

FISHES OF THE REPUBLIC OF EL SALVADOR, CENTRAL AMERICA

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INTRODUCTION

This report is based upon collections made in El Salvador during the last half of January and the first half of February, 1924, by Fred J. Foster, superintendent of the United States Bureau of Fisheries station at Neosho, Mo., and the writer. This visit to El Salvador was made in response to a request of the Government of that country to the Government of the United States for the services of one or more specialists to examine principally the fresh waters to determine the status of the fisheries and to study their needs. The United States Commissioner of Fisheries thereupon detailed Mr. Foster and the author to proceed to El Salvador for that purpose. A report embodying the economic phase of these studies has been prepared by Mr. Foster and the author; it is sufficient to state here that fish are very scarce in most fresh waters and that the quantity taken annually appears to be very small. Two brief collecting trips were made to salt water, and there, too, fish appeared to be rather scarce. It is well understood, however, that the abundance of fish in salt water usually varies greatly with the season, and the results obtained from the two short visits made are not sufficient to form the basis for any conclusions.

The scarcity of fresh-water fishes may be due mainly to the absence in the past of measures of protection, and in certain waters probably to the liberation, through earth disturbances, of poisonous gases. Fishing has been carried on at all seasons of the year, and such destructive methods as the use of dynamite and plant poisons appear to have been used frequently. Fishes of nearly all sizes are taken and marketed. Individuals 75 millimeters in length, belonging to species that reach a length of 300 millimeters and more, are taken and sold in the markets. Even the top minnows (*Pœciliidæ*, locally known as "chimboles") are sold both in the fresh and dried state.

El Salvador is the smallest of the Central American Republics, having an area of 34,126 square kilometers, or about equal in size to the State of New Jersey, and it is the only one of these republics which is wholly within the Pacific drainage and which does not also border on the Atlantic Ocean. The climate, of course, is tropical, but the country is largely mountainous, and a considerable variation in temperature, according to altitude, exists. This country, like most tropical countries, has a wet and a dry season. The wet season extends from about May to November, and the dry season occupies the balance of the year. The wet season is referred to by the inhabitants as winter and the dry season as summer.

The Republic, from an agricultural standpoint, is rich, and, exclusive of Haiti, it is said to be the most densely populated country of the Western Hemisphere. The great mass of the people are Indians, who live a simple life, have little, and whose wants seem to be satisfied easily. Spanish, the State language, is spoken everywhere.

El Salvador, although small, is well supplied with fresh-water lakes and streams. The Rio Lempa, a comparatively large stream, lies mostly within its borders. Lake Guija, with an area of 300 square kilometers, lies on its border, partly in El Salvador and partly in Guatemala. It appears to be quite rough a large part of the time, and plant growths were found only in protected coves. Soundings taken

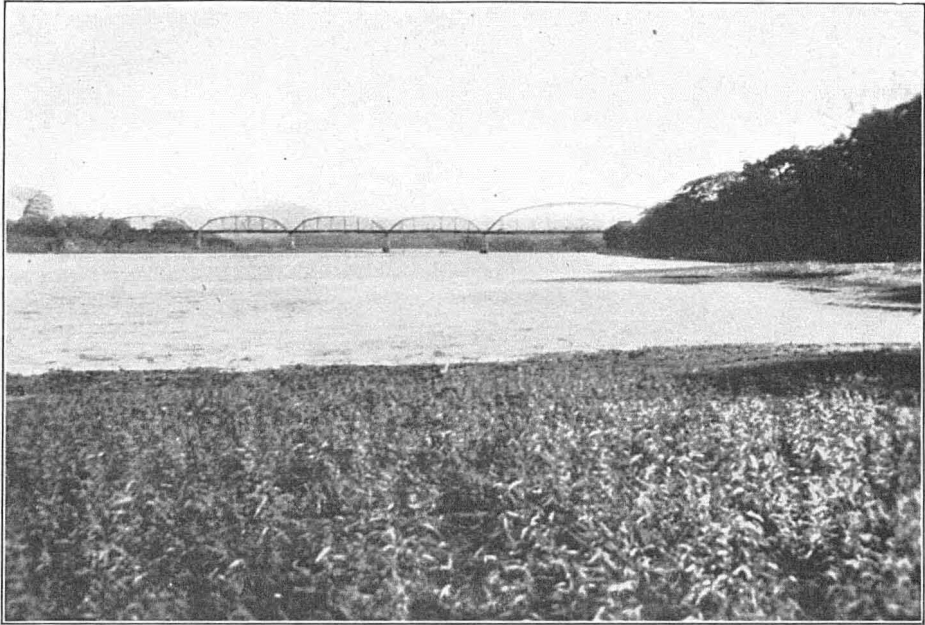


FIG. 1.—Rio Lempa at San Marcos, with railroad bridge in the background



FIG. 2.—Natives fishing with a cast net in Lake Ilopango



FIG. 3.—View from Lake Coatepeque, showing buildings along the shore and a steep mountain side in the background, with zigzag trail



FIG. 4.—Indian fishing in deep water from a balza on Lake Coatepeque

offshore varied from 4.5 to 16 meters. Lake Ilopango, with an area of 70 square kilometers, and Lake Coatepeque, with an area of 30 square kilometers, are beautiful, deep, clear bodies of water having considerable vegetation along the shores, some of the plants growing at a depth of 7 meters or more. The plants consist largely of *Chara*, *Ceratophyllum*, and *Naias*, the plant growing at the greatest depth being *Naias marina*. Lake Ilopango has an outlet, but Lake Coatepeque has none, and the water in the latter has a slightly salty taste, the sodium chloride content, according to an analysis posted in a local hotel, being 0.4465 grams per liter. The maximum depth of Lake Ilopango was not obtained, as the lake was too rough at the time of our visit to make vertical soundings with the apparatus at hand.

The greatest depth found in Lake Coatepeque was 83 meters. Hook and line fishing from the native raft, the "balza," is carried on in this lake to a depth as great as 30 meters, and the species taken at the greatest depth is *Cichlasoma motaguense*. In Lake Ilopango food fishes are scarcer than in any other lake visited. This may be due to overfishing stimulated by its proximity to San Salvador, where fishes command a fancy price.

Lake Olomega is another lake of considerable size, having an area of 20 square kilometers. This lake is shallow, having an average depth of scarcely 2 meters, and the water is turbid. Vegetation is abundant along the shores where they are not too rocky. The country also has quite a number of smaller lakes, among which Metapan,¹ Ahuachapan, Chalchuapa, Zapotitan, and Chanmico were visited. Among these lakes Metapan and Ahuachapan are shallow and afford some of the best fishing found in El Salvador. Chalchuapa and Chanmico are quite deep and food fishes are scarce, while top minnows are very abundant. Lake Zapotitan covers considerable territory, but it can scarcely be considered more than a swamp that is so densely overgrown with vegetation that a boat can not be used.

The Rio Lempa, the largest river in El Salvador, was visited at Suchitoto and San Marcos, and collections were made at each place. Collections were made in two of its tributaries also, namely, in the Rio del Desague near Lake Guija, of which it forms the outlet, and in the Rio Sucio at Sitio del Niño. In the Rio San Miguel, a much smaller stream than the Lempa, a collection was made at San Miguel. In the Rio de Paz basin collections were made in the Rio Molino near Ahuachapan and in the Rio Pampe near Chalchuapa. One day was devoted to collecting in the small mountain streams near San Salvador, some of which empty into Lake Ilopango and some into the Rio Lempa.

All the streams of El Salvador that were seen are rocky, having rapids and comparatively large, deep stretches between the rapids. Sand and gravel are found only occasionally, and collecting with drag nets is difficult. The natives use cast nets both in the streams and in the lakes. Hook and line fishing also is engaged in in some localities.

The temperature of the water at the surface in the different lakes and streams ranges from about 74 to 83° F., the average being close to 78°. The difference between the bottom and the surface temperatures in the lakes is small. In Lake

¹ In the vicinity of the city of Metapan is located a group of lakes known as "Laguna de Metapan," which are all connected during the rainy season but which become separated during dry weather. The collections reported in this paper were made in the small division of the Laguna de Metapan located nearest the city of Metapan.

Coatepeque, for example, at a depth of 83 meters at 8.20 a. m., the temperature was 72.5° F., while at the surface at the same time and place it was 74°; in Lake Ilopango, at a depth of 15 meters, the temperature was 80° F., at 2.30 p. m., and at the surface at the same time and place it was 81°; and in Lake Guija, at a depth of 16 meters, the temperature at 11 a. m. was 74.5° F., while at the surface it was 76.5°.

Fish, due chiefly to their scarcity, sell very high in comparison with other foods, bringing a better price than fresh fish do in our inland markets. The fish, furthermore, are usually small and far from the choice supply seen in our markets. Many fish are marketed in the dry state, having been sun cured without the addition of salt or any preservative. This stock, too, finds ready sale. The species sold chiefly in the dried state are the catfishes, locally known as "bagre"; the top minnows, "chimbolas"; and the characins, "sardina" and "plateada."

No collecting worthy of the name had previously been done in El Salvador. Records of only two species of fresh-water fishes, the four-eye or "cuatro-ojo" (*Anableps dovii*) and the top minnow or "chimbola" (*Mollienesia sphenops*, recorded as *Paccilia salvatoris*) were found. Only a small amount of collecting likewise appears to have been done on the Pacific slope of Guatemala, Honduras, and Nicaragua. It is therefore not surprising that several of the species taken apparently are new. The Pacific slope in El Salvador, as in most of Central America, is narrow and the rivers are short. A large number of species, therefore, is not to be expected. Six marine species have been included with the fresh-water fishes because they appear to be regular visitors. One species of marine catfish, locally known as the "bagre" (*Galeichthys guatemalensis*), is one of the common food fishes found in nearly all the fresh waters, except in the lakes having no outlet. This fish, although to the writer's knowledge not previously recorded from fresh water, has become so much fresh water in its habits in El Salvador that one is led to believe it may be able to maintain itself there. It is understood that this fish, in order to reach Lake Olomega from the sea, would have to scale falls of considerable size situated in the Rio San Miguel. None of the other marine species, such as *Mugil cephalus*, *Centropomus nigrescens*, *C. robalito*, and *C. pectinatus*, which ascend the Rio Lempa far above salt water, appear to be able to ascend beyond the falls, as none was taken by us in the Rio San Miguel above the falls or in Lake Olomega.

The accompanying table shows where the different species of fresh-water fishes were taken in El Salvador, whether their range extends north or south of this country, or both, and whether they are common to both the Atlantic and Pacific drainages or only to the Pacific. It will be seen that most of the fresh-water species inhabit both lakes and streams. The table also shows that several species reach their southernmost range of distribution, so far as known to date, in El Salvador, while every species known from more southern countries also ranges northward of El Salvador.



FIG. 5.—Lake Zapotitan. Nearly the entire lake is overgrown with dense vegetation

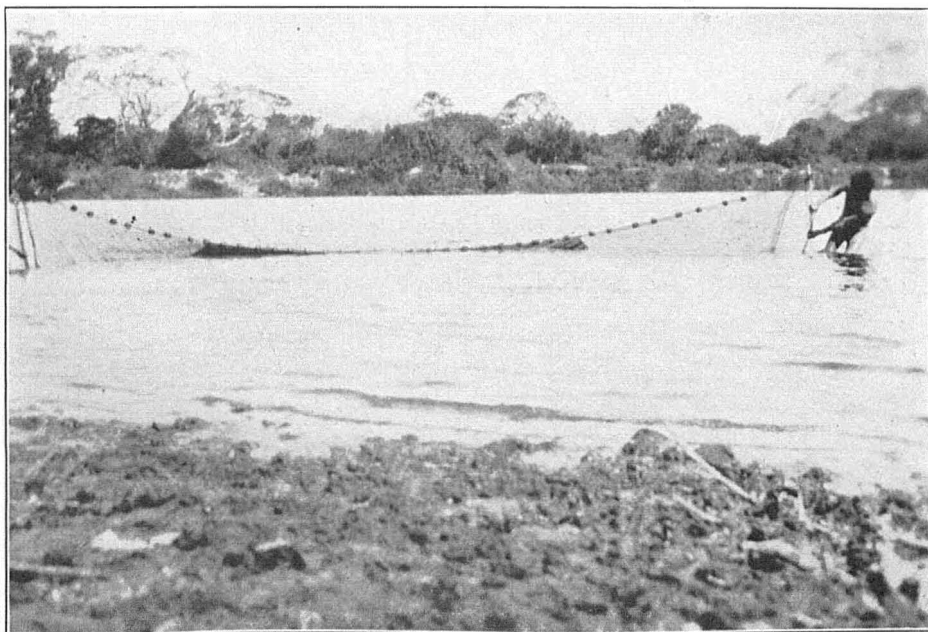


FIG. 6.—Collecting fish in El Salvador

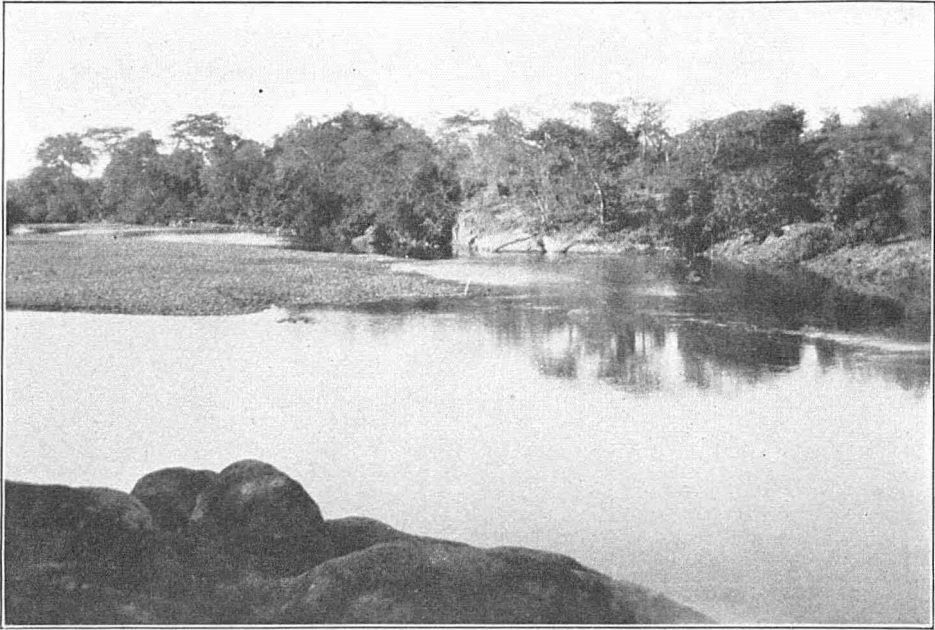


FIG. 7.—Rio San Miguel at San Miguel, during the dry season

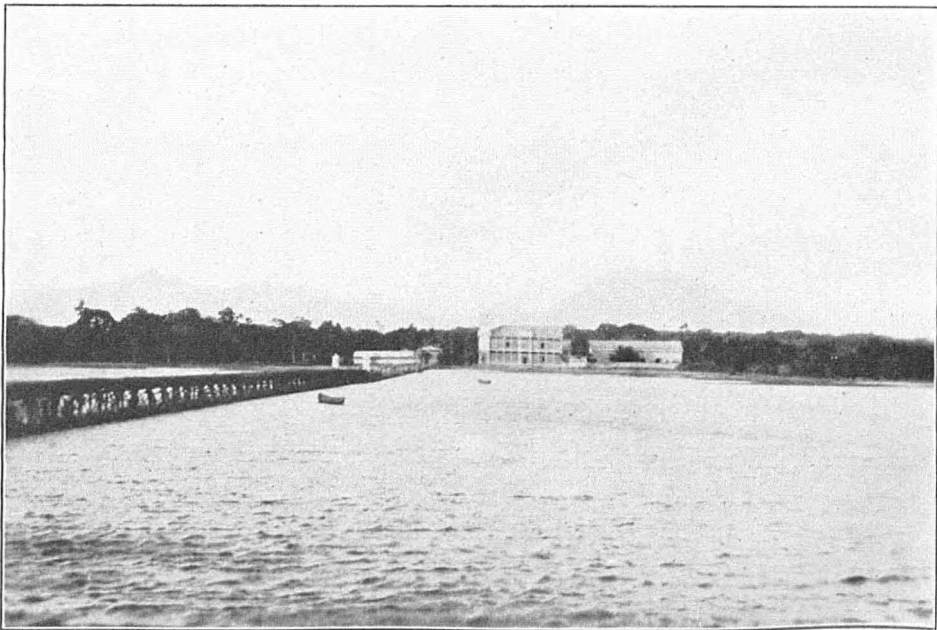


FIG. 8.—Harbor of El Triunfo. A smoking volcano, the San Miguel, is in the background

TABLE 1.—Localities in which collections were made in El Salvador and the species taken in each.

[The range of the species, as to whether extending north or south of El Salvador, or both, and also whether extending into both the Atlantic and Pacific drainages or the Pacific only, is indicated]

Species	Lakes							Fonds at El Angel	Rio del Desague near Lake Guija	Tributaries of the Rio de Paz		Rio Suncio at Sitio del Niño, tributary of the Rio Lempa	Small streams at San Salvador	Rio Lempa at Suchitoto	Rio Lempa at San Marcos	Rio San Miguel at San Miguel	Salt and brackish water		Range							
	Guija	Metapan	Ahuachapan	Chalchuapa	Coatepeque	Chamnico	Zapotitan			Ilopango	Olomega						Rio Pampe at Chalchuapa	Triunfo	Cutuco	North	South	El Salvador only	Pacific slope only	Atlantic and Pacific slopes		
1. <i>Astyanax fasciatus</i> genus.....	x	x								x			x	x				x	x				x			
2. <i>Roeboideasalvadoris</i> sp. nov.....	x	x											x	x												
3. <i>Galeichthys guatemalensis</i>	x	x												x	x											
4. <i>Arius taylori</i> sp. nov.....														x	x											
5. <i>Rhombia guatemalensis</i>	x	x											x												x	
6. <i>Profundulus punctatus</i>																										
7. <i>Mollienisia sphenops</i>	x	x	x	x	x	x	x	x	x	x			x	x												x
8. <i>Priapichthys letona</i> sp. nov.....	x	x											x	x												
9. <i>P. fosteri</i> sp. nov.....													x	x												
10. <i>Anableps dovii</i>	x												x	x												
11. <i>Thyrina guijsa</i> sp. nov.....	x													x	x											
12. <i>Mugil cephalus</i>																										
13. <i>Agonostomus monticola</i>																										
14. <i>Centropomus nigrescens</i>																										
15. <i>C. robalito</i>																										
16. <i>C. pectinatus</i>																										
17. <i>Cichlasoma nigrofasciatum</i>	x	x	x	x	x	x	x	x					x	x												
18. <i>C. macrocanthus</i>			x																							
19. <i>C. meeki</i> sp. nov.....	x	x		x																						
20. <i>C. trimaculatum</i>	x	x																								
21. <i>C. motaguense</i>	x	x	x		x																					
22. <i>Gobiomorus maculatus</i>																										

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and the completeness of the collection upon which the present report is based. Irving L. Towers, scientific assistant, Bureau of Fisheries, deserves credit for much valuable assistance rendered in the preparation of the report. The illustrations of fishes are from photographs made by Herbert F. Prytherch, scientific assistant, Bureau of Fisheries, and retouched by an artist. The plants mentioned in the text were identified by Paul C. Stanley, of the National Museum.

EXPLANATORY NOTES

The usual abbreviations used in systematic ichthyology by most recent authors has been followed. For example, the expression "head 3.3 to 4.1; depth 4.3 to 6.2" signifies that the length of the head, measured from the tip of the upper jaw to the bony margin of the opercle (unless otherwise specified), is contained 3.3 to 4.1 in the "standard length"—that is, in the distance from the end of the snout to the base of the caudal fin—and the greatest depth of the body is contained 4.3 to 6.2 times in the standard length. In giving the number of spines and rays contained in a fin the spines are designated by Roman numerals and the soft rays by Arabic numerals. For example, "D. VII-I, 14; A. III, 8" signifies that the dorsal fins are separate and that the first consists of 7 spines and the second of 1 spine and 14 soft rays, and that the anal is continuous, being composed of 3 spines and 8 soft rays. If, in the case of the dorsal fin, the spines and rays had all been connected so as to form a single continuous fin, the result would have been written thus: D. VIII, 14. The number of scales given in the description, unless otherwise stated, is the number of oblique rows, running upward and backward, that occur just above the lateral line. This series is counted from the upper anterior angle of the gill opening to the last large scale on the base of the caudal.

In the arrangement of the families, Jordan's "A Classification of Fishes" (Stan. Univ. Pub., Univ. Ser. III, No. 2, 1923, pp. 79-243) was followed.

In order to render the catalogue more useful for ready identification keys to the families, genera, and species have been introduced. Since the species occurring in the waters of El Salvador are few, the keys are all short and no difficulty in using them should be experienced. No attempt has been made in the keys to show the natural relationship of the various groups. In using the keys first determine to which of the major groups the species in hand belongs, then take up the regular order of letters under that group. If the characters of the specimen do not agree with those under the single letter, look under the double letter, ignoring all intervening matter.

