. Nelson informs us that these cat-fish are eaten by the natives, and that he himself regards them as the best fresh-water food-fish in Mexico.

It is proper in this connection to call attention to the method of reproduction in the sea cat-fish (*Galeichthys felis*). From information obtained in 1896 by Evermann and Bean, while studying the fishes of Indian River, Florida, they were convinced that this species is ovoviviparous. According to the testimony of competent observers among the Indian River fishermen and dealers, the adult females of this cat-fish are found filled with well-developed young in March, "each rolled up in a ball and the balls connected in a long string." While the technical description is a trifle faulty, the evidence points very strongly toward the ovoviviparity of the sea cat-fish.

#### 6. *Rhamdia wagneri* (Günther).

The collection contains one specimen 11.5 inches long, from Teapa, and two others, 11.5 and 14.25 inches long, respectively, from Frontera. Head 4 to 4.5; depth 5 to 5.5; D. 1. 6, A. 10; eye 7.5 to 8 in head, 3 in snout, high in head; snout 2.5; interorbital 2.5; barbels 6; mouth moderate, jaws equal; teeth in broad, cardiform bands on each jaw; maxillary barbel reaching adipose fin, but probably variable; mandibular barbel to beyond base of pectoral, nearly twice as long as inner; head broad and flat, slightly longer than wide, covered with soft smooth skin; fontanelle in adult not continued behind eye; occipital process narrow, reaching about half way to dorsal spine; gillrakers 3 + 7 or 8; adipose fin 2.66 to 3 in body, reaching slightly farther than anal; caudal deeply divided, its lower lobe broad and rounded, upper smaller and pointed; body tapering backward from head, much compressed behind. General color, brown, lighter below, many dark dots over body; a dark lateral band; base of dorsal pale.

#### 7. *Pantosteus plebeius* (Baird & Girard).

One specimen of this sucker, 5.75 inches long, was obtained by Mr. Nelson from the Río Piedras Verdes, near Colonia Garcia, Chihuahua, and another 4.5 inches long by Messrs. Townsend and Barber from the Río Casas Grandes near Old Casas Grandes, Chihuahua.

#### 8. *Campostoma ornatum* Girard.

One specimen, 5.25 inches long, from near summit of the Sierra Madre Mountains in Chihuahua, near Colonia Garcia.

#### 9. *Leuciscus nigrescens* (Girard).

One specimen 5 inches long from Río Casas Grandes, one 5.25 inches long from near the summit of the Sierra Madre Mountains in Chihuahua, near Colonia Garcia, and one 5.75 inches long from Lake Santa Maria.

**10. *Notropis santamariæ*, new species.**

Type, No. 50002, U. S. N. M., a specimen 1.56 inches long, collected in September, 1899, by Mr. E. W. Nelson, from a small pool near Lake Santa Maria, Chihuahua, Mexico. Cotype, No. 964, U. S. F. C. reserve series, from same place.

Head 4; depth 2.65; eye 3.6; snout 4; maxillary 6; interorbital 6; scales 9-38-2, 13 pores; D. 8; A. 9. Body short, deep, and compressed; head short; snout short, obtuse; mouth rather small, oblique; jaws subequal, the lower slightly included; maxillary scarcely reaching eye; caudal peduncle moderate, its least depth 2.7 in head; scales large, loose, and closely imbricated, exposed portion of anterior ones deeper than long, 15 scales before origin of dorsal; lateral line greatly decurved and incomplete, only 11 to 13 pores; fins all small; origin of dorsal over base of ventrals, the longest dorsal ray about 1.4 in head; anal rather larger than dorsal; pectoral short, pointed, 1.25 in head, not reaching base of ventrals; ventrals barely reaching origin of anal; teeth apparently 4-4, slightly hooked.

Color in alcohol, 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 dusky, other fins pale.

This species seems related to *N. frigidus*, from which it differs in the larger scales and the incomplete lateral line.

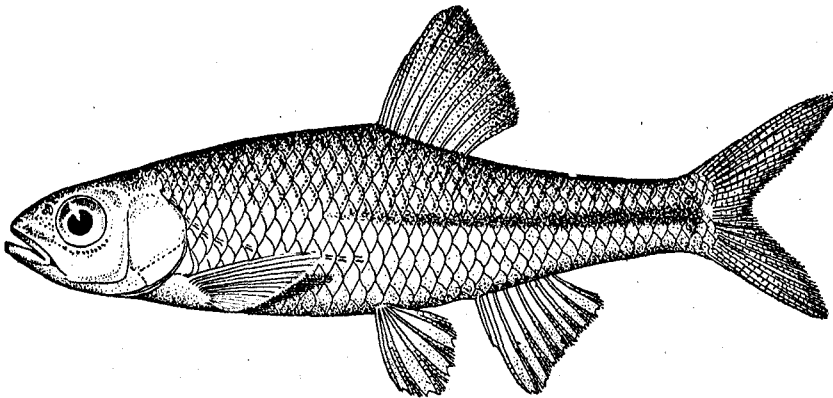


FIG. 2.—*Notropis santamariæ*, new species.

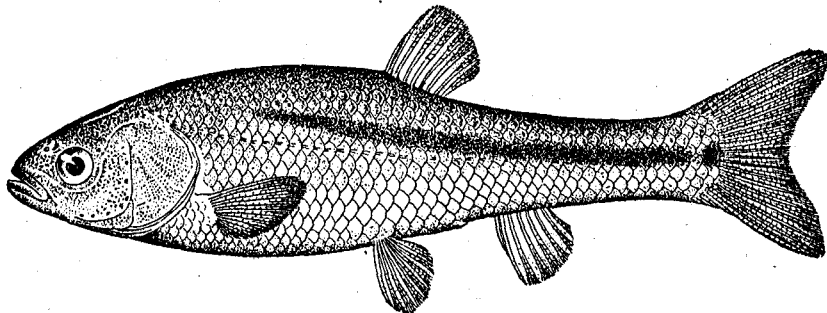


FIG. 3.—*Notropis lermæ*, new species.

**11. *Notropis lermæ*, new species.**

Type, No. 50003, U. S. N. M., a specimen, 2.5 inches long, collected August 9, 1901, by Dr. J. N. Rose, in Lake Lerma, near the town of Lerma, State of Mexico, Mexico; cotypes, 32 specimens, No. 50004, U. S. N. M.; 10 specimens, No. 977, U. S. F. C. reserve, and 10 specimens, No. 6762, Stanford University Museum—all from the type locality and collected under the same circumstances.

Head 3.7; depth 3.7; eye 5; snout 3.9; maxillary 3.3; mandible 3; interorbital 3; preorbital 6; D. 9; A. 8; scales 7-47-5, 23 scales before the dorsal; teeth 4-4. Body stout, deep, not greatly compressed, the back gently elevated, the anterior profile regularly curved from snout to origin of dorsal; head rather heavy; snout short and rather blunt; mouth small, oblique, the lower jaw included, the maxillary scarcely reaching eye; teeth small, hooked, somewhat crenate, the grinding surface not well developed;

caudal peduncle rather slender, not especially deep, the least depth being 2.5 in head; eye small; scales moderate, not closely imbricated, those before dorsal somewhat reduced in size; lateral line little decurved, not wholly complete, an occasional scale without any pore; fins all small; origin of dorsal much nearer base of caudal than eye, and behind insertion of ventrals, its rays about half length of head; anal short; pectoral very short, not nearly reaching ventrals, its length equal to height of dorsal fin; ventrals very short, not nearly reaching vent; caudal not deeply forked, the lobes about 1.5 in head.

Color in alcohol, grayish-olivaceous on back and upper part of side, the scales profusely covered with small dark punctulations; under parts paler; a broad dark median line from occiput to origin of dorsal, just in front of which it ends in a black blotch; a broad dark plumbeous band from humeral region along side to base of caudal fin, this band anteriorly somewhat above the axis of the body but following the axis posteriorly; dorsal, caudal, and pectoral fins dusky, the ventrals and anal pale.

