



3223

## 8.—REPORT ON A COLLECTION OF FISHES FROM THE RIVERS OF CENTRAL AND NORTHERN MEXICO.

By ALBERT J. WOOLMAN.

In the summer of 1891 the writer was a member of a party which, under the direction of Dr. J. T. Scovell, of Terre Haute, Ind., traversed the northeastern and central parts of Mexico for the purpose of making certain studies of Mount Orizaba. With the assistance of Mr. Ulysses O. Cox, of Mankato, Minn., collections of fishes were made in the mountain streams at intervals between El Paso, Tex., and Orizaba, Mexico. A list of the species obtained and notes on the same are given in the present paper.

In mountainous regions the number of species of fishes is small, and this is especially true in Mexico, where the streams are short, their basins isolated, and the volume of water varying greatly from one season to another. The present collection contains twenty-four species of fishes, and, although small, it is of unusual interest, as six of the species obtained and one genus were new to science. As the entire collection was made in the headwaters of the streams all the forms obtained are strictly fresh-water species.

Seven families are represented in the collection. Of those taken south of the Rio Grande, nearly 50 per cent are *Cyprinidae* and 30 per cent *Cyprinodontidae*, while the remaining 20 per cent are divided among five other families; the *Percidae* have two representatives in the genus *Etheostoma*, the only spiny-rayed fishes obtained; the *Catostomidae*, *Siluridae*, *Characidae*, and *Atherinidae* are each represented by a single species.

A notable feature of the fishes of this region is the uniformity in the teeth of the *Cyprinidae*, the dental formula in almost every case being 0, 4-4, 0. The scales of Mexican species are, as a rule, smaller than those of the related species taken farther north. Variability and richness of color are also more pronounced.

The writer is indebted to Dr. David S. Jordan, president of Leland Stanford Junior University, and Dr. Carl H. Eigenmann, professor of geology, University of Indiana, for assistance and suggestions in the preparation of this paper. Duplicate specimens of the species obtained are deposited in the U. S. National Museum, at Washington, D. C., in the museums of Leland Stanford Junior University and the Indiana University, and in the British Museum, London, England.

## CLASSIFIED LIST OF THE SPECIES OBTAINED.

- |  |  |
|--|--|
| <p>Order Nematognathi.<br/>         Family Siluridæ.<br/>           <i>Ictalurus punctatus</i>. Rio Grande.<br/>           <i>Ameiurus dugesi</i>. Rio Lerma.<br/>           <i>Leptops olivaris</i>. Rio Grande.</p> <p>Order Eventognathi.<br/>         Family Catostomidæ.<br/>           <i>Moxostoma congestum</i>. Rio Grande.<br/>           <i>Moxostoma austrinum</i>. Rio Lerma.</p> <p>Family Cyprinidæ.<br/>           <i>Notropis lutrensis</i>. Rio Conchos.<br/>           <i>Notropis aztecus</i>. City of Mexico.<br/>           <i>Notropis ornatus</i>. Rio Conchos.<br/>           <i>Notropis chihuahua</i>. Rio Conchos.<br/>           <i>Notropis orca</i>. Rio Grande.<br/>           <i>Leuciscus nigrescens</i>. Rio Conchos.<br/>           <i>Campostoma ornatum</i>. Rio Lerma;<br/>             Rio Conchos.<br/>           <i>Couesius adustus</i>. Rio Conchos.<br/>           <i>Hybopsis altus</i>. Rio Lerma.<br/>           <i>Hybopsis æstivalis</i>. Rio Grande.<br/>           <i>Pimephales promelas confertus</i>. Rio<br/>             Conchos.<br/>           <i>Algansea dugesi</i>. Rio Lerma.</p> | <p>Order Eventognathi—Continued.<br/>         Family Cyprinidæ—Continued.<br/>           <i>Evarra eigenmanni</i>. Canals, City of Mex-<br/>             ico.<br/>           <i>Hybognathus melanops</i>. Rio Conchos.</p> <p>Family Characinidæ.<br/>           <i>Tetragonopterus argentatus</i>. Rio Conchos.</p> <p>Order Haplomi.<br/>         Family Cyprinodontidæ.<br/>           <i>Gambusia nobilis</i>. Rio Conchos.<br/>           <i>Gambusia infans</i>. Rio Lerma.<br/>           <i>Pseudoxiphophorus bimaaculatus</i>. Ori-<br/>             zaba.<br/>           <i>Cyprinodon eximius</i>. Rio Conchos.<br/>           <i>Cyprinodon elegans</i>. Rio Conchos.<br/>           <i>Characodon variatus</i>. Rio Lerma.</p> <p>Order Percoces.<br/>         Family Atherinidæ.<br/>           <i>Chirostoma jordani</i>. City of Mexico and<br/>             Rio Lerma.</p> <p>Order Acanthopteri.<br/>         Family Percidæ.<br/>           <i>Etheostoma micropterus</i>. Rio Conchos.<br/>           <i>Etheostoma australe</i>. Rio Conchos.</p> |
|--|--|