Following is a list of the species which appear as new in the present paper:

	Page		Page
<i>Rœboides salvadoris</i>	246	<i>Priapichthys fosteri</i>	260
<i>Arius taylori</i>	250	<i>Thyrina guija</i>	264
<i>Priapichthys letonai</i>	258	<i>Cichlasoma meeki</i>	275

Part I.—DESCRIPTIVE CATALOGUE OF THE FISHES OCCURRING IN THE FRESH WATERS OF EL SALVADOR

All of the fishes of the fresh waters of El Salvador belong to the class *Pisces* (fishes) and to the superorder *Teleostei* (the bony fishes), which possess a bony skeleton, a well-developed skull, a single gill opening on each side, at least two nostrils that are not median, and well-developed fins.

KEY TO THE FAMILIES OF FISHES OCCURRING IN THE FRESH WATERS OF EL SALVADOR ²

- a. Scales wanting, body mostly covered with smooth skin; mouth and nostrils with several pairs of barbels or whiskers.
 - b. Nostrils close together, neither with a barbel; palatine teeth present.....*Ariidæ*, p. 248.
 - bb. Nostrils remote from each other, the posterior one without a barbel; teeth wanting on palatines.....*Pimelodidæ*, p. 251.
- aa. Body scaled; no barbels about the nostrils or mouth.
 - c. Fins without spines.
 - d. Adipose fin present; head naked; lateral line present.....*Characinidæ*, p. 244.
 - dd. Adipose fin wanting; head partly scaled; lateral line wanting.
 - e. Eye divided into an upper and lower portion by a dark-colored membrane in the cornea; anal fin in the male modified into a thick scaly conical copulatory organ with an orifice at its extremity.....*Anablepidæ*, p. 261.
 - ee. Eye normal, not as above; anal fin in the male normal or produced, but not forming a conical organ with an orifice.
 - f. Anal fin modified, the anterior rays more or less produced, forming an intromittent organ, but not enveloped in skin and not hollow as in *Anableps*.....*Pæciliidæ*, p. 254.
 - ff. Anal fin normal in both sexes.....*Cyprinodontidæ*, p. 253.
 - cc. Fins with spines.
 - g. Body elongate, not very deep; dorsal fins 2, separate.
 - h. Ventral fins abdominal; lateral line usually absent, never complete.
 - i. First dorsal with 3 to 9 flexible spines; anal fin with a single weak spine.....*Atherinidæ*, p. 263.
 - ii. First dorsal with 4 rather strong stiff spines; anal with 3 strong spines (sometimes 2 in very young).....*Mugilidæ*, p. 265.
 - hh. Ventral fins thoracic.
 - j. Lateral line complete, continued to end of caudal fin; anal with 3 spines, the second very strong; caudal fin forked.....*Centropomidæ*, p. 268.
 - jj. Lateral line wanting; anal fin with a single weak spine; caudal fin rounded.....*Eleotridæ*, p. 281.
 - gg. Body deep, compressed; lateral line interrupted under base of dorsal, reappearing lower down on side; dorsal fin single, composed of spines and rays.....*Cichlidæ*, p. 272.

² This key is intended to identify only the species of these families which occur in El Salvador, as some of the characters mentioned are not true of the families as a whole.

Class PISCES
Order HETEROGNATHI
Family I. CHARACINIDÆ

The Characins

Body variously shaped, usually more or less compressed; upper jaw mesially formed by premaxillaries, laterally by maxillaries; teeth various; scales present, usually cycloid, wanting on head; dorsal fin small, without spines; adipose fin usually present.

KEY TO GENERA

- a. Teeth in upper jaw in 2 series, none of them directed forward; anal fin of moderate length; usually composed of less than 30 rays ----- *Astyanax*, p. 244.
- aa. Teeth in upper jaw more or less definitely in 3 series, the outer series composed of strong teeth situated on outer margin of jaw and directed forward; anal fin very long, usually composed of 45 or more rays ----- *Raboides*, p. 246.

1. Genus **ASTYANAX** Baird and Girard

Astyanax Baird and Girard, Proc., Ac. Nat. Sci., Phila., VII 1854 (1856), 26 (type *Astyanax argentatus* Baird and Girard).

Body more or less elongate, compressed, the depth usually more than 2 in length; second suborbital narrow, leaving a naked triangular area below suture between first and second suborbitals; premaxillaries with 2 series of teeth, the first with several teeth on each side, the second equal or graduated, usually 10, sometimes 8 in number; lower jaw with strong teeth anteriorly, usually abruptly smaller, conical ones on sides; maxillary with a few or no teeth; gill rakers setiform; lateral line complete; no predorsal spine; adipose fin present; anal fin of moderate length, usually of fewer than 30 rays; caudal fin naked.

1. *Astyanax fasciatus æneus* (Günther)

PLATEADA; SARDINA

Tetragonopterus æneus Günther, Proc., Zool. Soc. London, 1860, 319 (Oxaca, Mexico).

Astyanax fasciatus æneus Eigenmann, Memoir., Mus. Comp. Zoöl., XLIII, Part 3, 1921, 306. (A complete synonymy is given here by Eigenmann, to which the reader is referred for further references.)

Head 3.5 to 5.13; depth 2.3 to 4.05; D. 11; A. 25 to 31; scales 33 to 38.

Body compressed, variable in depth and thickness; profile almost straight over the head, convex from nape to dorsal; caudal peduncle strongly compressed, broadly rounded underneath, its depth 1.85 to 2.55 in head; head small; snout blunt, 3.25 to 4.1 in head; eye 2.75 to 4.3; interorbital 2.45 to 3.1; mouth moderate, terminal; maxillary reaching to or slightly past anterior margin of eye, 2.5 to 3 in head; teeth strong, mostly tri- to multicuspid, in 2 series on the premaxillaries, the outer series with 8, the inner with 10 teeth, 2 teeth on each maxillary, 8 or 9 large teeth anteriorly on the lower jaw and abruptly smaller ones laterally; gill rakers short, 11 to 14 on the lower limb of the first arch; lateral line complete, slightly decurved; scales rather large, 10 to 12 rows crossing the back in front of dorsal, 10

or 11 between the dorsal and adipose, 6 or 7 from origin of dorsal to lateral line; dorsal elevated anteriorly, its origin equidistant from tip of snout and base of caudal or more usually a little nearer the former; adipose over the posterior rays of the anal; caudal fin broadly forked; anal fin rather long, its origin at or slightly behind vertical from end of dorsal base, usually about equidistant from margin of opercle and base of caudal; ventral fins moderate, inserted a little in advance of dorsal; pectorals short, 1.2 to 1.35 in head.

Color in life silvery with bluish green above; sides with an ill-defined bright silvery streak, most evident posteriorly; a dark shoulder spot, and frequently an indication of a second black spot behind it; dorsal olivaceous; caudal greenish, with an elongate black spot at its base extending to the end of the median rays; anal pink to deep red; ventrals usually more or less reddish; pectorals yellowish to red; upper part of iris red to reddish yellow.

Many specimens of this species, ranging in length from 20 to 135 millimeters, were preserved. This fish is very common in some localities but absent in others. It is especially abundant in Lake Olomega, where large quantities are taken and used for food. It was not taken in Lakes Ahuachapan, Chalchuapa, Coatepeque, Chanmico, and Ilopango. Especially large and fine specimens were taken in the Rio Pampe, a tributary of the Rio de Paz, near Chalchuapa. The individuals taken here are somewhat more slender, and they have a less distinct lateral band than the fish taken elsewhere. This fish inhabits the deeper parts of rocky and swiftly-flowing streams as well as quiet and shallow water.

The alimentary canal in this species is shorter than the body, and the peritoneum is black. The food found in 5 stomachs examined consisted of water fleas, copepods, water beetles, and fragments of fish. The sexual organs in the specimens dissected were collapsed, showing that spawning was not taking place during the period (January and February) when the specimens were collected.

A. fasciatus is an extremely variable species and many forms have been described. The specimens from El Salvador appear to be nearest the form which Eigenmann, in his monumental work, "The American Characidae," has designated as *A. fasciatus æneus*. It was pointed out in the preceding paragraph, however, that the specimens from the Rio de Paz basin differ somewhat from those taken elsewhere in El Salvador. Eigenmann, in speaking of the many variations, says: "Whether we call these forms species, varieties, or do not recognize them as worthy of name, the fact remains that different rivers are inhabited by individuals that in the aggregate differ from the individuals of another river, * * * that we have here a series of species in the making as the result of segregation." It would appear that at last two species are "in the making" in El Salvador.

This form, according to Eigenmann, ranges from Mexico to Panama. The specimens from El Salvador are from the Rio Pampe at Chalchuapa, Lake Guija, Lake Metapan, Lake Zapotitan, Rio Sucio at Sitio del Niño, Rio Lempa at Suchitoto and San Marcos, Rio San Miguel at San Miguel, and Lake Olomega.

2. Genus *RŒBOIDES* Günther

Ræboides Günther, Cat. Fish., Brit. Mus., V, 1864, 345 (type *Anacyrtus guatemalensis* Günther).

Body compressed; dorsal profile concave at nape in adult; teeth mostly pointed, in 3 more or less definite series in upper jaw, the outer ones of both jaws directed forward; shoulder girdle with a large spine; lateral line straight, complete; anal fin very long, with 45 or more rays; adipose fin well developed.

2. *Ræboides salvadoris* sp. nov.

PLATEADO; SARDINA; ALMA SECA; ULUMINA •

Type no. 87215, U.S.N.M. Length, 91 mm. Rio Sucio, Sitio del Niño.

Head 3.35 to 4.25; depth 2.55 to 3.4; D. 11; A. 46 to 50; scales 15 or 16—72 to 82; pores in lateral line variable, 53 to 73.

Body strongly compressed; the dorsal region elevated; profile deeply concave at occiput in the adult, not at all concave in young of 40 millimeters and less in length; head comparatively small; snout blunt, 3.25 to 3.9 in head; eye small, 3.2 to 3.8 in head or 11.5 to 15 in body; interorbital 3.2 to 3.8 in head; mouth large; maxillary notably broader than preorbital, reaching anterior margin of pupil to middle of eye, 2.1 to 2.5 in head; teeth moderate, 4 with broad conical bases, directed forward on margin of snout, 2 to 4 similar ones at sides on the maxillary and 2 on the margin of mandible; outer margin of maxillary with pointed teeth; premaxillary with irregular teeth, irregularly placed, some of the inner ones with small basal cusps; mandibular teeth all pointed, the anterior ones the largest, none of them definitely tricuspid; gill rakers short, 8 or 9 on the lower limb of the first arch; shoulder girdle with a spine, pointed both anteriorly and posteriorly, reaching nearly to base of pectoral; lateral line complete, nearly straight; scales very small; dorsal fin moderately elevated anteriorly, its origin equidistant from tip of snout and base of caudal or more usually a little nearer the former; the elevated portion measured from the origin of the fin to the tip of the longest rays 3.45 to 4.3 in body; adipose fin moderate, situated over the posterior part of anal; caudal fin deeply forked; anal fin very long, its origin equidistant from tip of snout and base of last anal ray or more usually a little nearer the former; ventral fins rather short, reaching opposite the fourth to the sixth anal ray, 5.25 to 6.4 in body; pectorals moderate, failing to reach the origin of anal, 1.3 to 1.45 in head or 4.6 to 5.7 in body; vertebræ 12+22.

Color in life silvery, slightly olivaceous on back; sides with a silvery band, most definite posteriorly; base of caudal with dark punctulations on a silvery background, forming a dark caudal spot; a smaller dark spot just above the lateral line and posterior to the vertical from base of ventrals, deeper than long, and variable in intensity, but not entirely wanting on any of the specimens at hand; upper parts of head dark; fins all greenish.

Many specimens of this species, ranging from 35 to 105 millimeters in length, were preserved. This fish is not universally distributed in the waters of El Salvador. It is abundant among vegetation in Lake Guija, apparently rather rare in Lake

Metapan, and common in the Rio Sucio at Sitio del Niño and in the Rio Lempa at Suchitoto. Elsewhere it was not seen.

The sexual organs in the fishes examined were in a collapsed condition, showing that spawning was not taking place during the period (January and February) when the specimens were collected. The air bladder is large and the alimentary canal is short. The contents of 4 stomachs examined consisted of fragments of insects and the scales of fish, which apparently remained after the rest of the fish had been digested.

The specimens from El Salvador evidently represent a species distinct from those of Panama. Material from other Central American countries is not available to the author for comparison. Günther, the discoverer of *R. guatemalensis*, considered his specimens from the Pacific slope of Guatemala identical with others obtained in the Rio Chagres in Panama. Authors, generally, had recognized but a single species from Central America. Meek and Hildebrand (Pub., Field Mus. Nat. Hist., Zool. Ser., X, 1916, pp. 291-3), however, found that the specimens from the Pacific slope of Panama were different from those of the Atlantic slope, and they described the former as new, giving it the name *occidentalis*. The Atlantic specimens were considered as *R. guatemalensis* of Günther, which is probably correct, for Günther, when describing the species, had some young from the Pacific slope of Guatemala and adult specimens from the Rio Chagres, Panama. Günther's description appears to have been based upon the adult fish, for he says: "Back elevated, the upper profile of the head and nape forming an S-shaped curve." This appears never to be true of the young of the genus. The Atlantic representatives from Panama, therefore, may for the present, at least, be considered the true *guatemalensis*, regardless of whether or not they are identical with specimens from Guatemala, which seems highly doubtful.

The El Salvador specimens differ from both the Panama species with which a direct comparison of specimens has been made, in having a smaller eye, shorter fins, in color markings, and in other minor respects. The number of scales in a lateral series appears to be nearly identical in the present species and in *R. occidentalis*. The number of gill rakers, however, is more nearly that of *R. guatemalensis*. In the position of the dorsal and anal the El Salvador specimens appear to be intermediate.

The diameter of the eye in the body in 12 specimens of the present species varying from 60 to 82 millimeters in standard length, ranges from 11.8 to 13.5, the average being 13.35. In an identical series of *guatemalensis* the range is from 9.4 to 13.1, average 11.63; in *occidentalis* the range is 10.03 to 13.3 and the average 11.64. The length of the fins in the body for 20 specimens from El Salvador, ranging in standard length from 28 to 86 millimeters, are as follows: Pectoral, 4.5 to 5.8, average 5.32; ventral 5.1 to 6.43, average 5.81; dorsal 3.44 to 4.3, average 3.94. The results for a similar series of *R. guatemalensis* are as follows: Pectoral 4.55 to 5.55, average 4.92; ventral 4.6 to 5.8, average 5.21; dorsal 3.2 to 3.66, average 3.51. For *occidentalis*, also using a like series of specimens, the following results were obtained: Pectoral 4.2 to 4.94, average 4.63; ventral 4.03 to 5.05, average 4.68; dorsal 3.1 to 3.5, average 3.32. The Salvador specimens, therefore, represent

what Dr. C. H. Eigenmann, in several of his recent works, has called a "statistical species."

In color the El Salvador specimens differ from *R. guatemalensis* in having no black in the lateral band, and in having a more or less distinct dark spot on the sides, which, however, is much smaller than the one in *occidentalis*.

Fowler (Proc., Ac. Nat. Sci., Phila., LXXV, 1923 (1924), p. 25) recently described *Ræboides bouchellei* from Great Falls, Pis Pis River, of the Atlantic slope of Nicaragua. According to the description, this species would appear to be close to the present one. It appears to differ as follows, however: (1) In the shorter maxillary, which is described as reaching only to the eye, while in the Salvador fish it reaches well beyond this point. (2) The preorbital, in comparison with the maxillary, is broader, being described as equal in width to the maxillary. In the specimens at hand it is always notably narrower. (3) Fowler counts 52 rays in the anal fin of his type. The largest number found in 25 specimens from El Salvador is 50. It is possible, therefore, that at least the average number for Nicaraguan specimens is higher. (4) The pectorals in *R. bouchellei* are described as reaching the anal and to be contained 1.66 in head. In the specimens at hand they do not reach the origin of the anal, yet they are contained only 1.3 to 1.45 in head. (5) The dark spot on the side situated just above the lateral line is described for *R. bouchellei* as being "midway in the predorsal length." In the El Salvador specimens it is only about an eye's diameter in advance of origin of dorsal. (6) The bright silvery lateral band, very evident in all alcoholic specimens from El Salvador, is not mentioned for *R. bouchellei*.

The specimens from El Salvador were collected in lakes Guija, Metapan, and in the Rio Sucio at Sitio del Niño, and in the Rio Lempa at Suchitoto.

Order NEMATOGNATHI

Family II. ARIIDÆ

The Sea Catfishes

Body elongate; head broad, depressed; nostrils close together, neither with a barbel, the posterior with a valve; palatine teeth present; skin naked; dorsal fin present, short, situated above or in front of ventrals; adipose fin present; caudal fin lunate or forked.

KEY TO THE GENERA

- a. Teeth all pointed; present on the jaws, vomer, and palatines.....*Galeichthys*, p. 248.
 aa. Teeth wanting on the vomer; those on the palatines broad and blunt.....*Arius*, p. 250.

3. Genus GALEICHTHYS Cuvier and Valenciennes

Galeichthys Cuvier and Valenciennes, Hist. Nat. Poiss., XV, 1840, 28, (type *Galeichthys feliceps* Cuvier and Valenciennes).

This genus may be recognized by the presence of pointed teeth on the jaws, vomer, and palatines. The palatine teeth are in small or moderate patches and do not have a backward extension. A single species belonging to this saltwater genus is present in most fresh waters of El Salvador.

BULL. U. S. B. F., 1925. (Doc. 985.)

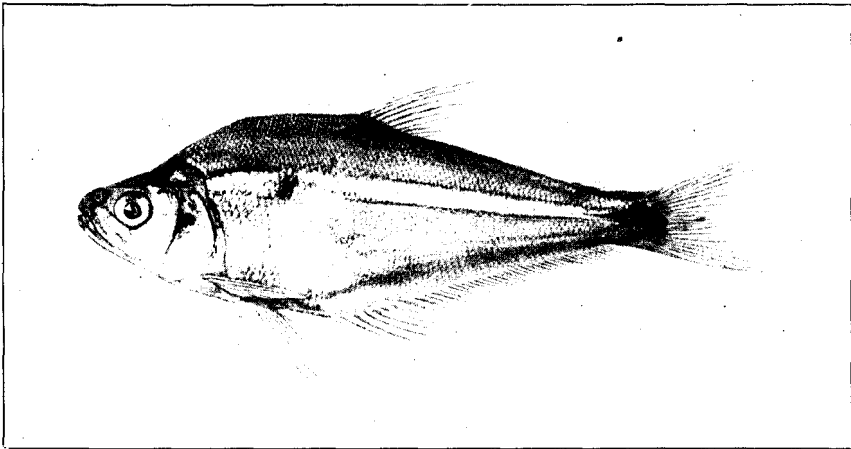


FIG. 9.—*Rochoides salvadoris* sp. nov. From the type. Length, 91 millimeters

BULL. U. S. B. F., 1925. (Doc. 985.)

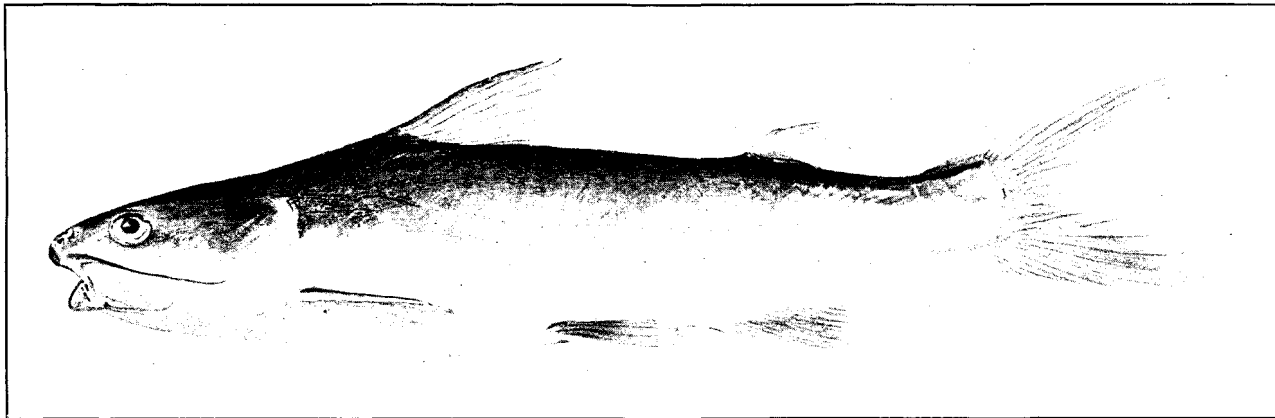


FIG. 10.—*Arius taylori* sp. nov. From the type. Length, 360 millimeters

3. *Galeichthys guatemalensis* (Günther)

BAGRE

Arius guatemalensis Günther, Cat. Fish. Brit. Mus., V, 1864, 145 (Guatemala).

Tachisurus guatemalensis Eigenmann and Eigenmann, Proc., Cal. Ac. Sci., 2 ser., I, 1888, 43, and Occ. Pap., Cal. Ac. Sci., 1890, 81.

Galeichthys guatemalensis Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1898, 2778; Regan, Biol. Cent. Amer., Pisces, 1907, 123.