This species seems most closely related to *Notropis aztecus* Woolman, from which it differs chiefly in the more slender caudal peduncle, the larger eye, less rounded snout, and the coloration.

The numerous cotypes show no appreciable differences.

The presence of fully developed eggs in one of the cotypes indicates that the spawning time of this species in Lake Lerma is in the late summer.

#### 12. *Notropis frigidus* (Girard).

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. The character of the teeth can not be made out and the scales are rubbed off so that they can not be accurately counted.

Head 4; depth 4.25; eye 3.5; snout 4; D. 7; A. 9; scales 5-35-6, 15 before the dorsal. Body slender, compressed; head small; mouth small, oblique, the 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 median line of back.

#### 13. *Agosia chrysogaster* Girard.

One specimen, 3.25 inches long, of this interesting little minnow is in the collection made by Messrs. Townsend and Barber near the summit of the Sierra Madre, Chihuahua.

#### 14. *Symbranchus marmoratus* Bloch.

One specimen, 12 inches long, from Cozumel Island, and two smaller ones, each 10.5 inches long, from Mujeres Island. Those from Mujeres Island were obtained by Mr. Goldman from the soft, slimy mud of a swampy, fresh-water pond about 2 miles from the southern end of the island. "This pond," Mr. Goldman says, "is 4 or 5 acres in extent and occupies a depression about a quarter of a mile from the open sea and only about 250 yards from the head of a salt-water lagoon, from which it is completely cut off, however, by a ridge 30 or 40 feet in height. The water in the pond is so shallow that it is everywhere filled with tall, growing, aquatic vegetation. There is a ranch close by, and to obtain water the people have dug holes at one end of the pond and walled them up with rocks to prevent their immediately refilling with soft mud. As it is, they gradually fill and have to be periodically cleaned. The only times the people ever see these eels are when these holes are cleaned. I happened to be there one day hunting birds and getting fish from the salt-water lagoon, and the people told me about the eels. After some difficulty I managed to persuade two men to undertake the job of cleaning the holes at once. They were hard to persuade, for they claimed they were apt to get fever from working in and overturning the mud. Many bushels of it were taken out and the eels found in cavities between the rocks. The people believe that the eels serve to purify the water. They assured me that no other fresh-water pond existed on the island."

Body very slender and eel-shaped, compressed posteriorly, the deepest part through base of head; head conic; tail very short, less than one-fourth total length; eye small, close to the end of snout; mouth horizontal, large; distance from tip of snout to angle of mouth contained three times in distance from tip of snout to posterior gill-opening; lips thin but long and overhanging; snout rounded, very short, equal to interorbital space; teeth small, those on jaws in a single row, except in the front of upper jaw where the rows from the sides join, forming a small patch; teeth on the palatines larger, conic, and in a patch anteriorly where the two rows join, a single row being on each side; gill-opening narrow, the width of the opening equaling distance between eyes; distance from vent to tip of tail 4.1 times in entire length; no fins except dorsal and anal, the latter extending from vent, the former beginning slightly in advance of this, both meeting at end of the narrowly pointed tail. Color in alcohol, dark olivaceous or brown, mottled with darker brown; under part of head and neck lighter.

**15. *Dorosoma cepedianum exile*** (Jordan & Gilbert). *Southern Hickory Shad.*

One specimen 12.5 inches long, from Montecristo. Head 4.66, 1.5 in last ray of dorsal; depth 2.75; eye 4.33; snout 5; maxillary 4; mandible 3; interorbital 3.5; D. 13; A. 31; scales about 75, -30; scutes 20 + 9. Body deep, compressed, the back elevated; dorsal median, slightly behind ventrals; caudal widely forked, the lobes equal. General color in alcohol, silvery, bluish above. This subspecies differs chiefly from the typical *cepedianum* in the considerably smaller scales.

**16. *Sardinella humeralis*** (Cuvier & Valenciennes). *Sardina Escamuda.*

Head 3.8; depth 3.25; eye 3; snout 3.5; D. 16; A. 18; scales 40; scutes about 27. Our specimens differ from current descriptions of this species in having an adipose eyelid; in the smaller eye, which is very slightly longer than snout; and in their greater depth. We can not, however, regard them as being any other species. Our two specimens, each 7.12 inches long, were taken from the crop of a brown pelican, at Puerto Morelos, April 1, 1901. Both are females, and their spawning time is in the spring, as evidenced by the mature eggs in each.

**17. *Fundulus grandis*** Baird & Girard.

Fifteen specimens, 5.2 to 6.8 inches long, from Progreso. Head 3; depth 4 to 4.3; eye 5.75 to 6; snout 3.3 to 3.7; mandible 2.4 to 2.5; interorbital 3; preorbital 9 to 10; D. 10 or 11; A. 9 or 10; scales 40 to 46, -14 or 15. The scales appear considerably smaller than in *F. heteroclitus*, the eye smaller, and the dorsal is more posterior.

**18. *Girardinichthys innominatus*** Bleeker.

Thirty-three specimens varying in length from 0.75 to 1.75 inches, all from Lake Lerma. Head, 3.7; depth 3.5; eye 3.5; snout 4.5; interorbital 2.5; D. 23; A. 26; scales 44, -16.

Body short, oblong, compressed; head compressed, thick, very steep; snout blunt; mandible directed vertically upward; premaxillaries greatly protractile; small cardiform or subconical teeth in each jaw in a single series, followed by a few small hooked teeth; mouth very small, nearly vertical; profile concave from orbit to nape, then slightly convex to dorsal fin; caudal slightly rounded; base of anal rather steep.

General color in alcohol, dusky gray, darker above, with many punctulations; a narrow dorsal band of dark from nape to dorsal fin; a dark, almost black, blotch on side above space between ventrals and vent, larger than eye; some specimens with many faint vertical broken dark bars on side of body, these usually obscure in the larger specimens.

This species is ovoviviparous. In several examples dissected, eggs were found in the ovary, each egg being surrounded by membranous tissue, which is attached to the sides of the ovary. Some of these young were very well developed; others are in a very immature state; while in others the eggs are very small. In one specimen were found 4 fully developed young showing the scales and fully developed fins, and in all respects resembling the parent, which was 1.2 inches long, while the young were nine-twentieths of an inch in length. In another specimen, 1.6 inches long, 24 young, two-tenths of an inch long, were found. These were immature, no scales being visible.

These specimens differ somewhat from current descriptions in several important particulars, viz. the dorsal and anal rays are more numerous, the eye is larger, and the color is different, no mention being made by previous writers of the black blotch on the side. This spot is present in all our examples.

So far as we have been able to learn attention has not previously been called to the viviparity of this little fish. Indeed, in Jordan and Evermann's *Fishes of North and Middle America* it is expressly stated to be oviparous. This opinion was probably simply an inference from the apparent fact that the anal fin of the male is not modified into an intromittent organ. No such modification is found in any of our 29 specimens, but we have not determined certainly that they are all females.

These fish, as well as those of all the other species obtained by Dr. Rose in Lake Lerma, are in many cases infested with some species of abdominal parasite—a tapeworm of some kind.

**19. *Cyprinodon eximius*** Girard.

The collection contains 44 specimens, all females, of this interesting little fish, obtained by Mr. Neilson from a pool near Lake Santa Maria, Chihuahua. They range in length from 1 to 1.5 inches.