## RIO GRANDE AT EL PASO DEL NORTE.

The Rio Grande was examined above the waterworks at El Paso. At this place there is a shallow ripple, but the bed of the stream is so rocky that a seine is handled with difficulty. Comparatively few species were taken, though the ripple was quite thoroughly seined. Following is a list of the species obtained:

1. *Ictalurus punctatus* (Rafinesque). *Channel Cat*. Very abundant; twenty or more specimens taken, averaging 10 inches in length.
2. *Leptops olivaris* (Rafinesque). *Flathead* or *Mud Cat*. Not common; only a few specimens taken.
3. *Moxostoma congestum* (Baird & Girard). Abundant.
4. *Notropis orca*, sp. nov. Teeth 2, 4-4, 2, strongly hooked. Head,  $4\frac{1}{2}$ ; depth, 5; eye, 4, small, slightly shorter than snout; D. 1, 7; A. 1, 8; scales, 8-12-4. Body plump, little compressed, with broad back and belly; dorsal outline somewhat elevated; head heavy, snout blunt, decurved; mouth subinferior, little oblique, lower jaw slightly included; maxillary scarcely reaching vertical of pupil; top of head unusually high and transversely rounded, so that the eye is as near to the lower as to the upper profile of the head. Interorbital space very wide and very convex, equal to the distance from tip of snout to pupil. Fins moderate; origin of dorsal a little nearer snout than base of caudal, slightly behind insertion of ventrals; dorsal high, falcate, its first rays longest,  $1\frac{1}{2}$  in length of head, its last rays less than half length of first; anal not so high, its longest rays  $1\frac{1}{2}$  in head and about twice as long as its last ray; margin concave; pectorals slightly falcate, almost reaching ventrals,  $1\frac{1}{2}$  in head; ventrals short, 2 in head, not reaching vent; caudal very deeply forked, the middle rays  $2\frac{1}{2}$  in longest lateral ones, which are as long as head. Scales rather large, thin; lateral line somewhat decurved. Color, in spirits, pale; sides with a broad silvery band, as broad as length of snout, bordered above by a narrow plumbeous line; back sparsely covered with fine dark punctuations, median line of back with a faint plumbeous band; top of head darkish, rest of head silvery; under parts pale; fins pale. Length,  $3\frac{1}{2}$  inches. Rio Grande, at El Paso, Tex.
5. *Hybopsis æstivalis* (Girard.) Typical example; the species was originally described from the Rio Grande basin.