Head 3.3 to 4.1; depth 4.3 to 6.2; D. I, 7; A. 17 to 19.

Body about as broad as deep at origin of dorsal, moderately compressed posteriorly; caudal peduncle rather long, its depth 3.65 to 4.8 in head; head broad, depressed, flat above; snout very broad, its length 2.75 to 3.7 in head; eye 4.5 to 8; interorbital 1.8 to 2.3; mouth very broad; upper jaw strongly projecting; teeth pointed, the band in upper jaw continuous, the one in lower jaw separated at symphysis, extending laterally well past the angle of mouth and ending in a sharp point; vomerine patches well separated from each other and from the larger palatine patch by a line and slight constriction; maxillary barbel scarcely reaching margin of opercle in adult, past base of pectoral in small specimens (150 millimeters and less in length); gill rakers, 11; distance from snout to dorsal 2.4 to 3 in length; upper surface of head granular in adult, almost smooth in young, occipital process a little longer than broad; fontanel scarcely produced in a groove, appearing as an elongate pit slightly behind a straight line drawn between the posterior margin of the eyes; dorsal fin small, its origin usually about equidistant from tip of snout and origin of adipose, the spine about three-fourths the length of the longest rays, 1.7 to 2.1 in head; adipose fin small, its base 3.1 to 4 in head; caudal fin deeply forked, the upper lobe the longer, pointed; anal fin moderate, its origin under or a little posterior to that of the adipose, its base 1.75 to 2.8 in head; ventral fins shorter than pectoral, thickened, and somewhat longer in the female than in the male, usually inserted a little nearer end of anal base than base of pectoral spine; pectoral spine with barbs on the inner edge, 1.6 to 1.8 in head.

Color, bluish dusky above; sides silvery; pale underneath; vertical fins all dusky, the anal sometimes partly pale; paired fins black on inner sides.

Thirteen specimens, ranging from 88 to 395 millimeters in length, were preserved. The largest individual taken measured 560 millimeters in length, which, according to local fishermen, is about the maximum size attained. Measurements and proportions were obtained from this fish and are included in the description. This fish, which is known as "bagre" throughout the Republic, although belonging to a salt-water genus of catfishes, appears to have become fresh water in its habits, at least in El Salvador, where it is one of the important commercial species caught in the rivers and in some of the lakes. It was not taken in any of the lakes having no outlet (unless the statement that Lake Metapan has an underground connection with Lake Guija should prove to be erroneous), and consequently it does not appear to have become definitely landlocked, the distribution apparently being such that it can retreat to the sea at will. Falls of considerable size are present in the Rio San Miguel, which receives the water from Lake Olomega and carries it to the sea, and no other marine species were seen in the lake nor in that river above the falls. It may be, however, that this catfish is able to ascend the falls and that it reaches

the lake from the sea. The species is said to be nocturnal in its habits, hiding among rocks or elsewhere during the day and coming out at night to feed. It is more abundant in Lake Olomega than in any other locality where collections were made. It does not appear to be esteemed there as a food fish, however, for the native fishermen did not care to save the fish not desired for specimens. Large numbers, however, are sun-dried and shipped. Several bundles, weighing 100 pounds or more, inclosed in nets, were seen at the local railway station.

Three large females taken in the Rio Lempa at Suchitoto on February 5 were examined and found to contain eggs provided with large, red, blood vessels and measuring about 10 millimeters in diameter. The eggs were still attached to the ovary by prominent stalks, and since it is known that marine catfishes produce very large eggs it is improbable that the spawning period was immediately at hand, although it might be expected to occur within a month or so. Two large specimens examined had fed on crabs and crawfish, while two smaller ones had eaten fish, snails, insects, and insect larvæ.

This species ranges from Mazatlan, Mexico, to Panama. The specimens at hand were taken in Lake Guija, Lake Metapan, Rio Lempa at Suchitoto and San Marcos, and in Lake Olomega.

4. Genus *ARIUS* Cuvier and Valenciennes

Arius Cuvier and Valenciennes, Hist. Nat. Poiss., XV, 1840, 53, (type *Pimelodus artus* Hamilton).

This genus of catfishes is characterized by the absence of teeth on the vomer and by the broad blunt teeth on the palatines, which are in small or moderate-sized patches and without backward projections. A single apparently undescribed species of this salt-water genus was taken in strictly fresh water. It is therefore included here with the fresh-water species.

4. *Arius taylori* sp. nov.

BAGRE

Type No. 87224, U.S.N.M.; length 360 mm.; Rio Lempa, San Marcos.

Head 3.8; depth 4.6; D. I, 7; A. 23.

Body moderately elongate, somewhat deeper than broad at origin of dorsal, posteriorly compressed; caudal peduncle rather slender, its depth 3.25 in head; head not very broad, flat above; snout moderate, 3.25 in head; eye large, lateral, 5.5; interorbital 2.25; mouth not excessively broad, its width scarcely equal to interorbital space; teeth in the upper jaw villiform, divided by a narrow line, not pointed posteriorly and not reaching angle of mouth, each half about twice as long as broad; teeth on lower jaw all pointed except the posterior one at middle of jaw, these blunt like the palatine teeth, the band well separated at symphysis, tapering and pointed posteriorly, and extending well past angle of mouth, its greatest width less than one-third the length of each patch; vomerine teeth wanting; palatine teeth blunt, in small patches, placed far apart, the distance between them about equal to half the length of the band on upper jaw; maxillary barbel reaching to margin of opercle; gill rakers 11; distance from snout to dorsal 2.7 in length; top

of head only feebly granular; occipital process scarcely as broad as long, scarcely keeled; an elongate pit on snout and a fontanel groove reaching from posterior part of interorbital nearly to occipital process; dorsal fin rather small, its origin about equidistant from tip of snout and origin of adipose, the spine 1.6 in head; adipose fin rather large, its base 3.1 in head; caudal fin long, deeply forked, both lobes pointed, the posterior margin definitely V shaped, the upper lobe the longest, a little longer than head; anal fin moderate, its origin about an eye's diameter in advance of the adipose, the length of its base 1.55 in head; ventral fins rather short, failing to reach the origin of anal, inserted about equidistant from base of pectoral spine and middle of anal base; pectoral spine short, 1.6 in head.

Color in alcohol dark brownish above, sides silvery, pale underneath, the fins all slightly dusky.

A single specimen, 360 millimeters long, was preserved. The species was not distinguished from *G. guatemalensis* in the field, therefore others may have been captured but not preserved.

The species appears to be related to *A. furthii*, known from Panama. The El Salvador specimen, however, has a much longer and more deeply forked caudal fin, the lobes being pointed and equal to or longer than the head, and the outer margin is definitely V shaped. In *A. furthii* the lobes of the caudal are not pointed and are notably shorter than the head, and the outer margin of the fin is broadly V shaped. The eye in the El Salvador fish is larger, the fins are longer, the palatine patches of teeth are much smaller and farther apart, and the band of teeth on the lower jaw is narrower.

The specimen in hand was taken in strictly fresh water at San Marcos, where the bridge of the International Railroad of Central America crosses the Rio Lempa, about 30 kilometers from the sea. The species is named for Frederic W. Taylor, director general of agriculture for the Government of El Salvador, under whose immediate direction the investigation was made.

Family III. PIMELODIDÆ

Body elongate, compressed posteriorly; head broad; mouth terminal or slightly inferior; barbels, 6; nostrils remote from each other, the posterior one without a barbel; teeth wanting on palatines; adipose fin present, usually long.

5. Genus RHAMDIA Bleeker

Pteronotus Swainson, Nat. Hist. Class. Fish., II, 1839, 309 (type *Heterobranchus sextentaculatus* Agassiz).

Rhamdia Bleeker, Verhand. Naturk. Vereen. Nederl. Indie, IV, 1859, 197 (sp.); Bleeker, Nederl. Tijdschr. Dierk., I, 1863, 101 (type *Pimelodus quelen* Quoy and Gaimard).

Pimelenuotus Gill, Ann. Lyc. Nat. Hist., N. Y., VI, 1858, 391 (type *Pimelenuotus wilsoni* Gill).

Body elongate; jaws with villiform teeth; no teeth on vomer or palatines; nostrils remote from each other; barbels, 6; no nasal barbel; occipital process small or wanting, never reaching dorsal plate; eye with free orbital margin; dorsal fin with 1 slender spine and 5 to 8 branched rays; adipose fin long, adnate to the back. A single species of this genus was taken in El Salvador.

5. *Rhamdia guatemalensis* (Günther)

FILIN

Pimelodus guatemalensis Günther, Cat. Fish. Brit. Mus., V, 1864, 122 ("Huamuchal," Pacific slope of Guatemala).

Rhamdia wagneri Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 152; Regan, Biol. Cent. Amer, Pisces, 1907, 132.

Head 3.65 to 4.25; depth 4.4 to 6.25; D. I, 6; A. 11 to 13.

Body elongate, compressed posteriorly; caudal peduncle strongly compressed, its depth 2 to 2.45 in head; head depressed, its depth about three-fourths its width; snout broad, its length 2.55 to 2.8 in head; eye 5.3 to 6.2; interorbital 2.95 to 3.6; mouth broad, almost wholly transverse, its width equal to length of snout and half of eye; teeth small, in rather broad villiform bands in each jaw; maxillary barbel variable in length, apparently always reaching past the origin of the adipose and occasionally nearly to the end of this fin; dorsal fin rather small, round, the spine about three-fourths the length of the longest rays, 2.4 to 3.3 in head, origin of fin equidistant from tip of snout and vertical from origin of anal or a little nearer the latter; adipose fin long, its base 2.4 to 2.7 in body; caudal fin deeply forked, the median rays scarcely half the length of the longest; anal fin with convex margin, its origin a little anterior to middle of base of adipose; ventral fins short, inserted at vertical from end of dorsal base; pectorals small, the spine strong, without definite barbs on the inner margin, its length 2.2 to 3 in head.

Color in life plain dark green, usually with a dark lateral band; dorsal, adipose, caudal, and anal dusky; the other fins paler.

This fish is represented by 9 specimens ranging from 90 to 185 millimeters in length. The species does not appear to be abundant enough anywhere to be of much commercial importance. The few individuals that were seen were quite small, none of them exceeding 185 millimeters in length. This catfish inhabits both lakes and streams, and it is said to be nocturnal in its habits, hiding during the day and coming out to feed principally at night. It is taken chiefly with hook and line.

The contents of the stomachs examined consisted of the remains of fish, fragments of insects, and strands of algæ. The ovary of a fish 185 millimeters long, taken in Lake Guija on January 25, was fairly well developed. Its length was 48 millimeters, and it contained several thousand eggs approximately 0.5 millimeters in diameter. It seems probable that this fish would have spawned within about one month.

This catfish is recorded from western Guatemala, and according to Regan it also occurs in southern Mexico and in British Honduras. The El Salvador specimens are from Lake Guija, Rio del Desague, Lake Metapan, Rio Sucio at Sitio del Niño, Rio Lempa at Suchitoto, and Lake Olomega. It was not seen elsewhere.

Order CYPRINODONTES

Family IV. CYPRINODONTIDÆ

The Killifishes

Body elongate, compressed posteriorly; head more or less flattened above; mouth small; premaxillaries strongly protractile; teeth present on both jaws; lateral line wanting; dorsal fin single; anal fin not modified in male; species oviparous.

6. Genus PROFUNDULUS Hubbs

Profundulus Hubbs, Misc. Pub., Mus. Zoöl., Univ. Mich., No. 13, 1924, 12 (type *Fundulus punctatus* Günther).

Body rather robust; head somewhat depressed; dorsal and anal fins relatively long and low and inserted far posteriorly; anal fin lower in the adult male than in the adult female; the oviduct not produced and not extending on the first ray of the anal fin, as in *Fundulus*. A single species was taken in El Salvador.

6. *Profundulus punctatus* (Günther)

CHIMBOLA

Fundulus punctatus Günther, Cat. Fish., Brit. Mus., VI, 1866, 320, and Trans., Zoöl. Soc., London, VI, 1868, 482, Pl. LXXXIV, fig. 5 (Chiapas, Guatemala); Regan, Biol. Cent. Amer., Pisces, 1907, 78.

Fundulus guatemalensis Günther, Cat. Fish., Brit. Mus., VI, 1866, 321, and Proc., Zoöl. Soc., London, VI, 1868, 482, Pl. LXXXIV, figs. 3 and 4 (Lakes Duenas and Amatlan, and Rio Guacalate).

Head 3 to 3.7; depth 2.9 to 3.8; D. 12 or 13; A. 13 or 14; scales 31 to 33.

Body rather robust, compressed; caudal peduncle strongly compressed, its depth 1.75 to 2.15 in head; head somewhat depressed; snout broad, 3 to 3.5 in head; interorbital 2 to 2.4; mouth transverse; the lower jaw slightly projecting; teeth in bands, pointed, the outer ones enlarged; scales firm, cycloid, 10 or 11 rows between the dorsal and anal, many of the scales along the upper part of sides with pits; dorsal small, its origin usually about equidistant from the posterior margin of the eye and the end of the caudal; caudal fin broadly rounded; anal fin somewhat longer than the dorsal, its origin a little behind that of the dorsal; ventral fins small, about as long as snout and half the eye, reaching nearly or quite to the vent; pectoral fins broad, 1.45 to 1.75 in head.

Color brownish green above, pale underneath; a dark blotch above and behind base of pectoral; most specimens with a dark lateral band posteriorly, this band wanting in some specimens and broken up into spots in others; occasionally with a series of pale spots above and below the lateral band; a dark vertebral band; the scales on upper part of sides and on base of caudal frequently with dark spots; fins mostly yellowish in life; the dorsal and caudal dusky in spirits, the former with indications of a dark bar at base; the other fins usually all pale, the anal occasionally slightly dusky and with a white margin.

This species is represented by 26 specimens, ranging from 25 to 77 millimeters in length. It was taken only in Rio Molino, a rather small tributary to the Rio de Paz. This stream was visited late on the evening of January 27, and only a small stretch, in the vicinity of Ahuachapan, was seen. That portion was too rocky to

permit of the operation of a drag net. Three charges of dynamite produced only the species here described and, according to a native who was questioned, the stream in that vicinity contains no other fish.

One of the large females examined had large roe, the ovary containing 30 eggs measuring 2.25 millimeters in diameter and an equal number approximately half that size. The food in the 3 stomachs that were examined consisted mainly of unicellular algæ, but fragments of worms and winged insects also were present.

This fish is known from the Pacific slope of southern Mexico and Guatemala, and it is now for the first time recorded from El Salvador. According to Günther (1866) and subsequent authors this species also occurs in "western Ecuador," but this quite evidently is a mistake, for Meek (Pub., *Field Mus. Nat. Hist., Zoöl. Ser., X*, 1914) did not get it in Costa Rica; Meek and Hildebrand (Pub., *Field Mus. Nat. Hist., Zoöl. Ser., X*, 1916) did not take it in Panama; and Eigenmann (Memoir., *Carnegie Mus., IX*, 1922) does not record it in "The Fishes of Western South America." The specimens from El Salvador were taken in the Rio Molino, tributary to the Rio de Paz, near Ahuachapan. It was not found in the basins of the Rio Lempa and the Rio San Miguel, indicating that the species may reach the southermost limits of its distribution in the basin of the Rio de Paz.

Family V. PÆCILIIDÆ

The Top Minnows

Body elongate, compressed posteriorly; head more or less depressed above; anal fin in the male modified, the anterior rays becoming more or less united and usually produced, forming an organ for the transmission of the sperms to the genital opening of the female; species small; viviparous.

Many genera belonging to this family have been described by Regan, Eigenmann, Henn, and recently by Hubbs, based mainly upon the minute structure of the modified anal fins of the males. The number of genera that have been proposed, particularly in consideration of Hubbs's recent additions (*Misc. Pub., Mus. Zoöl., Univ. Mich., No. 13*, 1924, pp. 5-11), is rapidly approaching the total number of species recognized. Geiser (*Amer. Midl. Nat., VIII*, 1923, 175-188, with 18 figs.), in his studies of the minute structure of the modified anal fins ("Gonopod") of the *Gambusia* of the United States, which, by most recent authors, have been considered all identical as to species, has shown that three and possibly four divisions may be made. If the microscopic structure of the intromittent organ is used as a generic character, each species, as described and figured by Geiser (it would appear from the work of Hubbs, at least), should also constitute a genus. The use of the structure of this organ alone, as a generic character, obviously results in too many divisions, and the genus loses its value as a convenience in classification.

The author is of the opinion that the intromittent organs could be grouped as to general type or gross structure and thus serve a useful purpose, in combination with other characters, in defining genera; as, for example, in *Mollienesia* the modified portion of the fin is not greatly produced and it has a membranous covering (sometimes referred to as a hood), which covers or shields the anterior part of the organ,

but which is distally free. In *Gambusia*, on the other hand, the intromittent organ is notably produced and the membranous hood is wanting. The characters of the intromittent organ in these genera are supported by the comparatively long, convoluted intestine in *Mollienesia*, while *Gambusia* has a short intestine, which is not convoluted. The minute structure of the intromittent organ would then become of specific value only, and it is believed that less confusion would result than by retaining and adding to the already too numerous very closely related "genera."

Some of the species of this family—as, for example, the *Gambusia* of the United States—have been found to be of great value as eradicators of mosquito larvæ. Limited observations made in the field, as well as the examination of stomach contents, indicate that all the species of this family occurring in El Salvador are of value as destroyers of mosquitoes.

KEY TO THE GENERA

- a. Intestinal canal longer than the total length of the body, usually more or less convoluted; dorsal fin in adult male very high; the intromittent organ not much produced, shorter than head, anteriorly shielded by a short membranous hood..... *Mollienesia*, p. 255.
 aa. Intestinal canal not longer than the length of body and not convoluted; dorsal fin in males not much, if any higher than in females; the intromittent organ greatly produced, longer than head, and without a membranous hood..... *Priapichthys*, p. 258.

7. Genus MOLLIIENESIA Le Sueur

Mollienesia Le Sueur, Jour., Ac. Nat. Sci., Phila., II, 1821, 3 (type *Mollienesia latipinna* Le Sueur).

Body elongate, rather robust; head more or less depressed; mouth transverse; teeth in the jaws in bands, the outer ones movable; dorsal fin elongate in the adult male, much higher than in the female; intromittent organ short, not as long as head, anteriorly shielded by a membranous hood; intestinal canal convoluted and longer than the total length of the fish. A single variable and rather widely distributed species was taken in the waters of El Salvador.

7. *Mollienesia sphenops* (Cuvier and Valenciennes)

CHIMBOLA

Pecilia sphenops Cuvier and Valenciennes, Hist. Nat. Poiss., XVIII, 1846, 130, Pl. DXXVI, fig. 2 (Vera Cruz, Mexico); Regan, Biol. Cent. Amer., Pisces, 1907, 102, Pl. XIII, figs. 1-7.

Xiphophorus gilli Kner and Steindachner, Abhandl. k. Bayer, Ak. Wiss. München, X, 1864, 25, Pl. IV, fig. 1 (Rio Chagres, Panama).

Platyptecilus mentalis Gill, Proc., Ac. Nat. Sci., Phila., 1876, 335 (Panama).

Pecilia boucardi Steindachner, Sitzb. k. Ak. Wiss., Wien, LXXVI, 1878, 386, Pl. III, fig. 263 (Colon, Panama).

Pecilia salvatoris Regan, Ann. and Mag. Nat. Hist., 7 ser., XIX, 1907, 65, and Biol. Cent. Amer., Pisces, 1907, 104, Pl. XIV, figs. 2 and 3 ("Salvador").

Platyptecilus tropicus Meek, Pub., Field Col. Mus., Zool. Ser., VII, 1907, 148 (Turrialba, Costa Rica).

Pecilia tenuis Meek, Pub., Field Col. Mus., Zool. Ser., VII, 1907, 147 (Tiribi, San Jose and Rio Maria Aguilar, Costa Rica).

Mollienesia sphenops tropica Meek, Pub., Field Mus. Nat. Hist., Zool. Ser., X, 1914, 116 (Costa Rica).

Head 3 to 4.25; depth 2.75 to 3.65; D. 9 to 11; A. 8 to 10; scales 25 to 29.

Body rather robust, variable, compressed; caudal peduncle strongly compressed, its depth 1.1 to 1.85 in head; head depressed, flat above, broader than deep over middle of eyes; snout broad, its length 2.8 to 3.6 in head; eye 3 to 4.4; interorbital 1.65 to 2.35; mouth transverse, directed slightly upward; lower jaw a little the longer; teeth in bands, the outer ones movable, enlarged, slightly broadened, curved

inward, and well separated from the inner, minute, villiform ones; scales cycloid, enlarged ones present on head and snout, 11 or 12 in median series from occiput to dorsal, 8 complete longitudinal rows between dorsal and anal; dorsal fin with convex margin, occasionally nearly straight, the origin in females and young a little in advance of the anal and a little nearer the base of caudal than posterior margin of eye; dorsal much higher in the adult male and situated slightly farther forward, quite as near the eye as the base of caudal; caudal fin strongly convex to nearly straight; anal fin small, its origin in female slightly nearer base of caudal than eye, farther forward in adult males, usually an eye's diameter nearer tip of snout than base of caudal, and modified into a copulatory organ, but not greatly produced, always shorter than head, the produced portion anteriorly with a sort of membranous hood, which is free distally, the third, fourth, and fifth rays produced, 2 branches each of the anterior and median produced rays reaching the end of the organ, the branches of the anterior ray with small antrorse hooks at tip, the posterior branch of the median produced ray with 8 or 9 prominent spurlike hooks below the apex of the organ, the posterior produced ray not quite reaching the apex, both branches coterminal, each bearing a small posterior hook; ventral fins in the female moderate, inserted about equidistant from margin of opercle and end of anal base, reaching vent in large examples, to origin of anal in small ones, the third ray somewhat produced in the male and reaching beyond the base of fin; pectoral fins moderate, 1 to 1.8 in head.