Head 3.2; depth 2.5 to 3.2; eye 3.8; snout 3.8; interorbital 2.5 to 3; D. 9 or 10, length of longest ray about 2 in head, the anterior quite spine-like; A. 8 to 10, longest ray 1.8 in head. Body oblong, deepest in front of dorsal fin, compressed posteriorly; anterior profile evenly arched from base of dorsal fin to tip of snout; head large, deep, slightly compressed; eye high, distance from posterior edge

of opercle to eye equaling distance from tip of snout to posterior edge of pupil; upper jaw protractile; lower jaw prominent, very oblique, including upper jaw; a row of small villiform teeth on each jaw; dorsal outline dropping downward and backward along base of fin, thence backward and but slightly downward to base of caudal; caudal truncate; lower profile similar to dorsal, though not so greatly arched. Color in alcohol, dusky grayish, the central portion of each scale in some cases being dark olivaceous, making bands on each row of scales on side of body; belly and neck silvery white; 8 or 9 bands of dark about as wide as pupil, but irregular in width, on side of body; fins all dusky pale.

**20. *Belonesox belizanus* Kner.**

Three specimens, 4.2 to 5 inches long, from Progreso, Yucatan. Head 3 (2.75 to 3); depth about 6; eye 6 (5.5 to 6); snout 2.25; mandible 1.8 to 2; interorbital 3.8; scales 55 or 60, -16 or 17, about 6 rows on cheek; D. 8, the longest ray 3 in head; A. 10, the longest ray 2.8; ventrals 3.8; pectoral 2.8. Body very oblong, compressed posteriorly; head and anterior portion of body flat; head long, very flat above, the snout wedge-shaped; eye high; distance from tip of snout to anterior edge of eye equaling distance from center of pupil to posterior edge of opercle; upper surface of premaxillary plate not quite as long as postorbital part of head; upper jaw protractile, the premaxillaries forming together an elongate triangular plate, the bones separated by membrane; lower jaw long, projecting slightly beyond upper; mandibles formed similarly to premaxillaries; jaws arched, each with a broad band of cardiform teeth; dorsal placed far posteriorly; caudal rounded; anal in advance of dorsal, modified in the male into a long, slender intromittent organ. General color in alcohol, dark olivaceous, darker above; side with longitudinal series of dark spots, the spots on the posterior central portion of each scale; a dark spot, slightly larger than pupil, just above the central base of caudal; caudal dusky pale with numerous dark punctulations; other fins dusky pale.

**21. *Anableps dovii* Gill. "Cuatro Ojos"; Four-eyed Fish.**

We have examined 2 specimens of this interesting fish, 7 and 8 inches long, respectively, collected by Mr. Nelson in the Tehuantepec River at Tehuantepec City. Head 4; depth 6.25; eye 4.5; snout 3.75; interorbital 4; width of mouth 2.5; dorsal 8; anal 8; scales, 67, -15; pectoral 1.5; ventral 2.3; anal 2.4; dorsal 2.4; middle caudal rays 1.4. Body long, much depressed on anterior half, posterior half somewhat compressed; head broad, very greatly depressed; mouth small, the maxillary and mandible short, the cleft not nearly reaching anterior border of eye; eye large, set very high, fully one-half being above the level of the low interorbital space; fins all small; dorsal posterior, its origin over tip of anal; caudal rather long, rounded; ventrals short, wide apart, not reaching vent; pectorals short, reaching only halfway to base of ventrals; scales small, smooth, and moderately firm.

Color in alcohol, brownish olive on back and upper part of side, pale below; median line of back with an obscure blackish band; a distinct black band from eye along middle of side to base of caudal peduncle, its lower boundary very distinct, in contrast with the paler color of lower side; a similar but paler dark line from above base of ventral to base of caudal, the pale yellowish line between these two scarcely equal to diameter of eye in width; in some cases this second dark line begins under tip of pectoral; dorsal and caudal dusky, other fins pale; tip of upper jaw dark; peritoneum black.

The unique structure of the eye of this curious fish merits a fuller description. Mr. M. C. Marsh, pathologist of the Commission, has made careful dissections of the eye of this species and kindly furnishes us the following notes:

The eye is crossed by a bar, like the diameter of a circle, and parallel with the length of the body. This bar is darker than the other external portions of the eyeball and has its edges darker still. Dividing the external aspect of the eye equally, it has its lower edge on the same level as the back of the fish, which is flat and straight from snout to dorsal, or nearly the whole length of the fish; so that when the body of the fish is just submerged the level of the water reaches to this bar, and the lower half of the eye is in water, the upper half in the air. Upon dissecting the eyeball from the orbit, it appears nearly round. A membranous sheath covers the external part and invests most of the ball. It may be peeled off, when the dark bar on the external portion of the eye is seen to be upon this membrane, which may correspond to the conjunctiva. The back portion of eyeball being cut off, one lens is found. The lining of the ball consists, in front, of one black layer, evidently choroid. Behind, there is a retinal layer. The choroid layer turns up anteriorly, making a free edge comparable to an iris. The free edge is chiefly evident in the lower part of the eye. A large pupil is left, but is divided by two flaps, continuations of the choroid coat, projecting from either side and overlapping. There are properly then two pupils, an upper and lower, separated by a band consisting of the two flaps, which may probably,

by moving upward and downward, increase or diminish the size of either pupil; an upward motion of the flaps increasing the lower pupil at the expense of the other, and vice versa. (Marsh).

This division of the pupil into two parts permits the fish, when swimming at the surface of the water, as is its usual custom, to see in the air with the upper portion and in the water with the lower. It is thus able to see not only such insects as are upon the surface of the water or flying in the air above, but also any that may be swimming beneath the surface.

According to Mr. Nelson the individuals of this species swim always at the surface and in little schools arranged in platoons or abreast. They always swim headed upstream against the current, and feed upon floating matter which the current brings them. A platoon may be seen in regular formation breasting the current, either making slight headway upstream or merely maintaining their station, and on the qui vive for any suitable food the current may bring. Now and then one may be seen to dart forward, seize a floating food particle, and then resume its place in the platoon. And thus they may be observed feeding for long periods. They are almost invariably found in running water well out in the stream, or at least where the current is strongest and where floating matter is most abundant, for it is upon floating matter that they seem chiefly to depend. They are not known to jump out of the water to catch insects flying in the air or resting upon vegetation above the water surface, nor do they seem to feed to any extent upon small crustaceans or other portions of the plankton beneath the surface.

When alarmed—and they are wary and very easily frightened—they escape by skipping or jumping over the water, 2 or 3 feet at a skip. They rise entirely out of the water, and at a considerable angle, the head pointing upward. In descending the tail strikes the water first and, apparently by a sculling motion, new impetus is acquired for another leap. This skipping may continue until the school is widely scattered. When a school has become scattered, and after the cause of their fright has disappeared, the individuals soon rejoin each other. First two will join each other and one by one the others will join them until the whole school is together again. Rarely do they attempt to dive or get beneath the surface; when they do they have great difficulty in keeping under and soon come to the surface again.

The air-bladder in an example 8 inches long was three-fourths of an inch long and nearly one-fourth inch in diameter. It was attached by a slender thread or duct three-fourths inch long to the under side of the stomach at the anterior end. The air-bladder lies immediately ventral to the stomach, its anterior end lying against and dorsal of the liver, in the tissues of which the duct is immersed.

No opening from the duct into the stomach could be found in the specimen dissected, though more careful dissection of a well-preserved or fresh specimen would probably reveal one.

The specimens obtained by Mr. Nelson were secured by means of a cast net in the Tehuantepec River at Tehuantepec City, which is situated about 50 miles from the sea at an altitude of 200 feet. The fish are so wild that it is very difficult to catch them. They jump over a seine readily and will not ordinarily take a hook. The cast net seems the most effective means for their capture.

This fish is viviparous, as is well known. The female (7 inches long) examined by us was collected in April, and contains nine young, each about 1.5 inches long. In each of these the yolk sac is quite large but flabby, as a result of the absorption of a considerable portion of its contents. In these little young the septum in the eye is quite evident and the color pattern of the adult is well shown. After the young are born Mr. Nelson observed that they remain for a time in quiet, protected water, not venturing into the strong currents until of considerable size.