Color variable, fresh females 54 millimeters long, dark olivaceous above; lower part of sides silvery with bluish reflections; pale underneath; scales on sides with indications of rusty spots; dorsal red with black spots near base; caudal greenish with faint elongate dark spots; anal and ventrals plain; pectorals slightly greenish. Color of male, 37 millimeters long, identical except for more red and larger and more pronounced black spots on dorsal fin. Some specimens plain without spots; others with prominent dark spots along the rows of scales on median part of sides; still others with pronounced brick-red spots (pale in spirits) along the rows of scales on sides; an occasional specimen with irregular dark blotches on sides; many specimens with plain to faint pale crossbars; a dark caudal spot frequently present; dorsal fin usually spotted with black, the spots varying in number, size, and intensity; caudal fin frequently plain but oftener with elongate dark spots.

Many specimens of this species, ranging from 10 to 120 millimeters in length, were preserved. It is the most abundant and the most universally distributed of all the fishes of the Republic. It was taken in every locality except in the Rio Molino, in which collections were made in fresh water. It was found in lakes, swamps, and streams, and it does not shun currents to the extent that most top minnows do, but it evidently finds the environment of the quieter waters more congenial, as it is found there in greatest abundance. This fish occurs mainly in shallow water, but it is also found along the shores in water several feet deep. It is abundant among vegetation and frequently, also, along rocky shores. This species was found to be especially abundant in Lakes Chanmico, Chalchuapa, and Coatepeque. In Lake Guija it was common along the shores but less numerous than its smaller, spotted relative, *Priapichthys letonai*. In Lake Olomega *M. sphenops* was less abundant than in any other lake visited, notwithstanding that

BULL. U. S. B. F., 1925. (Doc. 985.)

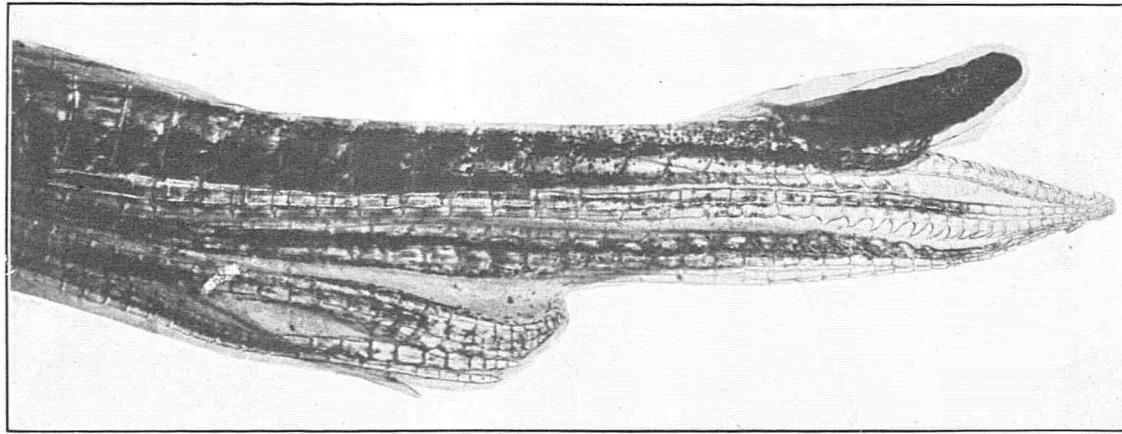


Fig. 11.—Distal part of the anal fin of the male *Mollienesia sphenops*, greatly magnified

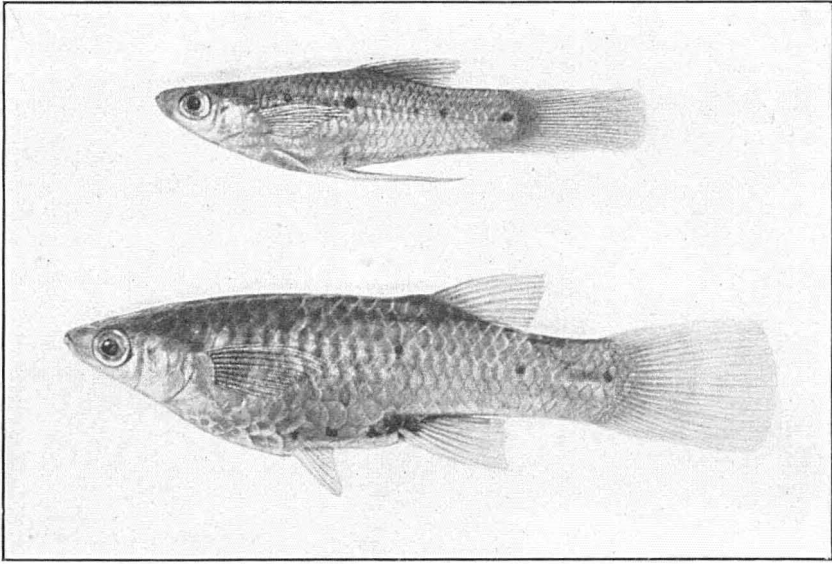


FIG. 12.—*Priapichthys letonai* sp. nov. Upper figure is the male. From the type. Length, 42 millimeters. Lower figure is the female. From a specimen 58 millimeters long

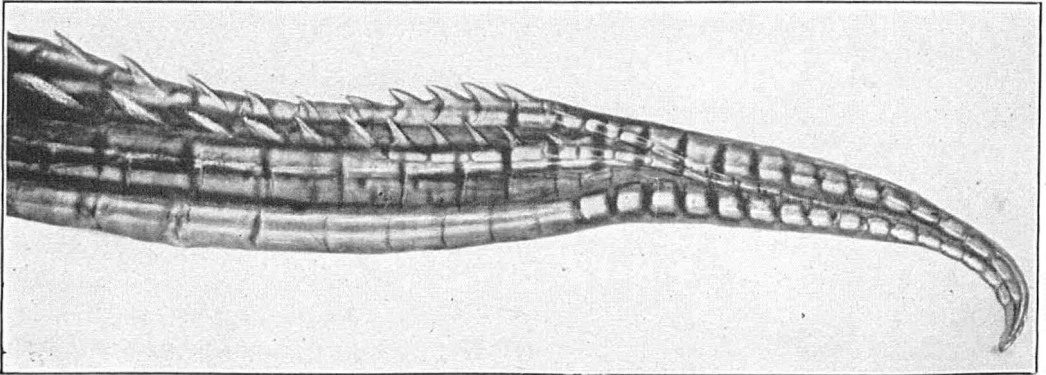


FIG. 13.—Distal part of the anal fin of the male *Priapichthys letonai* sp. nov., greatly magnified

the conditions for its development appeared to be ideal. Water birds, however, are extremely abundant on this lake and the fish probably are unable to protect themselves against these enemies.

The size attained by this species varies greatly in the different waters. The largest fish seen, ranging upward to 120 millimeters in length, were taken in small ponds at El Angel. Many large individuals were also taken in Lakes Guija, Coatepeque, and Ilopango. In Lakes Chanmico and Zapotitan, on the other hand, the usual size is rather small, the fishes ranging upward to only 55 millimeters in length. In this species, as in most top minnows, the males are smaller than the females, and sexual maturity is reached at a smaller size. Males 35 millimeters long appear to be fully mature, while the smallest mature female, among a limited number examined, was 60 millimeters. The males, as usual among the fishes of this group, are greatly in the minority. A lot of 245 fish gathered up at random after a discharge of dynamite on Lake Chanmico contained 80 males.

A comparatively small number of the fish collected appear to be gravid, indicating that the period (January and February) during which the collections were made was not the principal spawning season. Only a single stage of development of the egg or embryo was found in any one ovary, indicating that broods of young probably are not born in such rapid succession as in some of the other species of top minnows. The largest number of embryos found was 82, which were taken from the ovary of a fish 90 millimeters long.

The intestinal canal is about one-third longer than the total length of the fish. The contents of the stomachs of 24 specimens examined consisted mainly of disorganized masses, containing a relatively large amount of sand and some plant fragments, fragments of insects, minute ova (probably insect eggs), and in a few instances small quantities of Entomostraca. The species is used for mosquito control in Nicaragua by Sanitary Engineer F. E. Hulse, of the International Health Board, apparently with success, but it is believed from the field observations made, and from the examination of stomach contents, that its relatives, *Priapichthys letonai* and *P. fosteri*, are more efficient agents for the control of the malaria-transmitting mosquitoes, Anopheles.

This fish, as here understood, is a widely distributed, variable species, several nominal species having been defined. Much variation exists with respect to the depth of the body, shape of the dorsal and caudal fins, and especially with respect to color. These characters, however, appear to intergrade. Careful measurements and scale and fin counts were made of 40 specimens, selected to include all the extremes of variations. The minute structure of the intromittent organ, which is regarded as a very helpful character in determining species, was critically studied in all the extreme color phases represented among the El Salvador specimens, and this organ also was compared with others taken from specimens from Nicaragua and Panama and found to be identical. The range, as here understood, includes both slopes from southern Mexico to northern Colombia. This is one of a very few species of fishes that have previously been recorded from the fresh waters of El Salvador. Our specimens were collected in the following localities: Lake Guija, Rio del Desague, Lake Metapan, Lake Chalchuapa, Rio Pampe near Chalchuapa, Lake Ahuachapan, Lake Coatepeque, Lake Chanmica, Rio Sucio near Sitio del

Niño, Lake Zapotitan, ponds at El Angel, Lake Ilopango, small streams near San Salvador, Rio Lempa at Suchitoto and San Marcos, Rio San Miguel at San Miguel, and Lake Olomega.

8. Genus PRIAPICHTHYS Regan

Priapichthys Regan, Proc., Zool. Soc. London, 1913, 901 (type *Gambusia annectens* Regan).

Body elongate, head depressed above; mouth transverse; teeth in the jaws in narrow bands, the outer ones scarcely movable; dorsal fin in the adult male scarcely higher than in the female; intromittent organ greatly produced, longer than the head; alimentary canal not exceeding the length of the body and without convolutions. Two species, both apparently new, appear to belong to this genus.

KEY TO THE SPECIES

- a. Dorsal fin in the female usually equidistant from the tip of snout and end of caudal, or slightly nearer the former; two branches of the median produced ray of the intromittent organ bearing spur-like hooks; median line of sides with a row of round black spots scarcely as large as the pupil, varying in number from 3 to 10.....*letonai*, sp. nov., p. 258.
- aa. Dorsal fin in the female, usually an eye's diameter nearer the end of caudal than tip of snout; only one branch of the median produced ray of the intromittent organ with spur-like hooks; sides with 6 to 10 dark crossbars.....*fosteri*, sp. nov., p. 260.

8. *Priapichthys letonai* sp. nov.

CHIMBOLA

Type No. 87251, U.S.N.M.; male, length 42 mm., Rio San Miguel, San Miguel. Head 3.1 to 4.3; depth 3.15 to 4.05; D. 8 or 9; A. 9 or 10; scales 28 to 30.

Body moderately compressed anteriorly; caudal peduncle strongly compressed, its depth 1.35 to 2.35 in head; profile nearly straight from snout to nape, slightly convex from nape to dorsal; head rather broad, flat above; snout short, broad, 2.75 to 4.65 in head; eye 2.5 to 4.25; interorbital 2.2 to 3.28; mouth small, the cleft transverse; teeth loosely attached, the outer series slightly broadened, curved inward, and well separated from the very minute inner teeth; scales cycloid, present on head and snout and on base of caudal, each scale with 11 to 20 radii, average of 30 scales taken from 10 specimens ranging in length from 24 to 63 millimeters, 13.7; origin of dorsal in female a little in advance of middle of anal base, equidistant from tip of snout and end of caudal, or a little nearer the former; dorsal placed further forward in the adult male, about half the length of head, nearer tip of snout than end of caudal; caudal fin broad, gently convex; anal fin in females and young similar to dorsal, its origin a little nearer base of caudal than posterior margin of eye; anal fin in adult males inserted far in advance of dorsal, greatly produced, much longer than the head, reaching nearly to base of caudal in sexually mature but small males, proportionately shorter in larger specimens, the third, fourth, and fifth rays all of about equal length, the branches greatly crowded distally and forming a compound curve, the apex being directed forward, two of the branches of the median produced ray bearing about 12 spur-like hooks on their posterior margins; ventrals reaching vent in small females, proportionately shorter in large

specimens, reaching past origin of anal in males; pectoral fins moderate, 1 to 1.85 in head; vertebræ about 15 + 17; alimentary canal about as long as the body; peritoneum black.

Color of the sexes similar; olivaceous above; lower part of sides silvery; median line of sides with a row of round black spots scarcely as large as pupil, varying in number from 3 to 10, present even in the mature embryo (wanting only on a single large female); a faint dark vertebral band; a sharp dark median line from anal to caudal; base of anal sometimes surrounded by black in large females; fins all unspotted; dorsal, caudal, and anal olivaceous; other fins plain translucent.

Many specimens of this species, ranging in length from 10 to 85 millimeters, were preserved. This fish inhabits both lakes and streams, but it was not taken in the tributaries of the Rio de Paz nor in Lakes Chalchuapa, Ahuachapan, Coatepeque, Chanmico, and Ilopango. Neither was it obtained in the Rio Lempa at San Marcos, notwithstanding that the species appeared to be common in that stream about 200 kilometers further upstream at the village of Suchitoto.

This fish appears to grow much larger in some localities than in others. In Lake Zapotitan, for example, the largest male and female obtained were, respectively, 20 and 27 millimeters in length, yet fully mature, as shown by the completely developed intromittent organ of the male and by the presence of large embryos in the ovaries of the female. Specimens of this size from some of the other localities at which collections were made are clearly sexually immature. The largest fish seen, ranging a little more than 80 millimeters in length, were taken in the Rio San Miguel at San Miguel. The males are much smaller than the female and they occurred rather sparingly in the catches made.

Many of the specimens in the collection (taken during January and February) are in spawning condition, the ovary usually containing large eggs in two distinct stages of development, in addition to smaller ova. An ovary taken from a specimen 67 millimeters long, for example, contained 26 well-developed embryos and 30 apparently fully mature eggs, measuring about 1.5 millimeters in diameter, and minute ova. The young fish when born is from 8 to 10 millimeters long, and well developed. The body is covered with dark punctulations, which usually are concentrated in about three places on the median line of the sides, later forming the dark lateral spots which are characteristic of the species.

Stomachs examined contained insects, fragments of fresh-water sponge, algæ, leaf fragments, small ova (probably insect eggs), and inorganic matter consisting largely of sand. Field observations would indicate that the species probably is of considerable value as an eradicator of mosquito larvæ.

The specimens were obtained at the following localities: Lake Guija, Rio del Desague at Lake Guija, Lake Metapan, Lake Zapotitan, Rio Sucio at Sitio del Niño, Rio Acelhuate at San Salvador, Rio Lempa at Suchitoto, Rio San Miguel at San Miguel, and Lake Olomega.

9. *Priapichthys fosteri* sp. nov.

CHIMBOLA

Type No. 87263, U.S.N.M.; male, length 38 mm., Rio Lempa, San Marcos.

Head, 2.95 to 5.2; depth, 3.25 to 4.8; D., 8; A., 9 or 10; scales, 27 to 30.

Body moderately compressed anteriorly; caudal peduncle deep and strongly compressed, 1.4 to 1.8 in head; profile straight from snout to nape, gently convex from nape to dorsal; head broad, flat above; snout short, broad, 3.2 to 4.25 in head; eye, 2.7 to 3.7; interorbital, 1.85 to 2.9; mouth small, the cleft transverse; teeth loosely attached, the outer series slightly broadened, curved inward, and well separated from the very minute inner teeth; scales cycloid, present on head and snout and on base of caudal, each scale with 6 to 11 radii; average of 30 scales taken from 10 specimens, ranging from 23 to 61 millimeters in length, 8.86+; origin of dorsal in female a little in advance of middle of anal, occasionally equidistant from the tip of snout and the end of caudal, but more usually an eye's diameter nearer the latter; dorsal placed further forward in adult male, about an eye's diameter nearer tip of snout than end of caudal; caudal fin broadly rounded; anal fin in females and young similar to the dorsal, its origin about equidistant from tip of snout and base of caudal; anal fin in adult males inserted far in advance of dorsal, greatly produced, much longer than head, failing to reach base of caudal by a distance equal to the length of snout and eye, the third, fourth, and fifth rays all of about equal length, the branches greatly crowded distally and forming a compound curve, the apex being directed forward, the posterior branch of the median produced ray bearing about 16 spurlike hooks on its posterior margin; ventral fins reaching origin of anal in young, scarcely to vent in adult females, past the origin of anal in males; pectoral fins moderate, 1 to 1.35 in head; vertebrae 15+17; alimentary canal scarcely as long as body; peritoneum black.

Color of the sexes similar; upper parts greenish; lower parts silvery; sides with from 6 to 10 dark crossbars; a narrow vertebral line; a sharp dark median line from anal to caudal; ventral fins yellowish; other fins all slightly olivaceous.

This species is represented by 98 specimens, ranging from 35 to 80 millimeters in length. It was taken only in the Rio Lempa at San Marcos and at Suchitoto in quiet water, and 2 specimens were secured in brackish water in the estuary at El Triunfo. The males in this species, as is usual for the family, are much smaller than the females and fewer in number.

Many of the specimens collected (during January and February) were in spawning condition. Embryos and eggs of several sizes usually were present in one ovary. The ovary from a female 80 millimeters long, for example, contained 44 well-developed embryos, 42 "eyed" eggs, and 44 large, probably mature, eggs. Two other ovaries contained, respectively, 7 large embryos and 20 eggs in the "eyed" stage in addition to smaller ova.

The stomachs examined contained principally fragments of insects and vegetable débris. The species is quite probably of value as an eradicator of mosquito larvæ.

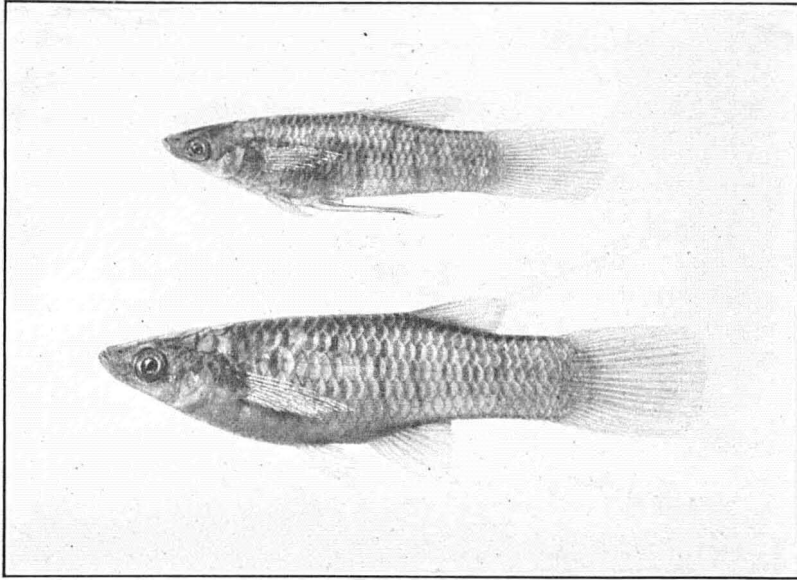


FIG. 14.—*Priapichthys fosteri* sp. nov. Upper figure is the male. From the type. Length, 38 millimeters. Lower figure is the female. From a specimen 50 millimeters long

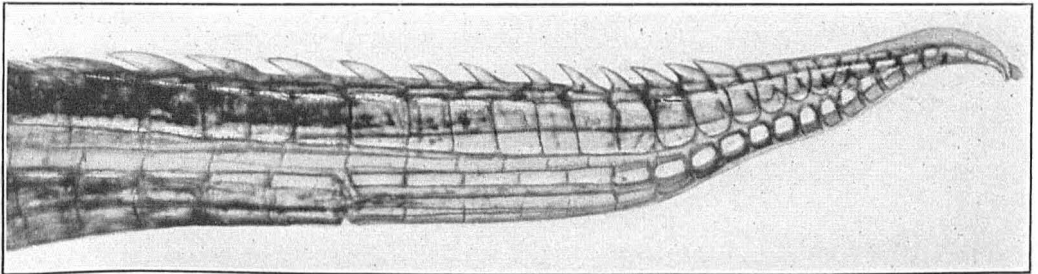


FIG. 15.—Distal part of the anal fin of the male *Priapichthys fosteri* sp. nov., greatly magnified

This fish differs notably in color from the preceding one, but in structure the two are very similar. The dorsal fin, however, appears to be inserted slightly further backward in the female in the present species, usually being an eye's diameter nearer the end of the caudal than the tip of the snout, instead of being equi-distant or nearer the snout. The scales, on an average, possess fewer radii in the present species, as shown by Figure 16, and in the distal part of the intromittent organ of the male, in which only one branch of the produced rays bears spurlike hooks, while in the preceding species two of the branches have hooks. This species also appears to be related to *Priapichthys panamensis*, Meek and Hildebrand (Pub., Field Mus. Nat. Hist., Vol. X, 1916, p. 322), from which it differs in the relative position of the dorsal and anal fins, the shape of the caudal, and in the shape and structure of the produced portion of the anal fin.

The specimens were obtained in the Rio Lempa, at San Marcos and Suchitoto, and in brackish water at El Triunfo.

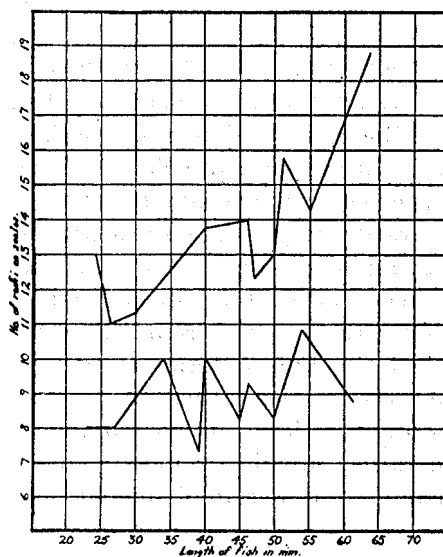


FIG. 16.—Upper figure, *Priapichthys fosteri* sp. nov.; lower figure, *Priapichthys letonai* sp. nov. Each point in the graph is based on the average number of radii on three scales from one specimen. The scales were taken below the dorsal fin—one above, one in, and one below the lateral line.

Family VI. ANABLEPIDÆ

Cuatro-ojos

Body elongate, depressed anteriorly, compressed posteriorly; head broad; supraorbital rims much raised; eye divided into an upper and a lower portion by a dark-colored transverse membrane in the cornea; mouth mostly transverse; premaxillaries protractile; teeth in each jaw in a villiform band; scales small or of moderate size; dorsal and anal fins short; anal fin of the male modified into a thick scaly conical organ with an orifice at its extremity. This family consists of a single genus.

9. Genus ANABLEPS Scopoli

Anableps Scopoli, Introd. Hist. Nat., 1777, 450 (type *Cobitis anableps* Linnæus).

The characters of the genus are included in the family description. The eye in these fish is divided into an upper and a lower half by a dark horizontal partition in the cornea. The upper half of the eye is higher than the rest of the head, is usually exposed above the surface of the water, and evidently is for seeing in the air, while the lower portion is for use in the water. It is from this singular structure and function of the eye that the name "Cuatro-ojo," or four-eye, has originated. A single species is known from Central American waters.

10. *Anableps dovii* Gill

FOUR-EYE; CUATRO-OJO

Anableps dowei Gill, Proc., Ac. Nat. Sci., Phila., 1861¹(1862), 4 (Panama; where it quite certainly does not occur).
Anableps dovii Regan, Biol. Cent. Amer., Pisces, 1907, 108.

Head 3.6 to 4.3; depth 4.4 to 7.5; D. 8 to 10; A. 10, rarely 9; scales 62 to 73.

Body very elongate, notably depressed anteriorly, compressed posteriorly; depth of caudal peduncle 2.2 to 3 in head; head strongly depressed, flat above, its depth between eyes about half its width; snout broad, its length 2.9 to 4 in head; eye rather large, the cornea with a somewhat thickened, black, longitudinal bar in the middle, dividing the eye into an upper and a lower half, its diameter, 3.6 to 5.9 in head; interorbital deeply concave, 3.3 to 5.55 in head; mouth broad, almost wholly transverse; premaxillaries broad, excessively protractile; maxillary rather broad, reaching anterior margin of eye; teeth small, in a broad villiform band in each jaw; scales rather small, enlarged on head; dorsal small, situated posteriorly, its origin at least an eye's diameter behind vertical from end of anal base; caudal fin rather broadly rounded; anal fin similar to the dorsal, its origin about equidistant from margin of opercle and tip of caudal in adult, much further forward in

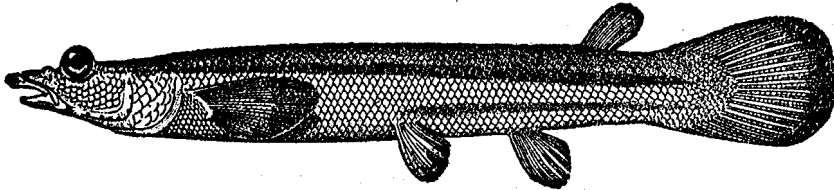


FIG. 17.—*Anableps dovii* Gill

young, modified into an intromittent organ in the male, the anterior rays enveloped in loose scaly skin, extending to the end of the longest rays, where there is a perforation; ventral fins short, reaching to or a little past the vent in the young, failing to reach this point in the adult, pectoral fins moderate, 1.25 to 1.6 in head.

Color of a fresh specimen, 115 millimeters long, dark greenish above; white underneath; sides with a white lateral band about half as wide as eye, bordered above and below by black; back crossed by several indistinct black bars; eye with a median black stripe, the upper half dark, the lower half white; dorsal dark green; caudal somewhat lighter green, with black on distal parts; anal, ventrals, and pectorals light greenish, the pectorals with black on lower half. In larger examples the lateral band is yellow and it is broken up into spots anteriorly.

This species is represented by 36 specimens, ranging from 50 to 235 millimeters in length. It is common in some localities but scarce or wanting in others. It inhabits both lakes and streams. In the streams it is partial to the quieter places. This species is especially common in Lake Guija and in the outlet, the Rio del Desague. It is also very common in the Rio Lempa in the vicinity of Suchitoto. A single fish was seen and captured in salt water at the wharf at Cutuco. The fish swim at the surface with the upper half—that is, the portion above a dark longitudinal band of the modified superior eye—above water, and they are usually

seen in small schools. They are rather shy, and when frightened they sometimes make leaps of a meter or so above the water, or, more usually, they lift the head and body above the surface, leaving only the tail in the water. In this way they make rapid headway, and repeated efforts at surrounding a school with a 9-meter seine failed.

The four-eye apparently is never used for food, although it reaches a much larger size than several other species that are eaten. The largest fish seen by the collectors was 235 millimeters long, but according to the natives at Lake Guija the species attains a length of at least 300 millimeters. The male appears to be smaller than the female, as no males occurred among the larger individuals examined. The largest male seen was 180 millimeters long.

The species is viviparous, and the anal fin in the male serves as a copulatory organ. As the fish develops and reaches sexual maturity the anterior rays of the fin become enveloped in scaly skin, which extends to the end of the longest rays, forming a sort of tube, and having an orifice distally. A thin membranous receptacle lies in the abdominal cavity at the base of the anal, which is entered by the posterior end of the testes. A tube extends into the modified anal fin from this receptacle. This tube lies either right or left of the enveloped fin rays, through which the seminal fluid is conveyed to the distal orifice. The ovary is single, and the number of young produced at one time appears to be rather small. One ovary contained 6 embryos, each approximately 11 millimeters long; another inclosed only two embryos, each about 14 millimeters long.

This fish appears to feed on algæ and small entomostracans, insects, and other animals found among these plants at the surface of the water. The contents of the stomachs examined and the habit of surface feeding and swimming indicate that this species may be of value as an eradicator of mosquito larvæ.

This fish is known from Southern Mexico, Guatemala, and El Salvador. The type locality given by Gill, who first described the species, is the "Pacific coast of Panama," where the species quite certainly does not occur. It is more probable that the single specimen upon which the description was based came from Guatemala or Mexico, where Captain Dow, for whom the species is named, also collected. The specimens at hand were collected in Lake Guija and its outlet, Rio Lempa at Suchitoto and San Marcos, Rio San Miguel at San Miguel, Lake Olomega, and Cutuco. It was also seen in the Rio Sucio at Sitio del Niño, but no specimens were obtained there.

Order PERCOMORPHI

Family VII. ATHERINIDÆ

The Silversides

Body elongate, more or less compressed; premaxillaries protractile; jaws with two or more series of conical teeth; lateral line usually absent, never complete; two well-separated dorsal fins, the first formed of 3 to 6 slender spines, the second with a short spine and 7 to 13 branched rays; caudal fin forked; anal fin with a single spine and 12 or more branched rays; ventral fins abdominal, each with a

spine and 5 branched rays; vertebræ more than 30; sides with a silvery longitudinal band.

This is a large family of small fishes. Some of the members inhabit fresh water, but the majority of them live in salt and brackish water.

10. Genus *THYRINA* Jordan and Culver

Thyrina Jordan and Culver, Proc., Cal. Ac. Sci., 2 ser., V, 1895, 419 (type *Thyrina evermanni* Jordan and Culver).
Melaniris Meek, Pub., Field Col. Mus., Zool. Ser., III, 1902, 117 (type *Melaniris balsanus* Meek).

Body elongate, compressed; trunk sharply compressed ventrally; profile in advance of dorsal almost straight and nearly parallel with the posterior half of the ventral contour; lower jaw included; teeth unequal, the outer ones more or less enlarged in each jaw; scales often crenate, particularly on the back; origin of first dorsal well behind the origin of anal; base of anal longer than head; pectoral fins rather long, frequently longer than head.

A single species, which appears to be undescribed, was taken in fresh water.

11. *Thyrina guija* sp. nov.

PEPESCA; MANJUDA; ALFILER; ROVALETE

Type No. 87273, U.S.N.M.; length 88 mm., Lake Guija, El Salvador.

Head 4 to 4.75; depth 5.5 to 6.65; D. III to V-8 to 10; A. I, 22 to 26; scales 43 to 47.

Body very elongate, compressed; abdomen rather sharply compressed, almost but not quite forming a keel; caudal peduncle long and slender, at least twice as long as deep, its least depth 2.55 to 3.8 in head; head rather short, flat above; snout moderate, its length 2.9 to 3.2 in head; eye 2.9 to 3.5; interorbital 2.4 to 2.7; mouth small; the small hidden maxillary reaching nearly to anterior margin of eye; premaxillary fully protractile, the anterior margin strongly curved, posteriorly greatly extended; lower jaw included, a little shorter than the upper; teeth in jaws in bands, the outer series in each jaw enlarged, those of the upper jaw more so than in the lower jaw and placed on the extreme outer edge of the jaw, curved inward and exposed when the mouth is closed; gill rakers short, about 16 on lower limb of first arch; scales mostly with straight edges, those on back with rather broad indentations, small scales extending on base of dorsal but none on the other fins; origin of spinous dorsal over the base of about the sixth ray of the anal, the spines reaching less than half the way to origin of soft dorsal; origin of the soft dorsal over or a little behind middle of anal base and about half as far from base of caudal as the margin of opercle; caudal fin forked, the lower lobe larger and longer; anal fin long, its base extending slightly beyond the end of the base of second dorsal, origin of anal about equidistant from posterior half of eye and base of caudal; ventral fins small, inserted about equidistant from margin of opercle and base of caudal; pectoral fins longer than head, falcate, 3.45 to 4.25 in length of body; vertebræ 20 + 20.

Color greenish above, silvery below; sides with a silvery lateral band, about the width of the pupil, with a dark margin above; the scales on the back with dusky punctulations; a dark vertebral line; upper surface of head dusky; fins mostly pale green to translucent; a dark line along base of anal.

BULL. U. S. B. F., 1925. (Doc. 985.)

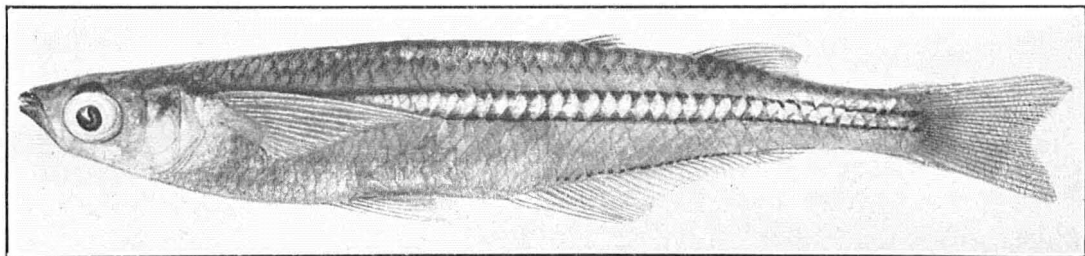


FIG. 18.—*Thyrina guija* sp. nov. From the type. Length, 88 millimeters

Many specimens, ranging from 20 to 105 millimeters in length, were preserved. This fish was taken only in Lake Guija, its outlet, and in two localities on the Rio Lempa. It appeared to be common in the Rio del Desague, the stream forming the outlet of Lake Guija. In the other localities where the species was found it appeared to be rather rare.

This fish appears to differ from *T. guatemalensis* (Günther), recorded from the Pacific slope of Guatemala, according to the very inadequate descriptions of that species, in having a more slender body, more numerous scales in a lateral series, and a slightly inferior mouth. According to Günther (Proc., Zoöl. Soc., London, 1864, p. 151) *T. guatemalensis* has only 36 scales in a lateral series. Regan (Biol. Cent. Amer., Pisces, 1907, p. 64) gives 36 to 42. Jordan and Hubbs (Leland Stanf. Jr. Univ. Pub., Univ. Ser., 1919, pp. 58 and 60), however, are of the opinion that Regan was considering three species under one name, and therefore the range given by him may not be correct.

In the present species the range in the number of scales, based upon the enumeration of 30 specimens, is 43 to 47. The mouth in *guatemalensis* is described as terminal, while in the species at hand the lower jaw is included and is a little shorter than the upper. The depth of the body in the length in *guatemalensis* is given as 5 by Günther and 4 to 5 by Regan. In the present species the depth is contained from 5.5 to 6.65 times in the length.

Eight small specimens, taken in salt water in the estuary at Triunfo, agree fairly well with this species, except that the scales above the median line of the side, at least, have broad indentations, and the number in the lateral series appears to be a little lower, 41 to 43. These fish are referred to the present species, although further study and more specimens may show that they belong to a distinct species.

The contents of 4 stomachs examined consisted of insects and insect larvæ, entomostracans, and filaments of algæ. The sexual organs were in a collapsed state, showing that the spawning season was not near at hand when the specimens were collected (January and February).

The specimens are from Lake Guija, Rio del Desague near Lake Guija, and from the Rio Lempa at Suchitoto and San Marcos.

Family VIII. MUGILIDÆ

The Mulletts

Body elongate, more or less compressed; mouth small, terminal or inferior; teeth, if present, small, various in form; premaxillaries protractile; gill openings wide, the membranes free from the isthmus; gills 4, a slit behind the fourth; lateral line usually absent, never complete; scales large, extending forward on head; dorsal fins 2, well separated; first dorsal composed of 4 rather strong spines; second dorsal with I, 7 to 10 rays; anal fin with II or III, 7 to 11 rays; caudal fin forked; ventral fins abdominal, each with I, 5 rays. Most of the species of this family are marine but several are strictly fresh water in their habits.

KEY TO THE GENERA

- a. Stomach muscular, gizzard-like; teeth minute, slender; lower jaw angulate in front; anal with 3 spines, except in very young *Mugil*, p. 266.
 aa. Stomach not gizzard-like; teeth in villiform bands on jaws and vomer; lower jaw anteriorly rounded; anal fin with 2 spines..... *Agonostomus*, p. 267.

11. Genus MUGIL Linnæus

Mugil Linnæus, Syst. Nat., Ed. X, 1758, 316 (type *Mugil cephalus* Linnæus).

Querimanna Jordan and Gilbert, Proc., U. S. Nat. Mus. V, 1882 (1883), 588 (type *Myxus harengus* Günther).

Body rather robust, the back and belly rounded; head broad; mouth terminal; jaws weak, the lower one with a median obtuse angle; teeth in the jaws minute, flexible; eye large, with an adipose lid; scales large, extending forward on head; anal spines 3 (2 in very young); stomach very muscular, gizzardlike. The species of this genus are marine, but some of them enter fresh water and the one included here appears to be a regular visitor to the fresh-water streams of El Salvador, where it is of some commercial importance and highly prized as a food fish.

12. *Mugil cephalus* (Linnæus)

“LIEBRE ANCHA;” “LIZA”

Mugil cephalus Linnæus, Syst. Nat. Ed. X, 1758, 316 (Europe; based on Artedi); Jordan and Evermann, Bull., U. S. Nat. Mus. XLVII, 1896, 811, Pl. CXXVI, fig. 343; Meek and Hildebrand, Pub., Field Mus. Nat. Hist., Zool. Ser., XV, 1923, 275. (For a fuller synonymy and additional references see one of the two last-mentioned works.)

Head 3.9 to 4.1; depth 3.9 to 3.96; D. IV-I, 8; A. III, 8; scales 42.

Body elongate, compressed; head low and rather broad; snout tapering, its length 3.2 to 3.45 in head; eye 4.35 to 4.9; interorbital slightly convex, 2.2; mouth rather broad, oblique; upper jaw projecting; maxillary scarcely reaching eye, 3.6 to 3.75 in head; teeth in the jaws minute but visible with the unaided eye; gill rakers minute, close-set; scales moderate, 11 or 12 rows between origin of second dorsal and base of anal, each scale with a finely serrate membranous border; origin of spinous dorsal slightly nearer tip of snout than base of caudal, the longest spine 1.8 to 1.9 in head; origin of second dorsal about an eye's diameter nearer origin of first dorsal than base of caudal; the fin with a few small scales at the base posterior to the anterior rays; caudal fin forked, the upper lobe longest, pointed, the fin with small scales; anal fin similar to the second dorsal, its origin a little in advance of second dorsal, with a few minute scales at base posterior to the anterior rays; ventral fins inserted under the posterior fourth of the pectorals; pectoral fins a little longer than the ventrals, failing to reach origin of first dorsal, 1.5 in head.

Color of a fresh specimen, 430 millimeters long, dark greenish brown above; lower parts silvery; rows of scales on sides with dark stripes; fins all dusky, except anal and ventrals, which are pale.

Two specimens, respectively 410 and 430 millimeters in length, were taken. This fish, although a salt-water species, occasionally runs upstream into fresh water. The specimens at hand were taken in the Rio Lempa at Suchitoto, about 180 kilometers, following the course of the stream, from the sea and far above the influence of tide. According to local fishermen this fish is a more or less permanent

resident and it is not infrequently taken. It occurs in the market in the village, and it was served on the table in a local hotel during our visit. Fish up to 500 millimeters in length are said to be taken locally. This fish was not seen elsewhere.

This widely distributed mullet is known from nearly all warm waters of both hemispheres—on the American coasts from Monterey to Chile and from Cape Cod to Brazil. The El Salvadorian specimens were taken in the Rio Lempa at Suchitoto.

12. Genus AGONOSTOMUS Bennett

Agonostomus Bennett, Proc., Zool. Soc., London, I, 1830 (1831), 166 (type *Agonostomus telfairii* Bennett).
Neomugil Vaillant, Bull., Soc. Philom., Paris, IV, 1894, 73 (type *Neomugil digueti* Vaillant).

Body elongate, compressed; mouth terminal in young, subinferior in adult; cleft extending laterally to or past front of eye; lower lip never greatly thickened; teeth in bands on jaws, vomer, and palatines; anal spines 2, the first one minute, often hidden in the skin; stomach not gizzardlike. The species of this genus inhabit mostly tropical rivers, some of them living in mountain torrents. A single species was taken in El Salvador.

13. *Agonostomus monticola* (Bancroft)

TEPEMECHIN; CHIMBERA; LIZA

Mugil monticola Bancroft, in Griffith's edition, Cuvier's Animal Kingdom, Fishes, 1836, 367, pl. 36 (West Indies).

Agonostomus monticola Günther, Cat. Fish. Brit. Mus., III, 1861, 464.

Agonostomus nasutum Günther, Cat. Fish. Brit. Mus., III, 1861, 463 (Rio San Geronimo, Guatemala).

Neomugil digueti Vaillant, Bull., Soc. Philom., IV, 1894, 73 (Lower California).

Agonostomus salvini Regan, Ann. and Mag. Nat. Hist., 7 ser., XIX, 1907, 66, and Biol. Cent. Amer., Piscoes, 1907, 68, Pl. XI, fig. 2 (Nacastl, Guatemala).

Head 3.9; depth 3.8; D. IV-I, 8; A. II, 10; scales 42.