Further down the Tehuantepec River near the coast the individuals of this fish are said to be larger than at Tehuantepec City. These fish are eaten by the natives, but are not often seen in market, on account of the difficulty in their capture.

## 22. *Pecilia butleri* Jordan.

Three specimens, 1.37 to 1.67 inches long, obtained by Mr. Deam from a salt-water pool near the seashore at Salina Cruz, Gulf of Tehuantepec.

## 23. *Mollienisia latipinna* Le Sueur.

Nine males and 7 females from Progreso, all excellent specimens, in fine condition. The males range in length from 3.75 to 4.63 inches, and the females from 2.25 to 4 inches. Two females from Montecristo, 2.25 and 2.75 inches long; and one female from Mujeres Island, 2 inches long.

## 24. *Tylosurus notatus* (Poey). *Needle-fish; Long-jaws.*

One specimen, 13 inches long, from Progreso. Snout broken; measurements not accurate. D. 1, 13; scales 85 before dorsal, about 45 from front of dorsal to caudal.

**25. *Tylosurus timucu*** (Walbaum). *Peixe Agulha; Timucu.*

One specimen, 20 inches long, from Teapa. Head 2.8; depth 11; eye 3 in postorbital part of head; A. 15; D. 16; about 135 scales before dorsal.

**26. *Hemiramphus brasiliensis*** (Linnæus). *Balao; Escribano.*

One specimen, 12 inches long, from Puerto Morelos. The following measurements are from end of upper jaw: Head 4.2; depth 5.75; eye 3.75; snout 3; interorbital 3.75; D. 14; A. 10; scales 54; pectoral 1.4 in head; ventrals 3.

**27. *Chirostoma humboldtianum*** (Cuvier & Valenciennes). *Pescado Blanco de Chalco.*

Five specimens, each about 5 inches long, from La Laguna, Jalisco, in the Sierra de Guanacatlan. Head 3; depth 4.75; eye 4.6; snout 3; maxillary 3; mandible 2.5; interorbital 4; scales 53, -15; D. iv-13; A. 19; longest dorsal ray 2 in head; longest anal ray 2.2; pectoral 1.6; ventral 2.6; depth of caudal peduncle 3.3. Body slender, compressed; eye large, nearer tip of snout than posterior edge of opercle by a distance almost as great as diameter of orbit; interorbital space flat, as is almost entire top of head; lower jaw projecting slightly, including the upper when closed; cleft of mouth horizontal, the edge of lower lip being on a line with center of pupil; lips thickened posteriorly, lower folding over upper at their union; maxillary nearly vertical, its distal end in advance of a vertical from anterior edge of orbit a distance equal to two-thirds diameter of pupil; minute teeth in small bands on jaws, none on vomer or palatines; gillrakers about 23, very slender, length of longest about equal to diameter of pupil; first two spines of dorsal about equal, the other two shorter; first few rays of soft dorsal highest, others gradually shortening; when the fin is elevated its edge is straight; caudal forked; anal similar to soft dorsal, except that its edge is slightly concave; ventrals reaching vent.

Color in alcohol, brownish-olive, darker above; a distinct dark lateral band, in which are small darker spots extending from upper part of base of pectoral to middle of base of caudal, becoming darker posteriorly; scales on upper part of body and sides edged with dark, sometimes with small dark dots; fins all dusky; dorsal, caudal, and pectoral with some dark.

**28. *Chirostoma promelas*** Jordan & Snyder.

One specimen, 8.5 inches long, from the Guadalajara market, caught in Laguna de Chapala, from which place the species was described. Head 3.3; depth 5; eye 6; snout 2.5; maxillary 3; mandible 2.25; interorbital 4.5; scales 53, -15; D. iv-11; longest dorsal ray 2.7 in head; A. 21; longest anal ray 2.5; pectoral 2; ventral 3.2; depth of caudal peduncle 3.8.

**29. *Chirostoma lucius*** Boulenger.

Two specimens, 8 inches long, from the Guadalajara market, caught in Laguna de Chapala, which is the type locality. Head 3.3; depth 5; eye 5.75; snout 2.6; maxillary 3; mandible 2.2; interorbital 4.2; scales 58, -15; D. v or vi-12; longest dorsal ray 2.4 in head; A. 20; longest anal ray 2.4; pectoral 1.7; ventral 2.8; depth of caudal peduncle 3.3.

**30. *Chirostoma bartoni*** Jordan & Evermann.

Forty-five specimens, ranging in length from 1.75 to 4.2 inches, all obtained by Dr. J. N. Rose in Lake Lerma, near the town of Lerma, State of Mexico. Until now, only the type of this species was known. A female, 3 inches long, gives the following measurements: Head 4; depth 5.5; eye 4; snout 3.5; maxillary 3.2; mandible 2.3; interorbital space, 3.2; D. iv-1, 10; A. 1, 13; scales 41, -11, about 20 before the dorsal. Body slender, moderately compressed, the back rounded; mouth small; snout short; lower jaw but slightly projecting. Otherwise as in the type. The anal fin formula varies from 1, 13 to 1, 15; and the scales from 40, -10 to 42, -12.

**31. *Eslopsarum jordani*** (Woolman).

Among the specimens brought home from Mexico by Dr. Rose in 1901 is a package of small dried fish, which he purchased in the market at Yauteppec, State of Morelos. These specimens range in length from less than one inch to 2.25 inches. They are thoroughly desiccated and difficult of identification, but seem to be the present species. Dr. Rose informs us that these little fish are sold in dishes containing a dozen or more and are eaten on toast or with meat. It is called "Charal de la Laguna" and is much relished.

**32. *Caranx hippos*** (Linnæus). *Horse Cravalla.*

One specimen, 13.5 inches long, from Montecristo. Head 3; depth 2.66; eye 4.66; snout 4; maxillary 2; mandible 1.8; interorbital 3.66; preorbital 5.5; D. vi-1, 20; A. ii-1, 17; scutes on lateral line about 26.



**33. *Caranx crysos* (Mitchill). *Hard-tail; Runner.***

One specimen, 9 inches long, from Puerto Morelos. Head 3.5; depth 3; eye 3.5; snout 3; maxillary 2.5; mandible 2.2; interorbital 3.25; preorbital very narrow, about 16; D. VIII-I, 24; A. II-I, 19; pectoral one-eighth longer than head, 3 in body; longest dorsal ray 2 in head; about 48 scutes.

**34. *Trachinotus glaucus* (Bloch). *Old-wife.***

One specimen, 10 inches long, from Puerto Morelos. Head 3.83; depth 2; eye 3.75; snout 4.5; maxillary 2.66; mandible 2.75; interorbital 2.75; preorbital very narrow; D. VI-I, 20; A. II-I, 17; longest dorsal ray 1.5 in body; longest anal ray 2.33; anterior rays of dorsal and anal greatly produced, reaching somewhat beyond middle of caudal.

**35. *Centropomus mexicanus* Bocourt. *Mexican Robalo.***

One specimen, 12.5 inches long, from Montecristo. Head 3; depth 3.66; eye 5.75; snout 3.5; maxillary 2.66; mandible 1.75; interorbital 7; preorbital 13.5; scales 11-80-14; D. VIII-I, 10; A. III, 6; longest dorsal spine 2 in head, 1.5 in depth of body; longest anal spine 1.66 in head, 1.25 in depth of body; pectoral as long as ventral, 1.66 in head; ventral outline nearly straight; suborbital with 8 or 10 sharp retrorse teeth; preorbital with teeth at angle strongly serrated; opercular flap large, nearly reaching front of dorsal. General color in alcohol, dusky, silvery below, darker above; lateral line in a narrow black band; a dark blotch on middle of opercle, covering nearly half of it; faint indications of dark blotches over body above lateral line; dorsal membranes dark, other fins pale, except third anal spine, which is dark brown.