Body elongate, moderately compressed; upper profile gently convex; head rather small; snout rather long, pointed, 3.4 to 3.55 in head; eye 3.4 to 4.1; interorbital 2.55 to 3.1; mouth moderate, nearly horizontal; upper jaw projecting; upper lip moderately thickened in a large specimen, rather thin in a smaller one; maxillary reaching a little past anterior margin of eye but scarcely to pupil, 2.85 to 3.1 in head; teeth small in bands on jaws, vomer, and palatines; gill rakers about half as long as eye, 19 on lower limb of first arch; scales rather large, strongly ctenoid, extending forward on interorbital, present on cheeks, 11 or 12 longitudinal rows between origin of second dorsal and base of anal; origin of spinous dorsal at least an eye's diameter nearer tip of snout than base of caudal, the spines strong, the anterior one a little longer than eye and snout, 1.55 to 1.6 in head; origin of second dorsal about an eye's diameter nearer the origin of the first than the base of the caudal, the outer margin of the fin concave; margin of caudal fin rather deeply concave; anal fin similar to the second dorsal but somewhat larger, its origin a little in advance of second dorsal; ventral fins moderate, inserted under or slightly posterior to middle of pectorals; pectoral fins a little longer than the ventrals, reaching to or a little beyond vertical from origin of spinous dorsal, 1.3 to 1.55 in head.

Color of a fresh specimen, 180 millimeter long, grayish black above; sides silvery; under parts pale silvery; scales on sides with dark edges; an indistinct dark blotch at base of caudal; first dorsal with dark spines and yellow interradial membranes; second dorsal greenish, with a broad translucent margin; caudal and pectorals plain translucent; the latter dark at base; anal and ventrals mostly yellowish; iris golden. A smaller specimen, 82 millimeters long, lighter, the black on margins of scales on sides not continuous, forming specks; caudal spot more distinct.

Two specimens of this species, respectively 82 and 180 millimeters in length were taken. It is improbable that this fish is as scarce as indicated by the few specimens secured, for it appears to be well known to the native fishermen, according to whom the species occurs in streams in several localities where it was not taken by us. One of our specimens was taken in a deep rocky place in the Rio del Desague, a short distance below Lake Guija, of which this river is the outlet. The smaller specimen was taken in quiet shallow water on a sandy bottom in the Rio Lempa at San Marcos.

According to the fishermen at Lake Guija the "Tepemechin" spawns in June. The eggs are much sought and considered a great delicacy. One fish is said to produce a quantity of eggs, which in bulk is greater than that of the entire fish. The species, according to native fishermen, reaches a length of about 250 millimeters.

This species, as here understood, ranges from southern Mexico to Panama, occurring on both slopes of Central America and Panama. It is also known from the West Indies. The specimens at hand are from the Rio del Desague, near Lake Guija, and from the Rio Lempa at San Marcos.

Family IX. CENTROPOMIDÆ

The Robalos

Body moderately elongate, compressed; head long, somewhat depressed above; mouth large, protractile; lower jaw projecting; teeth in villiform bands on jaws, vomer, and palatines; preopercle and supraclavicle serrate; preopercle with a ridge, usually bearing 2 spines; opercle without spines, produced as a flap; lateral line more or less arched, continued to end of caudal fin; scales small or of moderate size, ctenoid; two separate dorsal fins; the first consisting of 7 or 8 spines; second dorsal with 1 spine and 8 to 11 branched rays; caudal fin forked; anal short, with 3 spines and 6 or 7 branched rays; ventral fins inserted behind base of pectorals, with I, 5 rays; pectoral fins symmetrical; air bladder large, with or without appendages.

All the species of this family are American and are included in one genus.

13. Genus CENTROPOMUS Lacépède

Centropomus Lacépède, Hist. Nat. Poiss., IV, 1803, 248 (type *Sciæna undecimalis* Bloch).

Oxylabrax Bleeker, Arch. Neerl. Sci. Nat., XI, 1876, 264 (type *Sciæna undecimalis* Bloch).

Macrocephalus Bleeker, Arch. Neerl. Sci. Nat., XI, 1876, 336 (type *Sciæna undecimalis* Bloch).

The characters of the genus are included in the family description. The species of this genus are game fishes. Some of them reach a large size, and the

quality of the flesh is excellent. They are chiefly shore fishes, frequenting brackish water, and some of them ascend fresh-water streams. Three species were secured in fresh water in El Salvador; others, no doubt, occur there from time to time.

KEY TO THE SPECIES

- a. Scales small, 72 to 75 in a lateral series, about 8 rows between the middle of second dorsal and lateral line; gill rakers few, about 8 on lower limb of first arch. *nigrescens*, p. 269.
- aa. Scales larger, not more than 65 in a lateral series, 5 or 6 rows between middle of second dorsal and lateral line; gill rakers more numerous, not fewer than 12 on lower limb of first arch.
- b. Scales moderate, 52 to 54 in a lateral series; gill rakers numerous, 16 or 17 on lower limb of first arch; angle of preopercle with 2 abruptly enlarged serræ; lateral line not in a dark streak. *robalito*, p. 270.
- bb. Scales smaller, 58 to 62 in a lateral series; gill rakers fewer, 13 or 14 on lower limb of first arch; angle of preopercle with several gradually enlarged serræ; lateral line in a black streak. *pectinatus*, p. 271.

14. *Centropomus nigrescens* (Günther)

ROBALO; ROVALO

Centropomus nigrescens Günther, Proc., Zool. Soc., London, 1864, 144, and Trans., Zool. Soc., London, VI, 1868, 407 ("Chiapam", Pacific coast of Guatemala); Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 1119; Regan, Biol. Cent. Amer., Pisces, 1907, 50; Meek and Hildebrand, Pub., Field Mus. Nat. Hist., Zool. Ser., XV, Part II, 1925, 426, Pl. XLII.

Centropomus viridis Lockington, Proc., Cal. Ac. Sci., VII, 1876 (1877), 110 (Off Ascuncion Island).

Centropomus undecimlatus (not of Bloch) Gilbert and Starks, Memoir., Cal. Ac. Sci., IV, 1904, 89.

Head 3 to 3.1; depth 3.7 to 3.85; D. VIII-I, 9; A. III, 6; scales 72 to 75.

Body elongate, compressed; profile concave over eyes; caudal peduncle long, its least depth 2.75 in head; head long; snout broad, its length, 3.36 to 3.6 in head; eye 7.55 to 9; interorbital 4.75; mouth large, oblique; lower jaw strongly projecting; maxillary reaching nearly opposite middle of eye, 2.25 to 2.3 in head; preorbital with a few small serræ; preopercle strongly serrate, several serræ at angle enlarged; preopercular ridge without spines; gill rakers rather long and few, 8 on lower limb of first arch; scales rather small, about 8 rows between middle of base of second dorsal and lateral line, not greatly reduced in advance of dorsal, small scales extending on base of all fins, except spinous dorsal; origin of spinous dorsal nearly twice the diameter of eye behind base of pectorals, the spines moderate, the third and fourth of about equal length, the former not reaching the tip of the latter when deflexed, the length 2.05 to 2.5 in head; origin of second dorsal notably nearer base of caudal than preopercular margin; caudal fin forked, both lobes rather acute; origin of anal under middle of base of second dorsal, the second spine somewhat enlarged, not reaching the tip of the third when deflexed, 2.75 to 3.25 in head; ventral fins inserted about an eye's diameter behind base of pectorals, failing to reach vent; pectoral fins reaching about to the beginning of the distal third of ventrals, 1.9 to 1.95 in head.

Color of a fresh specimen, 715 millimeters long, bluish silvery above; lower part of sides and abdomen silvery; upper surface of head and sides in advance of pectorals yellowish; lateral line in a black streak; dorsals, caudal, and anal bluish black; second dorsal, caudal, and anal with pale margins; pectorals and ventrals yellowish green; ventrals with a broad white margin.

Several large individuals, ranging upward to 715 millimeters in length, were taken with dynamite in the Rio Lempa at San Marcos. Only one specimen, 475 millimeters long, was preserved, which, together with notes and measurements made in the field on still larger specimens, serves as the basis for the above description.

The "Rovalo" was reported by local inhabitants from several localities and streams in El Salvador, but, as already stated, it was taken only in one locality. Native fishermen at Suchitoto claimed that "Rovalo" exceeding a meter in length are occasionally taken there in the Rio Lempa. It is probable that this species and possibly several others of this genus ascend the river to and beyond that locality, as most of the representatives ascend fresh-water streams freely.

This species is known from Lower California to Ecuador. In El Salvador it was taken in the Rio Lempa at San Marcos.

15. *Centropomus robalito* Jordan and Gilbert

ROBALO; ROVALO

Centropomus armatus Günther (not Gill) Trans., Zool. Soc., London, 1868, 408.

Centropomus robalito Jordan and Gilbert, Proc., U. S. Nat. Mus., IV, 1881 (1882), 462 (Mazatlan; Acapulco); Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 1123.

Head 3 to 3.1; depth 3.25 to 3.4; D. VIII-I, 10; A. III, 6; scales 52 to 54.

Body moderately elongate, compressed; back elevated; head long, rather flat above; snout long and broad, its length 2.75 to 3 in head; eye 4 to 4.15; interorbital 4.75 to 6.8; mouth large, a little oblique, lower jaw strongly projecting; maxillary reaching nearly opposite middle of eye, 2.35 to 2.45 in head; preorbital with small serrations; preopercle strongly serrate, 2 serræ at angle notably enlarged; preopercular ridge with 2 spines at angle; gill rakers slender, rather numerous, 16 or 17 on lower limb of first arch; scales moderate, ctenoid, 5 or 5½ rows between middle of second dorsal and lateral line, reduced in advance of dorsal, about 14 rows crossing the back anterior to spinous dorsal, small scales extending on base of second dorsal, caudal, and anal; origin of first dorsal scarcely an eye's diameter behind base of pectorals, the third spine about equal in length to the fourth but not reaching beyond it when deflexed, 1.55 to 1.65 in head; origin of second dorsal about equidistant from preopercular margin and base of caudal; caudal fin forked, both lobes acute; origin of anal fin slightly posterior to middle of base of second dorsal, the second spine much enlarged, reaching somewhat beyond base of caudal when deflexed, its length 1.15 in head; ventral fins inserted slightly behind base of pectorals, reaching to or a little beyond vent; pectorals not quite reaching tips of ventrals, 1.35 to 1.6 in head.

Color bluish gray above, silvery below; lateral line not in a black streak; fins all more or less dusky; spinous dorsal usually with more or less black on interradiar membranes; membrane between second and third anal spine, with black next to the third spine.

Several small specimens, ranging in length from 120 to 140 millimeters, were seined in the Rio Lempa at San Marcos in strictly fresh water and well beyond the influence of tides. One small specimen of this species was taken in an estuary at Triunfo.

This fish ranges from Lower California to Panama. The specimens from El Salvador are from the Rio Lempa at San Marcos, and from salt water at Triunfo.

16. *Centropomus pectinatus* Poey

ROBALO; ROVALO

Centropomus undecimalis Cuvier and Valenciennes (part), Hist. Nat. Poiss., II, 1828, 102.

Centropomus pectinatus Poey, Memorias, II, 1860, 121 (Cuba); Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 1122; Regan, Biol. Cent. Amer., Pisces, 1907, 46; Meek and Hildebrand, Pub., Field Mus. Nat. Hist., Zool. Ser., XV, Part II, 1925, 421.

Centropomus medius Günther, Proc., Zool. Soc., London, 1864, 144, and Trans., Zool. Soc., London, VI, 1868, 406 ("Chiapam," Pacific coast of Guatemala).

Centropomus grandoculatus Jenkins and Evermann, Proc., U. S. Nat. Mus. XI, 1888 (1889), 139 (Guaymas).

Head 3 to 3.15; depth 3.5 to 3.7; D. VIII-I, 10; A. III, 7; scales 58 to 62.

Body elongate, compressed; profile concave over eyes; caudal peduncle long, its least depth 2.55 to 2.8 in head; head long; snout rather broad, its length 2.8 to 2.9 in head; eye 4.15 to 5.1; interorbital 4.45 to 5.6; mouth large, oblique; lower jaw strongly projecting; maxillary reaching nearly opposite middle of eye, 2.2 to 2.35 in head; preorbital with small serrations; preopercle strongly serrate, several serræ at angle enlarged; preopercular ridge with 2 spines at angle; gill rakers slender, 13 or 14 on lower limb of first arch; scales of moderate size, 5½ or 6 rows between middle of base of second dorsal and lateral line, somewhat reduced in advance of dorsal, about 14 rows crossing the back anterior to spinous dorsal, small scales extending on base of second dorsal, caudal, and anal; origin of spinous dorsal an eye's diameter behind base of pectorals, the spines long, the third the longest, reaching to or a little beyond the tip of the fourth when deflexed, 1.5 to 1.7 in head; origin of second dorsal a little nearer base of caudal than preopercular margin; caudal fin forked, both lobes acute; origin of anal fin under the posterior third of second dorsal, the second spine much enlarged but not reaching beyond the tip of the third when deflexed, 1.3 to 1.6 in head; ventral fins inserted less than an eye's diameter behind base of pectorals, reaching to or a little beyond vent; pectoral fins reaching somewhat past middle of ventrals, 1.7 to 1.75 in head.

Color bluish or grayish above; sides and abdomen silvery; tip of snout dusky; lateral line in a black streak; dorsals, caudal, and anal all more or less dusky; the membrane between the second and third anal spines darker than rest of fin but not black; ventrals and pectorals yellowish green; tips of ventrals black in young, this color disappearing with age.

Three specimens of this species, respectively 220, 280, and 350 millimeters in length, were preserved. The largest of these was taken in strictly fresh water in the Rio Lempa at San Marcos.

This species occurs on both coasts of tropical America where it enters fresh water freely. On the Atlantic it ranges from Cuba to Panama and on the Pacific from Guaymas to Colombia.

The El Salvador specimens are from the Rio Lempa at San Marcos and from the salt water estuary at Triunfo.

Order CHROMIDES

Family X. CICHLIDÆ

The Mojarras

Body elongate, compressed; mouth large or small, terminal or subinferior; teeth conical, incisorlike or lobate; vomer and palatines without teeth; premaxillaries freely protractile; nostrils single on each side; lateral line interrupted under soft dorsal, reappearing lower down on side; scales usually ctenoid; dorsal fin single, the spinous portion usually longer than the soft part; anal fin with 3 or more spines; ventral fins thoracic, with I, 5 rays; pseudobranchiæ wanting; branchiostegals 5 or 6; air bladder present. A single genus of this large family of tropical freshwater fishes is represented in the collection from El Salvador.

14. Genus CICHLASOMA Swainson

Cichlasoma Swainson, Nat. Hist. Class., Fish., II, 1839, 230 (type *Labrus punctatus*).

Heros Heckel, Ann., Mus. Wien, II, 1840, 362 (type *Heros severus* Heckel).

Hoplarchus Kaup, Arch. Naturg. XXVI, 1860, 128 (type *Hoplarchus pentacanthus*).

Body deep or elongate, compressed; mouth small or moderate; teeth on jaws in bands, the outer ones more or less enlarged, sometimes forming canines; maxillary exposed or not; premaxillary processes shorter than head; opercle entire; gill rakers short and few (6 to 15 on lower limb of first arch); lateral line interrupted; scales moderate or large, usually ctenoid, extending forward on head to the eyes or beyond, also present on cheeks and opercles; dorsal fin single, not notched, with XIV to XIX, 7 to 12 rays; anal IV to XII, 6 to 14; caudal round, truncate or emarginate; ventrals inserted below or a little behind base of pectorals; pectoral fins asymmetrical, with 12 to 18 rays.

This is a large genus with many representatives in Mexico, Central and South America. Five species are represented in the collections from El Salvador.

KEY TO THE SPECIES

- a. The outer teeth anteriorly in each jaw more or less regularly enlarged; premaxillary processes not reaching middle of eye; mouth small, the maxillary failing to reach anterior margin of eye.
- b. Dorsal XVII to XIX, 8 or 9; anal VIII to X, 5 to 8; body with black crossbars, the two bands anterior to dorsal arched forward.....*nigrofasciatum*, p. 273.
- bb. Dorsal XIV to XVI, 12 to 14; anal V, 9 or 10; body with dark crossbars (at least in young), none of them arched.
- c. Body deep, the depth 1.8 to 1.95 in length (specimens 30 to 85 mm. long); profile steep; eye large, 2.5 to 2.8 in head (specimens 30 to 85 mm. long); general color bluish gray above, pale silvery below; sides with 8 moderately distinct crossbars.....*macracanthus*, p. 274.
- cc. Body more slender, the depth 2 to 2.25; profile less strongly elevated; eye smaller, 3.6 to 4.95 in head; general color darker; the crossbars (in young) more distinct.....*meeki*, sp. nov., p. 275.

- aa. Anterior pair of teeth in upper jaw enlarged, canine-like; the anterior pair in lower jaw small, followed by one or more enlarged teeth; premaxillary processes reaching to or beyond middle of eye; mouth moderate, the maxillary reaching about to anterior margin of eye; dorsal XVII to XIX, 10 to 12; anal VII or VIII, 8 to 10.
- d. Body rather deep, the depth 2.12 to 2.47 in length (specimens 127 to 185 mm. long); about 6 rows of scales on cheek; a prominent dark spot above origin of lateral line (sometimes obscure in adults); no black spots or bars on opercle; no rusty spots on body and vertical fins-----*trimaculatum*, p. 277.
- dd. Body more elongate, the depth 2.54 to 2.74 in length (specimens 127 to 185 mm. long); about 8 rows of scales on cheek; no dark spot above origin of lateral line; opercle with one or two bars or blotches; adults usually with rusty spots on body and vertical fins-----*motaguense*, p. 279.

17. *Cichlasoma nigrofasciatum* Günther

BURRO; ACHIBA; CHAMARRA; CHINCOYO; CONGA; MOJARRA

Heros nigrofasciatus Günther, Trans., Zool., Soc., London, VI, 1868, 452, Pl. LXXIV, fig. 3 (Lakes Atitlan and Amatitlan).

Cichlasoma nigrofasciatum Jordan and Evermann, Bull., U. S. Nat. Mus. XLVII, 1898, 1525; Regan, Ann. and Mag. Nat. Hist., 7 ser., XVI, 1905, 75; Regan, Biol. Cent. Amer., Pisces, 1906, 22; Meek, Pub., Field Col. Mus., Zool. Ser., VII, 1908, 189.

Head 2.55 to 3.35; depth 1.9 to 2.25; D. XVII to XIX, 8 or 9; A. VIII to X, 5 to 8; scales 27 to 30.

Body compressed, short and deep; dorsal profile rather steep, only slightly convex over snout and eyes; caudal peduncle short and deep, 1.7 to 2.5 in head; head rather small; snout moderate, 2.4 to 3.3 in head; eye 3.2 to 4.6; interorbital 2.05 to 3.4; mouth small, terminal; maxillary hidden, failing to reach anterior margin of eye, 3.25 to 4.15 in head; fold of lower jaw interrupted at symphysis; premaxillary processes extending to anterior margin of eye; teeth in the jaws in bands, conical, the outer ones in anterior part of each jaw enlarged; gill rakers short, 7 to 9 on lower limb of first arch; scales rather large, somewhat reduced on nape and chest, about 4 or 5 rows on the cheeks, 4 complete rows between origin of dorsal and lateral line, a few small scales on the base of vertical fins; dorsal fin long, not notched, the last spine longest, about equal to postorbital part of head, the soft part elevated, the median rays filamentous in adults, sometimes reaching nearly to end of caudal, origin of fin over margin of opercle; caudal fin broadly rounded; anal fin with strong pungent spines, the soft part similar to that of the dorsal and coterminous with it; ventral fins inserted slightly behind the base of pectorals, the exterior rays more or less filiform, except in very young, and reaching beyond origin of anal; pectoral fins moderate, reaching to or more usually past the origin of anal, 1.05 to 1.4 in head; vertebræ 13 + 15.

Color of a fresh specimen, 55 millimeters long, grayish green above; pale with pinkish and silvery reflections on lower parts of sides; chest and abdomen nearly black with a slight greenish tinge; snout black; sides with 9 black bars, usually broader than interspaces, the first band arched, running across the nape and on opercle, a second band concentric with the first and extending across nape to behind base of pectorals, the third bar short, usually nearly and frequently completely connecting with the second bar on median line of side, forming a V; the other bars nearly vertical, the fourth to the seventh usually extending on dorsal fin, the eighth connecting the ends of the dorsal and anal, the last one at base of caudal; ventral fins

black; all other fins dusky. Some individuals are much darker than others, but the pattern is identical. The specimen described is one of the dark-colored ones. These color varieties are recognized by the natives who, on Lake Chalchuapa, at least, referred to the light variety as "plateada" and the dark ones as "negra."

Many specimens of this common species, ranging in length from 25 to 120 millimeters, were preserved. This fish is the most common one of the family in the fresh waters of El Salvador. However, it was not found in four localities visited, viz, Rio Molino at Ahuachapan, Lake Ahuachapan, Rio Lempa at San Marcos, and Lake Olomega. It is especially abundant in Lakes Coatepeque and Channmico.

This species reaches a small size, probably rarely exceeding a length of 120 millimeters. It is used for food and also for crab bait. Its habitat does not appear to be limited to any definite type of bottom, depth, or vegetation. In Lake Coatepeque it was especially abundant among the rocks where, because of the very clear water, it could be seen at a depth upward of 6 meters. In other localities it was found in shallow water among vegetation and often in comparatively muddy places. The species, according to the contents of 9 stomachs examined, feeds on small animal and plant life of suitable size. Meek (Pub., Field Col. Mus., Zool. Ser., VII, 1908, p. 189) states that this fish deposits its eggs in April, May, and June in Lakes Amatitlan and Atitlan, Guatemala. The sexual organs in the specimens examined (taken in January and February) were mostly in the early stages of development, containing very minute ova that were not visible with the naked eye. A few specimens, however, contained eggs upward of 3 millimeters in diameter and probably nearing maturity.