This fish is close to *C. parallelus*, but differs in that *C. mexicanus* has more teeth on the suborbital, those at the preopercle being fewer at the angle, larger and wider apart; those on the suprascapular are not so large, but there are 6 or 7, while in *C. parallelus* only 4 or 5 are found; scales larger in *C. mexicanus*, 5 or 6 fewer in lateral line, and 1 or 2 fewer between the lateral line and second dorsal.

**36. *Petrometopon cruentatus* (Lacépède). *Coney; Red Hind.***

One specimen, 6.75 inches long, from Puerto Morelos. Head 2.8; depth 3.2; eye 5; snout 4.6; maxillary 2; mandible 1.75; interorbital 6.75; preorbital 10.5; D. IX, 14; A. III, 8; pectoral 1.6; ventrals 2; scales about 12-85-30. Body not so deep as in specimens heretofore described, nor is the supplemental maxillary so evident.

**37. *Lutianus griseus* (Linnæus). *Gray Snapper.***

Five specimens, 8.25 to 9.5 inches long, from Mujeres Island, and one specimen, 3.5 inches long, from Cozumel Island. Head 2.7; depth 2.75 to 3; eye 4.3 to 5; snout 2.8 to 3; maxillary 2.5 to 2.8; mandible 2 to 2.3; interorbital 6 to 6.5; preorbital 6 to 6.5; D. X, 13 or 14; A. III, 8; scales 7-54-13, 7 rows on cheek; width of interorbital and preorbital usually equal; the fourth dorsal spine the longest, 2.75 to 3 in head; second and third anal spines about equal, the second the stouter, 3.3 to 3.67 in head; pectoral 1.5 to 2 in head; ventral 2 in head.

**38. *Hæmulon parra* (Desmarest).**

One specimen, 5.5 inches long, from Cozumel Island.

**39. *Pomadasis ramosus* (Poey).**

One specimen, 8.75 inches long, probably from Montecristo. Head 3.3; depth 3.5; eye 4.3; snout 3; maxillary 3.5; mandible 3.5; interorbital 4; preorbital 6; scales 6-55-12; D. XIII, 12; longest dorsal spine 1.8 in head; A. III, 7; longest spine 1.5 in head; pectoral and ventral each 1.5 in head.

**40. *Orthopristis chrysopterus* (Linnæus). *Pig-fish.***

Two specimens, 9.75 and 10 inches long, from Progreso. Head 3; depth 2.8; eye 5.5; snout 2.25; maxillary 3.3; mandible 3; interorbital 4.67; preorbital 3.6; pectoral 1.5 in head; D. XII, 16 or 17; A. III, 11 or 12; scales 10-65-17. Longest dorsal spine 3 in head; second anal 6 in head; base of soft dorsal 1.5 in spinous dorsal; highest dorsal spine 3 in head; pectoral not reaching past tips of ventrals.

**41. *Xystæma cinereum* (Walbaum). *Majarra Blanca.***

Two specimens, each 8.5 inches long, from Mujeres Island, and one small example from Cozumel Island. Head 3.3; depth 2.75; eye 3.25; snout 3.25; maxillary 2.8; mandible 2; interorbital 3; scales 6-45-10; D. IX, 11; A. III, 6; second dorsal spine longest, 1.8 in head; second anal spine longest, 2.5 in head; ventral short, not reaching vent, 1.66 in head; pectoral fin slightly longer than head; caudal deeply forked, lobes longer than head, scaled; dorsal and anal fins, when depressed, entirely concealed in a scaly sheath.

**42. *Gerres mexicanus* Steindachner.** *Mexican Mojarra.*

The collection contains four specimens of this rare species, all from Teapa, which is the type locality. They range in length from 5.75 to 10 inches. Head 3.3; depth 2.5; eye 3 in small specimens, 3.5 to 3.67 in larger ones; snout 3.25 to 3.67; scales 6-46 to 50-10 or 11; D. ix, 10 or 11; A. iii, 8 or 9. Body compressed, rhomboidal in form, covered with large smooth scales; back much elevated; lateral line continuous, concurrent with the elevated back, beginning on a line with upper margin of eye; head flat, a slight depression above the eye; mouth moderate, upper jaw very protractile; maxillary extending to about middle of eye, its length about 2.5 in head, exposed portion oblong, width 2 in length; preorbital and preopercle serrate; premaxillary groove entirely free from scales; second dorsal spine strong and long, head contained in it 1.3 times; second anal spine stronger but shorter than second dorsal, 1.67 in second dorsal; outer edge of dorsal fin forming a deep reentrant angle; anal same shape as dorsal but smaller; pectoral reaching beyond tips of ventrals in large specimens, not so far in small ones, its length equaling head.

General color, bluish-silvery above, silvery below; very distinct dark longitudinal lines along the middle of each row of scales; dorsal, caudal, and anal fins dusky; the margin of dorsal black; a dark supraorbital spot; pectoral and ventral pale.

**43. *Menticirrhus littoralis* (Holbrook).** *Surf Whiting.*

One specimen, 11.75 inches long, from Progreso. Head 4.5; depth 4.5; eye 7.3; snout 3.25; interorbital 4.75; D. x-i, 24; A. i, 7; scales 8-60-16. This fish has not heretofore been recorded south of Texas. It is worth noting that the more southern specimens have smaller scales, as noted in another member of the same family, *Aplodinotus grunniens*, found at Montecristo.

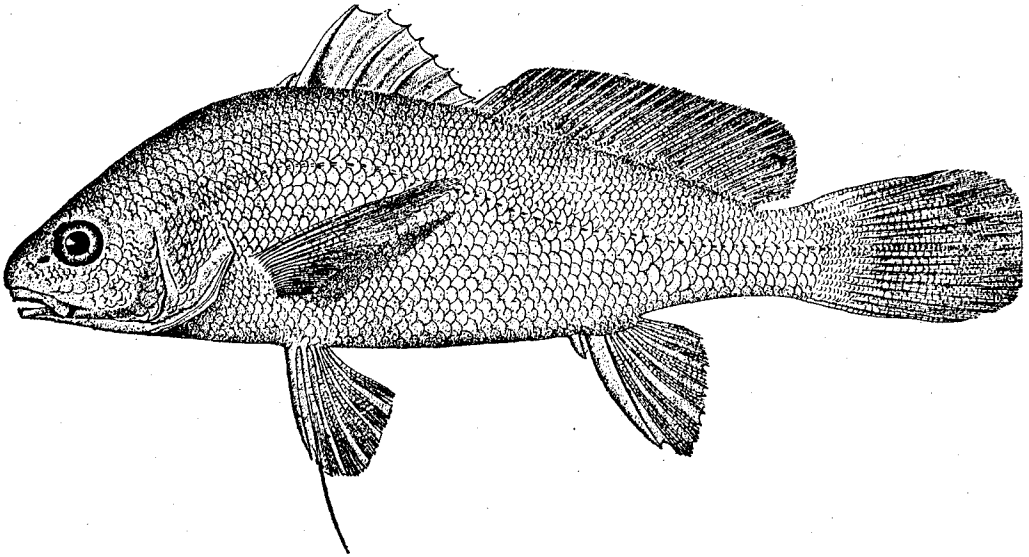


FIG. 4.—*Aplodinotus grunniens* Rafinesque.

**44. *Aplodinotus grunniens* Rafinesque.** *Fresh-water Drum; Gaspergou.*

One specimen, 13 inches long, from the Rio Usumacinta at Montecristo. Head 3.5; depth 3.2; eye 4.67; snout 4; maxillary 2.75; mandible 2.5; interorbital 3.5; preorbital 6.5; scales 9-60-12, counted from vent to lateral line, and from first dorsal spine to and including lateral line; D. x, 31; A. ii, 7; longest dorsal spine 2.16 in head; longest anal spine 1.67 in head; pectoral 1 in head. Body oblong; back much elevated and compressed; profile long, steep, and straight; head slightly compressed; mouth moderate; subinferior, low; maxillary reaching middle of eye; teeth in villiform bands, outer scarcely enlarged; lower pharyngeals completely united; gillrakers short, thickish, 6+14; preopercle serrated; snout bluntish; dorsal spines strong and high, a scaly sheath at base of spines, the two dorsals connected; caudal doubly truncate; second anal spine unusually large and strong; scales rather thin and deep, the series somewhat oblique, crowded anteriorly.

Color in alcohol, grayish-silvery, dusky above, with indications of two or three darker bands over shoulder; a dark blotch on opercle; dorsal and caudal same as body, the upper half of membrane darker, other fins pale. This fish differs from more northern specimens in the long, narrow, falcate pectoral fin.

The finding of this species so far south is a very interesting discovery. Though a fish of wide distribution, occurring throughout the Great Lakes region and southward in the larger streams of the Mississippi Valley and Texas, it has not hitherto been noted from any point south of Matamoras near the mouth of the Rio Grande, from which place Girard, in 1859, described it as a new species under the name *Ambloodon neglectus*. It was obtained by Drs. Jordan and Gilbert in the Red River at Fulton, Ark., and the Colorado River at Austin, and the senior writer of this paper has seen, in the Houston market, numerous examples from near the mouth of the Trinity River, Texas. He has also recorded it from the Neches and Angelina rivers in eastern Texas, and from Lakes Tasse and Peigneur, Louisiana. The Rio Usumacinta is about 600 miles south and 300 miles east of the mouth of the Rio Grande.

#### 45. *Petenia splendida* Günther.

The collections contain 3 specimens of this fish from Montecristo and 1 from Frontera. Head 2.87; depth 2.6; eye 5.3; snout 2.8; interorbital 4; maxillary 1.8; mandible 1.5; D. xv, 13; A. v, 10; scales 6-38-12, 8 vertical or 6 horizontal rows on cheek; longest dorsal spine about 3 in head; longest dorsal ray about 1.8; last anal spine 2.75; longest anal ray nearly 2; pectoral 1.5; ventrals 1.6.

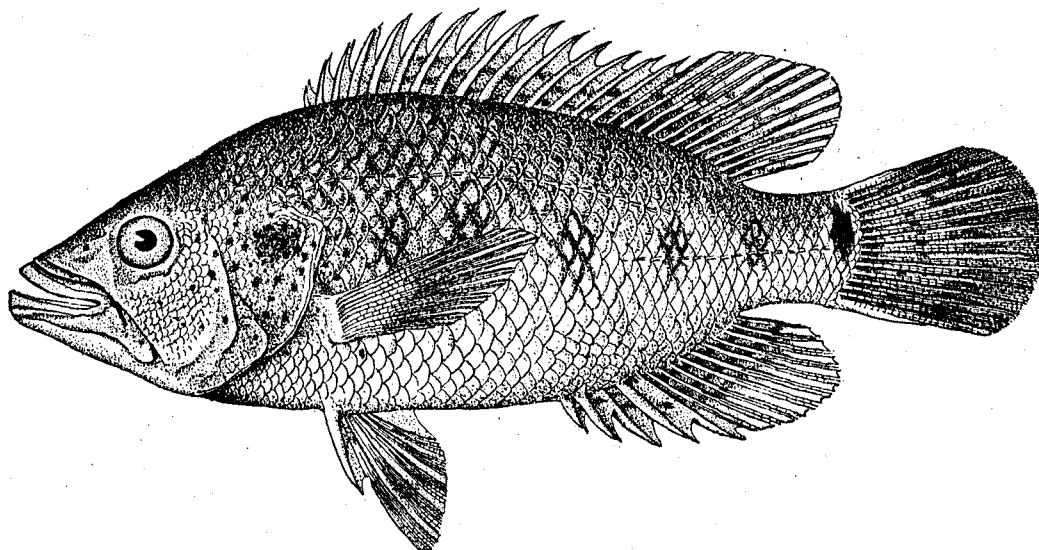


FIG. 5.—*Petenia splendida* Günther.

Body stout, greatly compressed; dorsal outline strongly arched; snout long and pointed; eye large, high up; mouth large, lower jaw projecting; maxillary long, clavate, reaching much beyond eye; preorbital very narrow; caudal peduncle much compressed, width 2.5 in least depth; form and general appearance very much resembling the crappie (*Pomoxis annularis*); dorsal and anal fins large, tips of the rays reaching beyond base of caudal; ventrals long and pointed, their tips reaching base of anal.

Color, silvery on side, darker above, body everywhere with numerous small black specks, these especially plain on side of head and humeral region, the dark on rest of body taking the form of dark borders on the scales; middle of side, especially in younger individuals, with 6 or 7 dark vertical blotches appearing as half bars extending from median line of back to below middle of side; the first of these rather as a dark blotch on upper part of opercle; base of caudal with a large round black spot, more or less definitely surrounded by a white border, the white in most specimens as a distinct white border, but in others breaking up and penetrating the black spot; dorsal, anal, and caudal with numerous small round black spots, plainest and most numerous on the soft dorsal, and arranged more or less definitely in rows extending downward and backward; pectoral pale; ventrals somewhat dusky.

The above description is based chiefly upon the largest specimen, which is from Montecristo.

**46. *Cichlasoma teapæ*, new species.**

Type, No. 50005, U.S.N.M., a mature male 9.5 inches long, collected April 1, 1900, by E. W. Nelson and E. A. Goldman, in the Rio Teapa, at Teapa, Tabasco, Mexico. Cotype, No. 976, U.S.F.C. reserve, a well preserved specimen, 8 inches long, collected at the same time and place.

Head 3.75; depth 2.6; eye 5; snout 2; maxillary 4.5; mandible 3.5; interorbital 2.6; preorbital 3.2; D. xvii, 13; longest dorsal spine 2.3 in head, ray 1.2; A. vi, 9, longest anal spine 2.2, ray 1.25; pectoral 1.5; ventrals 1.2; caudal 1.5; scales 6-33-12, 5 rows on cheek. Body comparatively slender, compressed; caudal peduncle much compressed, its least width 3 in its least depth; head short, compressed, its anterior profile ascending very abruptly from the short, blunt snout; a high nuchal crest or hump, highest above eyes, the anterior profile thus made concave in front of eyes; snout short, anterior profile ascending abruptly; mouth small, nearly horizontal; jaws subequal, or the lower slightly included; teeth strong, canine-like, tips brown; eye rather small, entirely above tip of snout; dorsal fin beginning over base of pectoral, the spines rather slender and weak; soft rays of dorsal long, reaching base of caudal; anal spines stronger than those of dorsal, the rays somewhat longer; caudal fin truncate; pectoral rather broad, not reaching tips of ventrals; ventrals long and