This fish heretofore has been recorded only from Lakes Amatitlan and Atitlan, Guatemala, and it apparently had not been taken in streams. The specimens from El Salvador were collected in the following localities: Lake Guija, Lake Metapan, Lake Chalchuapa, Rio Pampe near Chalchuapa, Lake Coatepeque, Lake Channmico, Lake Zapotitan, Rio Sucio at Sitio del Niño, ponds at El Angel, Lake Ilopango, Rio Lempa at Suchitoto, and Rio San Miguel at San Miguel.

18. *Cichlasoma macracanthus* (Günther)

MOJARRA

Heros macracanthus Günther, Proc., Zool. Soc., London, 1864, 153, and Trans., Zool. Soc., London, 1868, 451 (Chiapam; Huamuchal).

Cichlasoma macracanthum Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1898, 1518; Regan (part), Ann. and Mag. Nat. Hist., 7 ser., XVI, 1905, 241; Biol. Cent. Amer., Pisces, 1906, 24, Pl. V, fig. 1.

Head, 2.5 to 2.8; depth, 1.8 to 1.95; D. XV or XVI, 12 or 13; A. V, 9 or 10; scales, 30.

Body very deep, compressed; the dorsal profile strongly elevated, straight from snout to interorbital, then gently convex; caudal peduncle deep, its depth 2.2 to 2.55 in head; head moderate, deep; snout tapering, 2.7 to 2.8 in head; eye large, 2.5 to 2.8; interorbital 2.9 to 3.7; preorbital from two-thirds to three-fourths the length of eye; mouth small, terminal; maxillary covered by the preorbital, not reaching anterior margin of eye, its length 3.4 to 4.6 in head; premaxillary processes reaching anterior fourth of eye; lower lip without a definitely free margin at the

BULL. U. S. B. F., 1925. (Doc. 985.)

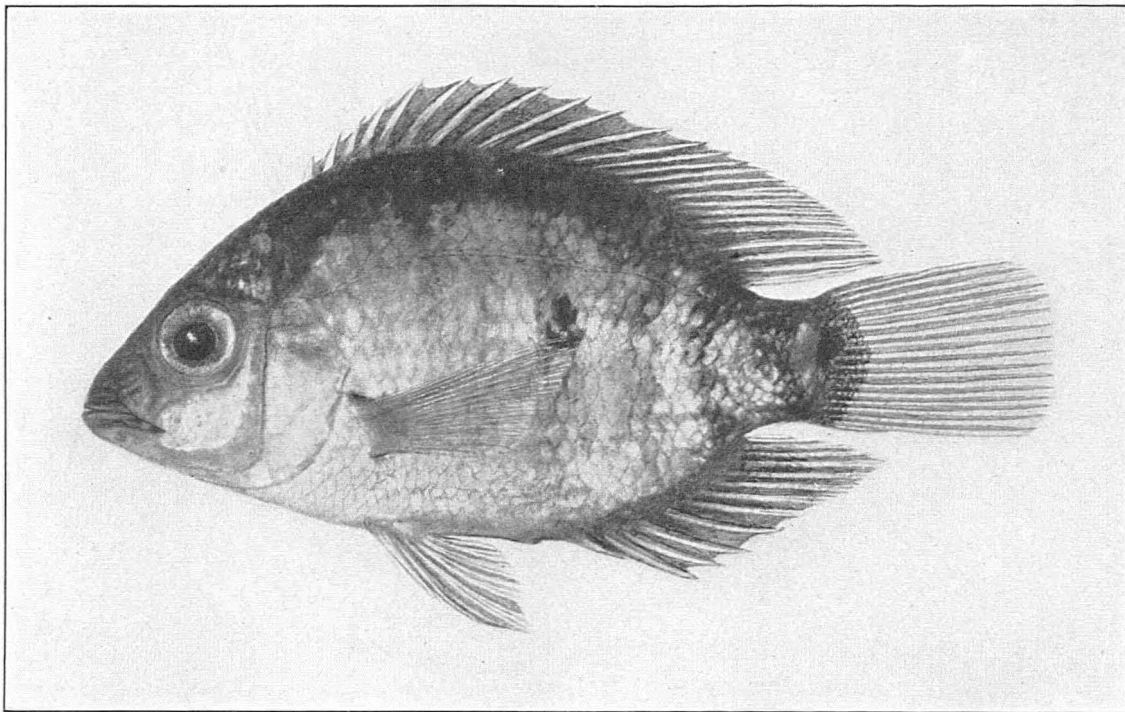


FIG. 19.—*Cichlasoma macracanthus*. From a specimen 78 millimeters long

BULL. U. S. B. F., 1925. (Doc. 985.)

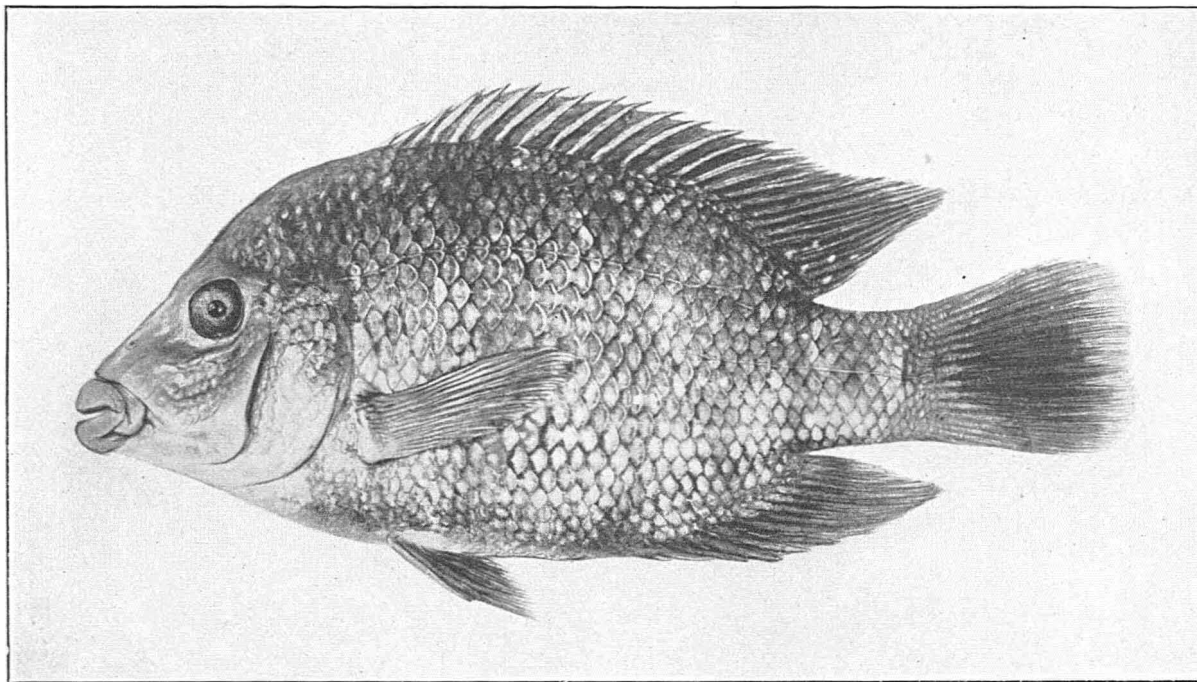


FIG. 20.—*Cichlasoma meeki* sp. nov. From the type. Length, 175 millimeters

symphysis; teeth in villiform bands in each jaw, the outer ones in each jaw anteriorly somewhat enlarged; gill rakers very short, about 6 on lower limb of first arch; scales moderate, 5 or 6 rows between origin of dorsal and lateral line, somewhat reduced on nape and chest, small scales extending on base of vertical fins, those above lateral line with smooth edges, those below lateral line with small spinules on posterior margin and on a part of the upper surface of the exposed portion; dorsal fin long, the spines graduated, the last one about half the length of head, origin of fin over margin of opercle; caudal fin rounded; anal fin with strong graduated spines, the last one a little longer and considerably stronger than the last dorsal spine, origin of fin about equidistant from base of pectorals and base of caudal; ventral fins inserted a little behind base of pectorals, reaching nearly or quite to origin of anal; pectoral fins reaching to or a little beyond origin of anal, 1.1 to 1.2 in head.

Color of fresh specimen bluish gray with silvery reflections above; lower parts pale silvery; sides with 8 dark crossbars, the fifth bar with an intensified black blotch on median line of sides; a black spot at base of caudal above lateral line; pectoral fins pinkish; all other fins dusky.

Nine small specimens, ranging in length from 30 to 85 millimeters, were preserved. These specimens agree fairly well with descriptions of *C. macracanthus*, a species first described from the western slope of Guatemala. The specimens at hand were taken in Lake Ahuachapan. This lake, although it has no visible outlet, is situated within the basin of the Rio de Paz, a stream forming a portion of the boundary between El Salvador and Guatemala.

This species has previously been recorded from the Pacific slope of Guatemala and Tequesixtlan, southern Mexico. The El Salvador specimens are from Lake Ahuachapan.

19. *Cichlasoma meeki* sp. nov.

MOJARRA; MOJARRA NEGRA; MOJARRA PLATEADA

Type No. 87301, U.S.N.M.; length 175 mm.; Lake Guija, El Salvador.

Head 2.4 to 3; depth 2 to 2.25; D. XIV or XV, 12 to 14; A. V, 9 or 10; scales 28 to 30.

Body moderately deep, compressed; dorsal profile rather strongly elevated, straight from snout to eye, then gently convex; adults of 200 millimeters and more in length with nuchal hump; caudal peduncle short and deep, its depth 1.95 to 2.6 in head; head moderate; snout rather long and pointed, longer than postorbital part of head, except in very young, 2.15 to 3.2 in head; eye small, 3.6 to 4.95; interorbital 2.5 to 3.6; preorbital as broad as eye in specimens about 160 millimeters long, proportionately broader in larger specimens and narrower in the young; mouth small, terminal; maxillary mostly covered by preorbital, failing to reach anterior margin of eye, 2.5 to 3.8 in head; lower lip with an uninterrupted free margin, the free part being very narrow at symphysis; premaxillary processes reaching anterior fourth of eye; teeth in the jaws in bands, mostly pointed, some of them in the larger specimens frequently worn and blunt, the outer ones in anterior part of jaws somewhat enlarged; gill rakers very short, 8 to 10 on lower limb of

first arch more or less developed; scales moderate, 5 or 6 rows between origin of dorsal and lateral line, reduced in size on nape and chest, those above lateral line with smooth edges, those below lateral line with small spinules on margin and on portion of exposed part; dorsal fin long and continuous, the spines graduated, the last one scarcely half the length of head, proportionately somewhat shorter in the adult than in young; median rays of the soft portion produced in adults reaching opposite about middle of caudal, origin of fin slightly in advance of margin of opercle; caudal fin rounded, sometimes more or less truncate; anal spines strong, graduated, the last one much stronger and longer than the longest dorsal spine, the soft portion similar to that of the dorsal, origin of fin usually about an eye's diameter nearer base of pectorals than base of caudal; ventral fins inserted just behind base of pectorals, reaching to origin of anal in young, failing to reach this point in large specimens; pectoral fins usually reaching to or a little beyond origin of anal, 1.18 to 2.35 in head.

Color of a fresh specimen, 75 millimeters long, greenish silvery with bluish reflections above; lower parts silvery; snout greenish; sides with 6 indistinct dark crossbars, the third bar with a black blotch on median part of side; a black spot on upper half of base of caudal; ventrals slightly yellowish; all other fins olivaceous; iris yellow. In the young the black in each bar on the median part of sides is intensified and somewhat broadened, suggesting a lateral band. In large specimens the black bars on the sides, anteriorly at least, become very obscure, the black blotch in the third bar disappears, and the caudal spot becomes obscure and many of the scales on the sides bear greenish specks. Two color varieties, "Mojarra negra" and "Mojarra plateada," which, however, show no structural differences and which appear to intergrade, are recognized in some localities by the natives.

This common food fish is represented by many specimens, ranging from 25 to 220 millimeters in length. The writer, however, has found it impossible to identify the specimens with any known form and he believes them to represent a new species. The species is related to *C. macracanthus*, of which small specimens were obtained in Lake Ahuachapan. The present species, however, is more slender, the anterior profile less steep and convex, the eye is notably smaller, and the color, while variable, as shown in the description, is darker and the bands are more distinct. These differences are most noticeable when specimens of like size are compared.

This mojarra is one of the most important food fishes of the fresh waters of El Salvador, and it was taken, or reported, from nearly all waters visited. It is said to reach a length of about 320 millimeters. In Lake Metapan it appeared to be more common than elsewhere. A fisherman, who waded and used a cast net, caught about 24 of these fish, ranging in length from 140 to 305 millimeters, during 4 hours' fishing, and only a few of other species. The flesh of this fish is firm and of good flavor.

According to information obtained from the natives, this species spawns along shore in comparatively shallow water. A disagreement as to the time of spawning (some saying that the species spawned in May and June, others that it spawned in August) either shows that the spawning period is a protracted one or, more probably, that little is known about it. The specimens dissected, which were taken during

January and February, contained small ova, indicating that the spawning season was not near at hand. The contents of four stomachs examined consisted of the remains of fish, insects, insect larvæ, spicules of sponges, filaments of algæ, and fragments of higher plants.

The species is named in honor of the late Dr. Seth E. Meek, curator of fishes in the Field Museum of Natural History, who contributed much to our knowledge of the fishes of Mexico and Central America.

The specimens were collected in the following waters: Lake Guija, Lake Metapan, Lake Chalchuapa, Rio Sucio at Sitio del Niño, Rio Lempa at Suchitoto and San Marcos, Rio San Miguel at San Miguel, and Lake Olomega.

20. *Cichlasoma trimaculatum* (Günther)

GUAPOTE; MOJARRA; ISTATAGUA

Heros trimaculatus Günther, Trans., Zool. Soc., London, VI, 1868, 461, Pl. LXXVI (Chiapam and Huamuchal, Pacific slope, Guatemala); Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1898, 1529.

Cichlasoma trimaculatum Regan, Ann. and Mag. Nat. Hist., 7 ser., XVI, 1905, 333, and Biol. Cent. Amer., Pisces, 1906, 28.

Head 2.3 to 2.75; depth 2.1 to 2.45; D. XVII (rarely XVIII) 11 or 12; A. VII (rarely VIII) 8 to 10; scales 29 to 31.

Body moderately elongate, becoming proportionately deeper with age; profile nearly straight over the head in young, concave in adult; caudal peduncle much deeper than long, its least depth 2.3 to 2.9 in head; head not much longer than deep; snout rather pointed, 2.5 to 3.6 in head; eye 3.35 to 5; interorbital 2.3 to 3.8; preorbital about half the diameter of eye in young (specimen 55 millimeters long), nearly as broad as eye in adult (specimen 185 millimeters long); mouth moderate, oblique; lower jaw projecting; maxillary partly exposed, reaching about to vertical from anterior margin of eye, 2.65 to 3.85 in head; premaxillary process extending about to middle of eye; lower lip with its lower margin free throughout; teeth in the jaws pointed, the anterior pair in upper jaw enlarged, canine like, the anterior pair in lower jaw small, the next two pairs enlarged similar to the anterior pair in upper jaw; gill rakers short, 7 to 9 more or less developed on the lower limb of first arch; scales rather large, somewhat reduced on nape and chest, extending on base of vertical fins, 5 rows between origin of dorsal and lateral line, about 6 rows on cheeks; dorsal fin long, the spines graduated, the last a little more than one-third the length of head, the median soft rays produced, the filaments varying in length among individuals, sometimes reaching the end of caudal fin but usually shorter, the origin of fin over margin of opercle; caudal fin round; anal spines stronger than the dorsal spines, the longest one longer than the last dorsal spine, about 2.6 in head, the origin of fin about equidistant from base of pectoral and end of anal base; ventral fins reaching past origin of anal to base of third or fourth spine in the young, shorter in the adult, the outer ray usually more or less produced; pectoral fins reaching scarcely as far back as the ventrals, 1.3 to 1.65 in head.

Color variable, a fresh specimen, 270 millimeters long, olivaceous, with a large wine-colored area in pectoral region, extending on gill covers; sides with 5 blackish blue blotches, the anterior one above origin of lateral line and the last on upper half of base of caudal; fins all olivaceous, the pectorals paler than the other fins, the

dorsal with wine-colored spots, caudal with a broad light margin, anal with a dark margin, ventrals with dark tips; iris brilliant red. Young, 40 millimeters long, greenish; sides with 7 indistinct dark bars, broader than the interspaces; a black blotch above origin of lateral line, another on median part of side above origin of anal, a third on upper half of base of caudal; fins olivaceous, the anal a little paler than the other fins, the median rays of ventrals dark. All of the smaller specimens and some of the larger ones have dark bars, or indications thereof, on the sides. Most of the larger specimens have 5 or 6 dark blotches on the sides, which in the plainer colored specimens, having no dark bars, are reduced to 3, viz, one above origin of lateral line, one on side above origin of anal, and the third on upper half of base of caudal.

Many specimens, ranging from 25 to 185 millimeters in length, were preserved. Only one specimen (185 millimeters long) has the exact color pattern described and figured by Günther in the original account of the species. Others, however, approach this pattern. In structure the present species is related to the other "Guapote," *C. motaguense*, common in certain lakes in El Salvador. *C. trimaculatum*, however, has a much deeper body, particularly in the adult. When a large series of various sizes is measured, however, due to variation in depth with age, the extremes for the two species, as shown in the description, overlap, but the average difference in depth remains evident. The average depth in the length of the body in 13 specimens of *C. trimaculatum*, ranging in length from 40 to 185 millimeters, is 2.57. In a similar series of *C. motaguense* it is 2.29. The difference in depth is not as great among the young as it is among larger fish. For example, in 5 specimens of *C. trimaculatum*, ranging in length from 127 to 185 millimeters, the range of the depth in the length is 2.12 to 2.47 (average 2.22). In *C. motaguense*, in an identical series, the range is 2.54 to 2.74 (average 2.65). In *C. trimaculatum* the head and snout are somewhat narrower and more pointed and the cheeks are not as deep and are provided with only about 6 rows of scales instead of about 8, as in *C. motaguense*. The differences in color, as shown in the description, are pronounced.

This species, although taken in streams in a few instances, is principally a lake fish. In Lakes Guija and Ilopango it is the most important food fish. The fish is said to reach a length of 355 millimeters, but the largest individual seen by us was only 270 millimeters long.

This "Guapote" is taken with hook and line, with trot lines, and with cast nets. In Lake Ilopango, a deep clear lake, the Indians, when fishing in deep water, dive and cast their nets under water. In the quality of its flesh this species ranks with the other "Guapote" (*C. motaguense*) taken in most lakes in El Salvador. It undoubtedly is the most handsome of all the fresh-water fishes of El Salvador, having both a pretty shape and pleasing color.

According to a native fisherman at Lake Ilopango this fish spawns from August to October in water varying from very shallow to 6 meters in depth. It builds nests, and the eggs and young are guarded by the adults for some time after hatching. The sexual organs in the specimens examined (taken during January) apparently were in the early stages of development, showing that the spawning season was

not near at hand when the collections were made. The contents of 5 stomachs examined consisted of the remains of fish, snails, insect larvæ, and plant fragments.

This species heretofore has been recorded from western Guatemala. The specimens in the present collection are from Lake Metapan, Lake Guija, Rio Lempa at Suchitoto and San Marcos, Lake Ilopango, Rio San Miguel at San Miguel, and Lake Olomega.

21. *Cichlasoma motaguense* (Günther)

GUAPOTE; MORO; PANDO

Heros motaguensis Günther, Trans., Zool. Soc., London, VI, 1868, 462, Pl. LXXVII, fig. 2 (Rio Motagua, Guatemala); Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1898, 1534.

Cichlasoma motaguense Regan, Ann. and Mag. Nat. Hist., XVI, 1905, 336, and Biol. Cent. Amer., Pisces, 1906, 29.

Head 2.35 to 2.8; depth 2.2 to 3; D. XVII or XVIII (rarely XIX), 10 to 12; A. VII (rarely VIII) 8 to 10; scales 30 to 32.

Body comparatively elongate; dorsal profile gently convex over the eyes in young, a little concave in adults; caudal peduncle short, its depth 2.55 to 3 in head; head longer than deep; snout long, its length 2.4 to 2.7 in head; eye 3.25 to 6.1; interorbital 3 to 4; preorbital only slightly more than half the diameter of eye in young (specimen 45 millimeters long), a little broader than eye in adult (specimen 200 millimeters long); mouth moderate, oblique; lower jaw projecting; maxillary partly exposed, reaching about to anterior margin of eye, 2.2 to 3.4 in head; premaxillary process extending to above posterior part of eye; lower lip with its lower margin free throughout; teeth in the jaws all pointed, the anterior pair in upper jaw enlarged, caninelike, the anterior pair in the lower jaw small, with several enlarged teeth on each side; gill rakers short, 7 to 9 more or less developed on the lower limb of the first arch; scales rather large, notably reduced on the chest, extending on base of vertical fins, 5 or 6 rows between origin of dorsal and lateral line, about 8 rows on cheeks; dorsal fin long, the spines graduated, the last one scarcely a third the length of head, the median soft rays produced, reaching opposite middle of caudal in large examples, shorter in young, origin of fin over opercular margin; caudal fin broadly rounded; anal spines strong, the last one a little longer than the last dorsal spine, the soft portion similar to that of the dorsal, origin of fin usually about an eye's diameter nearer base of pectorals than base of caudal; ventral fins inserted a little behind base of pectorals, the exterior ray produced in adult, usually extending to origin of anal; pectoral fins extending scarcely as far back as the ventrals, 1.5 to 1.7 in head.