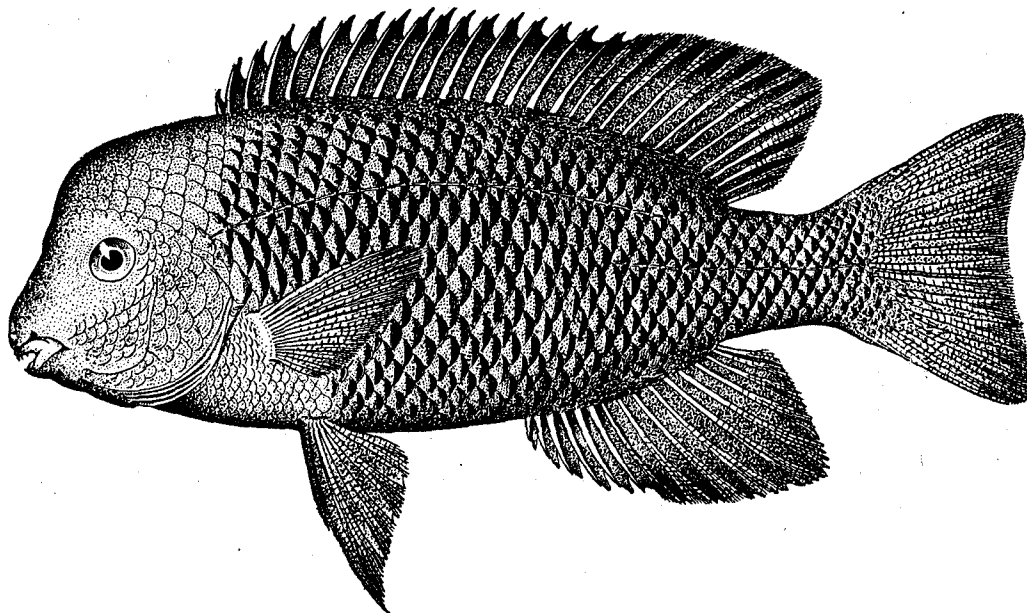


FIG. 6.—*Cichlasoma teapæ*, new species.

pointed, extending slightly beyond vent in type, not quite reaching it in cotype; tips of dorsal and anal extending slightly beyond base of caudal.

Color in alcohol, dusky white, paler on belly, the outer half of exposed portion of each scale brownish black, the distinction between this and the pale base of the scale being very marked; traces of four or five dark vertical blotches on side under dorsal fin and one at base of tail; trace of black blotch under and above tip of pectoral; entire head pale brownish; dorsal, anal, and caudal brownish, apparently without spots; pectoral and ventrals pale.

This species is related to *C. melanurus*, but differs from it in the more slender body and very different coloration. It also resembles *Heros gibbiceps* Steindachner, the type of which also came from Teapa, in the strong development of the nuchal crest. From that species it differs in the presence of a frenum on lower jaw, which makes it a true *Cichlasoma*, and in the different coloration.

**47. *Cichlasoma parma* (Günther).**

One specimen, 9 inches long, from Frontera, and one 4.13 inches long, from Montecristó. Head 3; depth 2; eye 4.75; snout 2.17; preorbital 3.75; interorbital 2.6; maxillary 3.5; mandible 2.4; D. xvii, 11; A. vi, 8; scales 6-30-12, 6 rows on cheek; longest dorsal spine 2, ray 1.1; longest anal spine 2,

ray 1.2; pectoral 1.4; ventral 1.1; caudal 1.25. Body oblong-ovate, much compressed; dorsal profile strongly and regularly arched, slightly concave between anterior part of eyes; snout moderate; mouth moderate, jaws subequal, maxillary not nearly reaching eye; teeth in front of jaws strong, canine-like, somewhat recurved, tips brown; caudal peduncle much compressed, least width 2.5 in least depth; fins large; soft lobes of dorsal and anal reaching past middle of caudal; pectoral broad, scarcely reaching vent; ventrals pointed, reaching base of anal.

Color, pale brownish, side with several more or less indistinct diffuse black blotches; a more or less ocellate black spot at base of caudal; pectoral pale, other fins dusky, the soft dorsal, anal and caudal with numerous obscure small black spots.

This species resembles *C. melanurus*, but seems to differ in the somewhat deeper body, longer snout, and more spotted coloration on the caudal and soft dorsal and anal.

**48. *Cichlasoma melanurus*** (Günther).

Four specimens, each about 8 inches long, 3 from Montecristo and 1 from Teapa. Head 3; depth 2.2; eye 4.5; snout 2.4; preorbital 3.5; interorbital 2.75; premaxillary 4; mandible 2.75; D. xvii, 11; A. vi, 8; scales 6-33-12, 5 rows on cheek; longest dorsal spine about 2, ray 1.17; last anal spine 2.17, ray 1.2; pectoral 1.4; ventral 1, caudal 1. Body rather oblong, compressed, the back considerably elevated; snout short; anterior profile more or less concave, depending upon the development of the fatty nuchal hump; eye entirely above level of upper lip; mouth small, slightly oblique, jaws subequal; anterior teeth in jaws moderate-sized canines, brown at tip.

Color, dirty white, marbled and blotched with darker, the dark tending to gather in irregular vertical bars; a more or less distinct ocellated black spot at base of caudal, this sometimes obscure; pectoral pale, other fins more or less dusky; soft dorsal and anal black at base, the outer part pale.

This species resembles *C. parma*, but seems to differ from it in the more slender body, the shorter snout, the more abrupt anterior profile and in the coloration.

**49. *Heros affinis*** Günther.

One specimen, 3.4 inches long, from Progreso.

**50. *Heros cyanoguttatus*** (Baird & Girard).

One example, 8 inches long, from Montecristo. Head 3.2; depth 2; eye 4; snout 2; preorbital 3; interorbital 2.3; maxillary 3.5; mandible 2.75; D. xvi, 11; A. vi, 9; scales 6-30-11, 6 rows on cheek; longest dorsal spine 2.2, ray a little longer than head; last anal spine 2.25, ray 1.2; pectoral 1.2; ventral 1; caudal 1. Body short and deep; head very short, anterior profile very high, gently curved from tip of snout to origin of dorsal; eye very high; mouth low, small, nearly horizontal; teeth rather small, canine-like in front of jaws, tips slightly brown; soft dorsal and anal extending to or beyond middle of caudal. Color in alcohol, dirty white, blotched and spotted with black, the black most evident below lateral line; outer half of many of the scales black; middle of side with numerous small, irregular wavy lines and roundish pale-spots, these probably blue in life; pectoral pale; the other fins dusky or even black, the ventrals and anal blackest.

This species has not hitherto been reported from southern Mexico.

**51. *Heros urophthalmus*** Günther.

Head 2.9; depth 2; eye 4.3 (4 to 4.5); snout 2.6 (2.5 to 3); maxillary 2.67; mandible 2.25; interorbital 3; preorbital 4; D. xvi, 10; A. vi, 7 (v to vii, 6 to 8); scales 5-29-10, 5 rows on cheek; longest dorsal spine 2.25, ray 1.25; last anal spine 2.25, ray 1.4; caudal 1.4; pectoral 1.25; ventral 1.25. Body short and robust, compressed, the caudal peduncle deep and narrow; back considerably elevated, anterior profile concave between the eyes; no nuchal crest on any of the specimens examined; head large, snout rather long; mouth rather large, somewhat oblique; maxillary reaching orbit; jaws equal; teeth conic, the tips brown; scales large, smooth, lateral line complete, but dropping three rows under middle of soft dorsal; fins all well developed; pectoral rather long, nearly reaching origin of anal; ventral reaching past vent; soft portion of anal and dorsal reaching middle of caudal.

Color, dark or brownish, with 7 broad black vertical crossbars, the first extending from in front of dorsal fin to upper end of gill-opening, the second from under front of dorsal to base of pectoral, the third and fourth from spinous dorsal to belly between ventrals and anal, the fifth from front of soft dorsal to front of soft anal, the sixth across base of caudal peduncle, the seventh across middle of caudal peduncle; a large ocellated black spot at base of caudal fin; pectoral pale, all other fins dark, sometimes almost black, probably bluish in life.

This species is well represented in the collection, there being 7 specimens 7 to 8 inches long from Mujeres Island, 7 specimens 8 to 9.5 inches long from Montecristo, 7 specimens 6.75 to 8.25 inches long from Chichen Itza, and 3 specimens 3.5 to 4 inches long from Progreso. It is easy to distinguish the specimens from any of these localities. Those from the salt or brackish waters at Mujeres Island are shorter, plumper, and decidedly darker than those from either of the other localities; the black bars are very distinct, as is also the caudal ocellus. The specimens from Montecristo are more slender and the color very much paler; the black vertical bars are in each case quite indistinct, in some instances being almost or quite lost. The black caudal spot is less black and the white border more evident. The 7 specimens from the cenote at Chichen Itza are intermediate in color between those from the two other places, and are considerably more slender. They have an emaciated, starved appearance, which is doubtless accounted for by the fact that they had been caught from the cenote and kept in a trough or small artificial inclosure, presumably without sufficient food, for some time previous to coming into Mr. Nelson's possession.

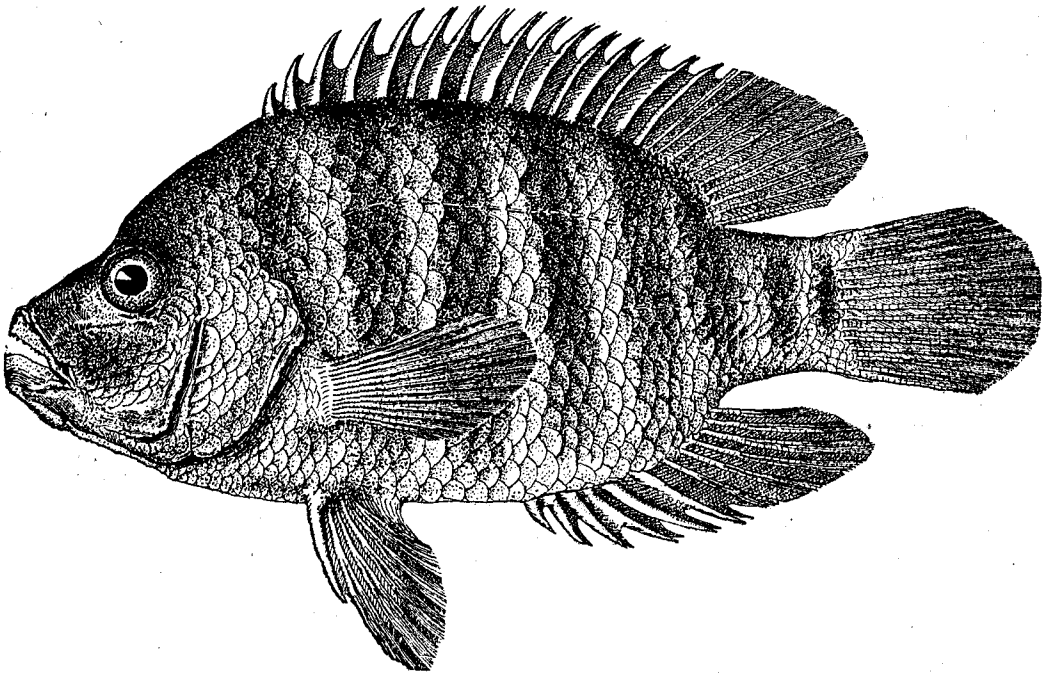


FIG. 7.—*Heros urophthalmus* Günther.

Although it is easy to pick out the individual fish from any one of these localities, we do not find any structural differences of value. The color differences are due simply to the character of the water in which they were found. The difference in form is simply a question of food supply. Had all received the same food or in the same amount, these differences probably would not have appeared.

**52. *Spheroides marmoratus* (Ranzani).** *Swell-fish.*

One specimen, 10.75 inches long, from Cozumel Island.

**53. *Spheroides testudineus* (Linnæus).** *Swell-fish; Puffer.*

One specimen, 9 inches long, from Mujeres Island. Head 3; eye 8; snout 2; interorbital 2.5 in head, 1.3 in snout; D. 8; A. 6. No cirri, no prickles, but many pores over most of anterior half of body.

**54. *Philypnus dormitor* (Lacépède).** *Guavina.*

Two specimens, 6 and 10.5 inches long, from Teapa. Head 3.6; depth 6.6; eye 7.5; snout 3.25; maxillary 2.33; interorbital 4.87; preorbital 7.5; D. vi, 10 or 11; A. i, 8; scales about 60,—22.

**55. *Dormitator maculatus* (Bloch). *Mapiro*.**

Four small specimens, 1.7 to 2.3 inches long, collected December 25, 1898, by Mr. C. C. Deam from a salt-water pool at Salina Cruz.

**56. *Batrachoides goldmani*, new species.**

Type, No. 50006, U. S. N. M., a specimen 10.5 inches long, collected May 7, 1900, by E. W. Nelson and E. A. Goldman, in the Rio Usumacinta, at Montecristo, Tabasco, Mexico.

Head 2.75; depth 5; eye 9; snout 4.25; D. III, 24; A. 18. Body fusiform; head very broad, much depressed; caudal peduncle slender, much compressed; mouth large, lower jaw strongly projecting; maxillary reaching far beyond eye; teeth small, those on vomer in two irregular rows, about 26 in number, the inner the larger; palatine teeth about 15 on each side, irregular in size and position; teeth of lower jaw in 2 large patches in front, the outer somewhat enlarged; eye small; dermal fold on side of occiput obscure; dermal filaments on jaws and sides of head rather small; opercle with 2 rather strong

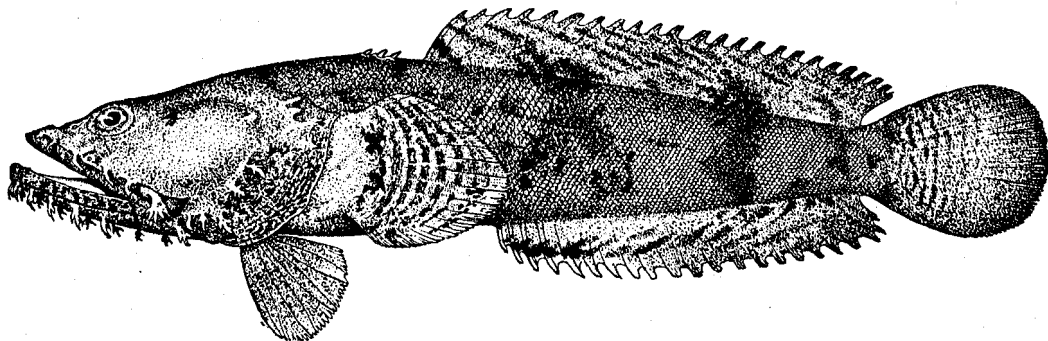


FIG. 8.—*Batrachoides goldmani*, new species.

divergent spines, but covered by skin; subopercle with 2 similar stronger spines; dorsal spines short and blunt; soft dorsal long, about half length of body; anal base 2.5 in length; caudal rounded; pectoral moderate, 1.67 in head; ventrals short, 2 in pectoral.

Color, grayish, with 4 irregular dark cross-blotches, the first under base of pectoral and involving the 3 free spines; the second under first one-third of dorsal and extending upon it; the third under last one-third of dorsal and likewise extending upon it; the fourth, a dark bar at base of caudal; top of head and back olivaceous or dusky, blotched irregularly with dark; under parts of head paler, with dusky and violet markings; spinous dorsal dark; soft dorsal violet or rusty with 2 large black blotches on base; a smaller one between them, the fin crossed by irregular short dark and pale lines; anal similar to soft dorsal; caudal dark, irregularly barred at the base; pectoral dark at base, the rest of fin with irregular bars of white and brownish; axil pale; ventrals somewhat dusky.

This species differs from *B. surinamensis* in several important particulars, but chiefly in the smaller size of the anal and dorsal fins. In *B. surinamensis* the anal has 26 rays and its base is nearly half the length of the fish, and the dorsal has 29 rays, the base being more than half length of body.