The color varies with age and also among individuals. A specimen, 260 millimeters in length, when removed from the water, possessed the following coloration: Very dark green above; lower parts of sides lighter; underneath dusky with punctulations; snout brassy; sides with black blotches forming a more or less continuous lateral band; a large black blotch on upper part of opercle; a black caudal spot; sides of head with dark brassy spots; dorsal and anal very dark green with dark spots; caudal somewhat lighter green with dark spots; ventrals dark; pectorals plain brassy. Color of a large specimen, 300 millimeters long, immediately after being removed from the water, bluish silvery on back; lower part of sides pale silvery; belly dingy white; sides with dark blotches forming an interrupted lateral

band; body and head, except snout, everywhere with rusty spots; pectorals plain translucent; ventrals dusky; other fins slightly brownish and everywhere with rusty spots, usually surrounded by blue. Young with alternating dark and light cross-bars; the dark lateral band more pronounced than in large examples, except occasionally in the very young (50 millimeters and less in length), in which it is often quite indistinct; these young with a prominent black spot on sides below lateral line at end of pectoral fin and a prominent caudal spot. Most specimens have a dark bar extending from the upper posterior margin of the eye across opercle; not quite connecting with a dark spot just above base of pectoral; another dark bar, frequently consisting of two separate spots, extending from lower posterior margin of eye to lower margin of gill opening.

This rather common lake fish is represented by many specimens, ranging from 25 to 300 millimeters in length. The specimens in hand agree fairly well with published accounts of *C. motaguense*, the types of which are reported from the Rio Motagua, Atlantic slope, Guatemala, and subsequently other specimens were recorded from the "Pacific slope of Central America" from El Rancho, on the Rio Motagua, and from Belize. The El Salvador specimens were taken in lakes and ponds, not a single one having been secured in streams. The apparent difference in habitat between the type specimens of *C. motaguense* and the El Salvador specimens suggests that they may not be identical. In the absence of material for comparison it seems advisable to refer the specimens in the present collection, tentatively at least, to *C. motaguense*.

This is the most common and most important food fish in Lakes Ahuachapan and Coatepeque. In Lake Guija only one specimen was taken, and the species was not seen among the catches of native fishermen. In Lake Chanmico a few small individuals were taken. In three small, spring-fed reservoir ponds at El Angel, situated on private property where the fish are protected, this was the most common species, and the largest individual (330 millimeters in length) seen was taken in one of the ponds.

In Lake Coatepeque this is the only food fish of importance taken. The only other cichlid found there is the small "burro," *C. nigrofasciatum*. The fish in Lake Coatepeque are taken mostly with hook and line and in rather deep water. Several fishermen, during our visit, made fairly good catches fishing at a depth of 25 meters.

This "Guapote" is a good food fish, the flesh being fairly firm and of good flavor. It reaches a larger size than any of the other cichlids, the maximum size attained; according to a local fisherman on Lake Ahuachapan, being about 500 millimeters.

The spawning season and habits are very imperfectly or not at all known. The specimens examined had the sexual organs undeveloped, showing that the spawning season was not near at hand when the specimens were collected (January and February). The food of this fish, according to 6 stomachs examined, in the young consists of entomostracans, insects and other small animal life, and algæ. Larger individuals feed on fish, crustaceans, and probably on plants.

The species is recorded from the Atlantic slope of Guatemala, from British Honduras, and from the "Pacific slope of Central America." The specimens from El Salvador were taken in Lakes Guija, Ahuachapan, Coatepeque, Chanmico, and in small ponds at El Angel.

Order GOBIOIDEA

Family XI. ELEOTRIDÆ

Body elongate, slender or robust; vomerine teeth usually wanting (present in *Gobiomorus*); premaxillaries protractile; opercle unarmed; orbital margin not free, continuous with skin of head; lateral line wanting; dorsal fins 2; caudal fin convex; ventral fins close together but separate, composed of I, 4 or I, 5 rays.

15. Genus GOBIOMORUS Lacépède

Gobiomorus Lacépède, Hist. Nat. Poiss., II, 1800, 583 (type *Gobiomorus dormitor* Lacépède).

Philypnus Cuvier and Valenciennes, Hist. Nat. Poiss., XII, 1837, 235 (type *Gobiomorus dormitor* Lacépède).

Lembus Günther, Cat. Fish., Brit. Mus., I, 1859, 505 (type *Lembus maculatus* Günther).

Body elongate, anteriorly subcylindrical, posteriorly compressed; mouth large; lower jaw projecting; teeth small, in bands on jaws and on vomer; gill opening large, extending forward to under eye; scales rather small, ctenoid; dorsal fins well separated, with VI-I, 9 rays; anal fin with I, 9 to I, 11 rays. A single species was taken in El Salvador.

22. *Gobiomorus maculatus* (Günther)

GVINA

Lembus maculatus Günther, Cat. Fish., Brit. Mus., I, 1859, 505 (Andes of Ecuador).

Philypnus lateralis Gill, Proc., Ac. Nat. Sci., Phila., 1860 (1861), 123 (Cape San Lucas); Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1898, 2195.

Eleotris lembus Günther, Cat. Fish., Brit. Mus., III, 1861, 121 (Western Ecuador).

Gobiomorus lateralis Eigenmann and Fordice, Proc., Ac. Nat. Sci., Phila., 1885 (1886), 69.

Gobiomorus maculatus Eigenmann and Fordice, Proc., Ac. Nat. Sci., Phila., 1885 (1886), 70.

Philypnus maculatus Regan, Biol. Cent. Amer., Pisces, 1906, 5, Pl. I, fig. 2; Meek and Hildebrand, Pub., Field Mus. Nat. Hist., Zool. Ser. X, 1916, 352.

Head 3 to 3.4; depth 3.45 to 5.5; D. VI-I, 9; A. I, 10 or 11; scales 55 to 59.

Body elongate, not much deeper than broad anteriorly, compressed posteriorly; caudal peduncle rather strongly compressed, its least depth 2.5 to 3 in head; head long, somewhat depressed; snout long and broad, its length 3.05 to 3.55 in head; eye 4 to 5.2; interorbital 3.6 to 5; mouth large, oblique; lower jaw strongly projecting; maxillary reaching middle of eye, 2.35 to 2.6 in head; teeth small, pointed, in bands on jaws and on vomer; gill rakers minute; lateral line wanting; scales ctenoid, extending forward on head to end of premaxillary processes; origin of spinous dorsal about an eye's diameter behind base of pectorals, the spines weak; origin of soft dorsal about an eye's diameter in advance of anal; caudal fin rounded; anal fin similar to soft dorsal; ventral fins inserted slightly behind base of pectorals, reaching a little more than half the distance to origin of anal; pectoral fins reaching to or a little beyond tips of ventrals, 1.3 to 1.6 in head.

Color of a fresh specimen, 80 millimeters in length, olivaceous, with indefinite and irregular dark markings above; pale underneath; sides with a black lateral band; preopercle with 2 horizontal bands, one extending backward from upper posterior margin of eye, the other a more definite one extending backward from lower posterior margin of eye; a dark band underneath eye; ventral fins pale; other fins greenish; spinous dorsal with black punctulations. In some specimens the dorsal and caudal fins are spotted with dusky markings which are arranged in irregular vertical bars on the caudal.

Several small specimens, ranging in length from 30 to 115 millimeters, were taken in the Rio Lempa. One small specimen was seined at Suchitoto, and all the others were taken at San Marcos, where the species appears to be common in the quiet, shallow, or disconnected pools of the river. No large individuals were seen.

This fish inhabits Pacific-slope streams from Lower California to Peru. The specimens in the present collection are from the Rio Lempa at Suchitoto and San Marcos.

Part II.—ANNOTATED LIST OF MARINE FISHES COLLECTED AT THE PORTS OF TRIUNFO AND CUTUCO, EL SALVADOR

Only part of a day was devoted to collecting at each, Triunfo and Cutuco. Triunfo is situated on a salt-water estuary lying wholly within the Departamento de Usulután. Cutuco is on Fonseca Bay and is one of the principal ports of El Salvador.

Fish appeared to be rather scarce at both ports during our visit, particularly as to variety. It is only to be expected, of course, that the abundance of fish life varies somewhat with the season. It is probable, however, that fishing is not very profitable, as little of it is being done. So far as known, no regular fisheries, in which modern equipment is used, have been established anywhere along the coast of El Salvador. All fishing observed by the writer was carried on with hook and line and with the cast net, and only very small catches were made. Because of the great scarcity of fresh-water fishes it would be a great help to the Republic if the supply could be more abundantly augmented from the sea. It is entirely possible that this could be done. The duty assigned to us was an investigation of the fresh waters; the two visits to salt water were only incidental, and the time devoted to salt-water collecting and the results obtained are too meager to form the basis for any conclusions. The results obtained, as shown by the following list of species and notes, therefore, should not be interpreted to mean that profitable marine fisheries could not be established. Furthermore, it is not known that fishing with modern gear has been given a trial.

Family CLUPEIDÆ

1. *Opisthonema libertatis* (Günther)

Meletta libertatis Günther, Proc., Zool. Soc., London, 1866, 603 (La Libertad).

Clupea libertatis Günther, Cat. Fish. Brit. Mus., VII, 1868, 433.

Opisthonema libertate Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 433; Meek and Hildebrand, Pub., Field Mus. Nat. Hist., Zool. Ser., XV, 1923, 188.

Several juveniles were seined at Triunfo. The species is known from Mexico south to Panama Bay.

Family ENGRAULIDÆ

2. *Stolephorus exiguus* (Jordan and Gilbert)

Stolephorus exiguus Jordan and Gilbert, Proc., U. S. Nat. Mus., IV, 1881 (1882), 342 (Mazatlan); Jordan and Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 442.

Anchovia exigua, Meek and Hildebrand, Pub., Field Mus. Nat. Hist., Zool. Ser., XV, 1923, 200.

Many specimens of this species were seined both at Triunfo and Cutuco. The species ranges from Mazatlan to Panama.

3. *Stolephorus panamensis* (Steindachner)

Engraulis panamensis Steindachner (Sitzb. k. Ak. Wiss. Wien., LXXII) Ichth. Beitr., IV, 1875, 39 (Panama).
Stolephorus panamensis Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 448.
Anchoia panamensis Meek and Hildebrand, Pub., Field Mus. Nat. Hist., Zool. Ser., XV, 1923, 207, Pl. XV, fig. 1.

A few small specimens were seined at Triunfo.

4. *Stolephorus rastralis* (Gilbert and Pierson)

Stolephorus rastralis Gilbert and Pierson, in Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 2311 (Panama).
Anchoia rastralis Meek and Hildebrand, Pub., Field Mus. Nat. Hist., Zool. Ser., XV, 1923, 209.

Many specimens, which appear to belong to this species, were seined at Triunfo. This fish previously was recorded only from Panama.

5. *Stolephorus brevirostris* (Meek and Hildebrand)

Anchoia brevirostra Meek and Hildebrand, Pub., Field Mus. Nat. Hist., Zool. Ser., XV, 1923, 198, Pl. XII, fig. 1 (Balboa, Panama).

Two small specimens, which appear to belong to this species, recently described from the Pacific coast of Panama, were seined at Cutuco.

Family ATHERINIDÆ

6. *Thyrinops pachylepis* (Günther)

Atherinichthys pachylepis Günther, Proc., Zool. Soc., London, 1864, 25, and Trans., Zool. Soc., London, VI, 1868, 443 (Panama).
Menidia pachylepis Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 801.
Thyrina pachylepis Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 2840; Regan, Biol. Cent. Amer., Pisces, 1907, 64.
Kirtlandia pachylepis Gilbert and Starks, Memoir., Calif. Ac. Sci., IV, 1904, 57.
Thyrinops pachylepis Hubbs, Proc., Ac. Nat. Sci., Phila., LXIX, 1917 (1918), 307; Jordan and Hubbs, Leland Stanford, Jr., Univ. Pub., Univ. Ser., 1919, 62.

Several specimens of this species were taken in Fonseca Bay at Cutuco. The species has previously not been recorded north of the coast of Costa Rica. The known range now extends from El Salvador to Ecuador.

Family MUGILIDÆ

7. *Mugil curema* (Cuvier and Valenciennes)

LIZA; LIEBRA ANCHA

Mugil curema Cuvier and Valenciennes, Hist. Nat. Poiss., XI, 1836, 87 (Brazil; Martinique-Cuba); Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 813, Pl. CXXVI, fig. 344; Meek and Hildebrand, Pub., Field Mus. Nat. Hist., Zool. Ser., XV, 1923, 279. (For a more complete synonymy and other references see the two last-mentioned works.)

A few small specimens of this species were taken in salt water at Triunfo.

Family POLYNEMIDÆ

8. *Polynemus approximans* (Lay and Bennett)

Polynemus approximans Lay and Bennett, Zool. Beechey's Voyage, Fishes, 1849, 57 (Mazatlan); Meek and Hildebrand, Pub., Field Mus. Nat. Hist., Zool. Ser., XV, 1923, 290.
Polydactylus approximans Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 829.

Two small specimens were seined at Cutuco. In some localities this fish is of considerable commercial importance. Its range extends from California to Peru.

Family CARANGIDÆ

9. *Caranx hippos* (Linnæus)

AUREL

Scomber hippos Linnæus, Syst. Nat. Ed., XII, 1766, 494 (Charleston, S. C.).

Caranx hippos Jordan and Evermann, Bull. U. S. Nat. Mus., XLVII, 1896, 920, Pl. CXXI, fig. 387.

Several small specimens of this common and widely distributed food fish were seined at Triunfo and Cutuco. The species is known from the warmer waters of both coasts of America and also from the East Indies.

10. *Oligoplites mundus* (Jordan and Starks)

Oligoplites mundus Jordan and Starks, in Jordan and Evermann, Rept., U. S. Fish Commission, 1896, 344, and Bull., U. S. Nat. Mus., XLVII, 1896, 2844 (Mazatlan).

A single small specimen was seined at Triunfo. The species ranges from the Gulf of California to Ecuador.

11. *Oligoplites saurus* (Bloch and Schneider)

Scomber saurus Bloch and Schneider, Syst. Ichth., 1801, 321 (Jamaica).

Oligoplites saurus Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 898.

Three small specimens were seined at Triunfo. The species is of no commercial value. It occurs on both coasts of tropical America.

Family CENTROPOMIDÆ

12. *Centropomus pectinatus* (Poey)

ROBALO; ROVALO

Centropomus undecimalis Cuvier and Valenciennes (part), Hist. Nat. Poiss., II, 1828, 102.

Centropomus pectinatus Poey, Memorias, II, 1860, 121 (Cuba); Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 1122.

Two specimens, respectively 220 and 280 millimeters in length, were taken at Triunfo. A large specimen, 350 millimeters long, was taken in fresh water in the Rio Lempa at San Marcos.

13. *Centropomus robalito* (Jordan and Gilbert)

ROBALO; ROVALO

Centropomus armatus Günther (not Gill), Trans., Zool. Soc., London, 1868, 408.

Centropomus robalito Jordan and Gilbert, Proc., U. S. Nat. Mus., IV, 1881 (1882), 462 (Mazatlan; Acapulco); Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 1123.

A single small specimen was secured at Triunfo and several others in fresh water in the Rio Lempa at San Marcos.

Family EPINEPHELIDÆ

14. *Epinephelus analogus* (Gill)

PARGO TIGRE

Epinephelus analogus Gill, Proc., Ac. Nat. Sci., Phila., 1864, 163 (Panama); Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1896, 1152.

Serranus courtadti Bocourt, Ann. Sci. Nat., Paris, 1868, 222 (La Union, San Salvador).

A single specimen, 235 millimeters in length, was taken at Cutuco. The range of the species extends from Mexico to Panama and the Galapagos and Revillagigedo Islands.

Family LUTIANIDÆ

15. *Lutianus argentiventris* (Peters)

PARGO; PARVO

Mesoprion argentiventris Peters, Berlin. Monatsber., 1869, 704 (Mazatlan).*Neomaenis argentiventris* Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1898, 1260.

Several individuals of this species were killed with dynamite in the estuary at Triunfo, where this snapper appears to be common. It was not seen in fresh water. The species is known from Lower California to Ecuador.

16. *Lutianus novemfasciatus* (Gill)

PARGO; PARVO

Lutianus novemfasciatus Gill, Proc., Ac. Nat. Sci., Phila., 1862, (1863), 251 (Cape San Lucas).*Neomaenis novemfasciatus* Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1898, 1252.

Many individuals of this species were killed with dynamite in the estuary at Triunfo. One large individual, 475 millimeters in length, which could not at the time be preserved, was taken in the same way in strictly fresh water in the Rio Lempa at San Marcos. Measurements, counts, and a color description were made in the field, and it is believed that this fish belonged to the present species. This snapper appears to be one of the most plentiful food fishes in the estuary at Triunfo. The species ranges from Lower California to Colombia.

Family POMADASIDÆ

17. *Orthopristis chalceus* (Günther)

RONCAN

Pristipoma chalceum Günther, Proc., Zool. Soc., London, 1864, 146, and Trans., Zool. Soc., London, VI, 1868, 415 (Panama Bay).*Pristipoma kneri* Steindachner (Sitzb. k. Ak. Wiss. Wien, LX) Ichth. Notiz., VIII, 1869, 3, Pl. II (Mazatlan).*Pristipoma chalceus* Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1898, 1337.

A single specimen, 185 millimeters in length, was secured at Triunfo. This is an important food fish in some sections on the Pacific coast of Central America. Its range extends from Lower California to Panama and the Galapagos Islands.

18. *Pomadasis panamensis* (Steindachner)*Pristipoma panamense* Steindachner (Sitzb. k. Ak. Wiss. Wien., LXXII) Ichth. Belt., III, 1875, 8, Pl. I, fig. 1 (Panama Bay).*Pomadasis panamensis* Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1898, 1331.

A single specimen, 170 millimeters long, was secured at Triunfo. Most of the representatives of this genus frequent fresh water, but it is not known that the present species enters streams. The species ranges from Guaymas to Panama.

19. Anisotremus dovii (Günther)

BERNEGATE

Pristipoma dovii Günther, Proc., Zool. Soc., London, 1864, 23, Pl. III, fig. 1, and Trans., Zool. Soc., London, VI, 1868, 414 (Panama).
Anisotremus dovii Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1898, 1317.

A single specimen, 165 millimeters in length, was taken at Cutuco. It was the only one among a dozen of its nearest relative, *A. pacifici*. The species ranges from Mazatlan to Panama.

20. Anisotremus pacifici (Günther)

BERNEGATE

Conodon pacifici Günther, Proc., Zool. Soc., London, 1864, 147, and Trans. Zool. Soc., London, VI, 1868, 417, Pl. LXIV, fig. 3 ("Chiapam," Pacific coast of Guatemala).
Anisotremus pacifici Jordan and Evermann, Bull., U. S. Nat. Mus. XLVII, 1898, 1316.

Several specimens of this species were seen at Triunfo and Cutuco, and three were preserved. It appears to be among the common food fishes in Fonseca Bay. The range of this species extends from Guatemala to Guayaquil.

Family GERRIDÆ**21. Gerres peruvianus Cuvier and Valenciennes**

MOJARRA

Gerres peruvianus Cuvier and Valenciennes, Hist. Nat. Poiss., VI, 1830, 467 (Payta, Northern Peru); Jordan and Evermann Bull., U. S. Nat. Mus., XLVII, 1898, 1376.

Several small specimens were seined at Triunfo, where the species appears to be common. Its range extends from Mazatlan to northern Peru.

Family EPHIPPIDÆ**22. Chætodipterus zonatus (Gerard)**

CHOPA

Ephippus zonatus Girard, Exp. Surv. R. R. Route, Miss. R. to Pac. Ocean, 1858, 110 (San Diego, Calif.).
Chætodipterus zonatus Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1898, 1668.

A single specimen, 270 millimeters in length, was taken at Triunfo. The species ranges from California to Ecuador.

Family GOBIIDÆ**23. Gobionellus sagittula (Günther)**

Euctenogobius sagittula Günther, Proc., Zool. Soc., London, 1861, 3 (west coast of Central America).
Gobius longicaudus Jenkins and Evermann, Proc., U. S. Nat. Mus., XI, 1888, (1889), 146 (Guaymas).
Gobionellus sagittula Jordan and Evermann, Bull., U. S. Nat. Mus., XLVII, 1898, 2228; Gilbert and Starks, Memotr., Cal. Ac. Sci., IV, 1904, 171.

Seven fine specimens, ranging in length from 32 to 78 millimeters, were seined in the estuary at Triunfo. The species ranges from the Gulf of California southward to Ecuador.