## RIO DE LOS CONCHOS AT CHIHUAHUA, MEXICO.

The river bed of the Rio de los Conchos, at Chihuahua, is more than half a mile in width, with numerous sand bars and depressions. It is, however, very little more than a bed, owing to the almost total lack of rainfall in this region throughout the year. Hence, the water in this large river bed is reduced to a very diminutive stream, which is brought from the mountains, 10 miles distant, by an aqueduct, to supply the city. About a mile below the city the stream is dammed, in order to make the water available for irrigation. Here on one side the bank is high and rocky, and the water entirely too deep for seining. The other shore is composed of a sand bank that slopes very gradually to the deeper water, and is easily accessible. The bed of the river is covered with several inches of mud; and, in the more shallow places, is thickly overgrown with waterweeds and other vegetation. The more quiet waters swarm with small fishes, which, for the most part, belong to the family *Cyprinidae*. At the upper end of the pond, caused from damming the waters, is a clear, shallow ripple, from which a number of darters and two or three species of *Cyprinodontidae* were taken. The following species were collected from this stream:

1. *Campostoma ornatum* Girard. This was one of the most abundant species in this locality. The adults differ but little in color and general shape from *Campostoma anomalum*; the sides, and especially the caudal peduncle, were marked with scattered dark spots; dark humeral bar present; orbit small and rounded. Head in length, 4; depth in length, 4+; eye in head, 5+. Four specimens of an average size measured as follows:

Length.	Head.	Depth.	Eye.	Lateral line.
mm.	mm.	mm.	mm.	
85	22.5	21+	4	73
80	20	20	4-	73
77	20	18	4-	72
77	20	20	4-	72

2. *Pimephales promelas confertus* (Girard). Two specimens taken; one a very large male with very bright colors, black with two broad light crossbands; pectoral fins white, except the black outer edge, which is followed by a narrow, sharply defined streak of silver. Lateral line complete.
3. *Couesius adustus* sp. nov. Body moderately elevated, compressed; the back a little elevated, the anterior profile somewhat convex; snout rather long, slightly pointed,  $3\frac{1}{4}$  in head; mouth low, terminal oblique, the jaws subequal, the maxillary opposite the posterior nostril; barbel small, flattish; eye moderate,  $3\frac{1}{2}$  to 4 in head; preorbital broad; interorbital space broad; scales small; those before dorsal and on belly smaller; lateral line decurved. Dorsal inserted a little behind ventrals, high and pointed; lower fins short, the pectorals not reaching ventrals, the latter to vent. Olivaceous, dusky above, sides silvery; a narrow plumbeous lateral band ending in the young in a small black caudal spot, obsolete in the adult; fins all plain. Head,  $4\frac{1}{4}$ ; depth,  $4\frac{2}{3}$ ; D. 8; A. 7. Scales, 13-58-8, 27 before dorsal; teeth, 2, 4-4, 2. Length, 102 mm. Three specimens were taken in the Rio de los Conchos at Chihuahua. The smallest, 65 mm. long, is more silvery and with the back somewhat arched; the barbel proportionally much longer and the black caudal spot distinct. It is probably, however, of the same species as the others.
4. *Leuciscus nigrescens* (Girard). (*Tigoma nigrescens*, *Tigoma pulchra*, and *Tigoma pulchella* Girard, Proc. Acad. Nat. Sci. Phila., VIII, 1856, 207; *Clinostomus pandora* and *Gila gula* Cope.) Body elongate; head long, conical; mouth large, terminal, slightly oblique; back slightly arched, shoulders heavy; dorsal well behind ventral; anterior part of dorsal mid-

way between snout and fork of caudal; ventrals midway between snout and base of caudal; lateral line decurved, parallel with line of belly, and followed about 1 mm. above by a narrow dark lateral stripe that ends in a dark caudal spot. Teeth, 1, 4-4, 1 in one specimen examined, but this species is said to have a very variable dentition.

Length.	Head.	Depth.	Eye.	Lateral line.
<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	
68	20	17	4.5	65
67	19	17	4.5	66
59	17	15	4+	65

5. *Notropis ornatus* (Girard). Abundant. Body very deep; head short and blunt; mouth terminal, slightly oblique; snout profusely tubercled; scales much deeper than long, very much as in *Notropis cornutus*; color smoky brown above, shading to lighter below lateral line; body with a distinct lateral stripe from the upper posterior margin of the opercle to the caudal; this is often faint or even obliterated on the anterior part of the body, but always distinct on the caudal peduncle. The body is barred with eight or ten dark vertical bars that extend from near the upper part of the body to below the lateral line. The fins are all dusky; dorsal, anal, and caudal, each with a dark bar near the outer margin; fins short; the base of the dorsal about one-half length of head; longest rays, from snout to opercle, little longer than the rays of the anal. Insertion of first rays of dorsal midway between anterior orbit and base of caudal, slightly behind ventrals, which are about midway between base of caudal and snout. The measurements of six adult specimens were:

Length.	Head.	Depth.	Lateral line.	Dorsal.	Anal.
<i>mm.</i>	<i>mm.</i>	<i>mm.</i>			
56	14.5	20	37	8	8
55	14.5	20-	37	8	8
55	15.5	20-	38	8	8
58	15.0	21	38	8	8
55	14.5	20	37	8	8
59	15.0	19+	38	8	8

6. *Notropis lutrensis* (Baird & Girard). Color (of males especially) very bright; back light olive; sides light blue, covered with white pigment; belly white; a dark or steel blue vertical bar (width of eye) just back of the opercle; head profusely tubercled, principally in three longitudinal rows; a few of the females contained eggs. Head in body, 4; depth in body, 3+.

Length.	Head.	Depth.	Lateral line.	Dorsal rays.	Anal rays.
<i>mm.</i>	<i>mm.</i>	<i>mm.</i>			
53	13	18	35	8	8
52	13	17	36	8	8
46	11.5	15	35	8	8

7. *Notropis chihuahua* Woolman. (Amer. Nat., vol. XXVI, 260, March, 1892.)

Body elongate, back but slightly elevated, rising gradually from snout to front of dorsal; head large; snout blunt, somewhat decurved; mouth medium, terminal almost horizontal; maxillary scarcely reaching front of eye; eye large, nearly 4 in head, longer than snout, but not quite equal interorbital space; anterior part of dorsal midway between snout and caudal; scales deeper than long, not crowded anteriorly; lateral line almost straight, and complete. Color light-olive or brown above; edges of scales above the lateral line sprinkled with irregularly placed, small, dark-brown dots; vertebral line present, but not conspicuous; sides of body with a plumbeous lateral stripe of about the width of the eye;

this lateral stripe can be traced through the eye and around the snout; the upper lip thickly sprinkled with minute dark dots, which, however, do not touch the lower lip; the lateral stripe terminates in an irregular spot at the base of the caudal; sides below the lateral line silvery; belly plain white. The fins are all plain except the dorsal and caudal, which are dusky, but without distinct markings; teeth, 0, 4-4, 0; grinding surfaces present, but small; ends of teeth hooked. Head in length of body nearly 4; depth, 4.

Following are measurements of a few adult specimens.

Length.	Head.	Depth.	Eye.	Lateral line.	Dorsal rays.	Anal rays.
<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>			
58	15	15	4	34	8	7
58	15	15	4	37	9	7
57	15-	14	4	35	8	7
53	13+	15+	3.5	34	8	7
50	12	13.5	3.5	36	8	7
49	12	13	3.5	33	9	7
54	14	14	4-	33	9	7
53	13+	14	4-	35	8	7
51	13	14	3.5	34	8	7
50	14.5	13	3.5	36	8	7

**8. *Hybognathus melanops* (Girard).** Two specimens. Body short and compressed; head small and short; nose blunt but not decurved; nape low, so that the profile does not present a regular curve; mouth small, terminal, forming a semicircle; eye large, length of snout; less than 4 in head. Dorsal about the width of one scale nearer snout than anal fin, and placed slightly in front of ventrals; base of ventrals short, equaling distance from snout to posterior edge of orbit; longest rays equaling distance from anterior orbit to posterior margin of opercle; when compressed the ends of rays reach first rays of anal. Ventrals short, reaching almost to vent. Color dark olive above, lighter below lateral line; sides covered with a very thin coat of silver, which extends to scales above lateral line; fins all pale and plain; no lateral band, vertebral stripe, or caudal spot. Teeth, 0, 4-4, 0, white, compressed. Scales, 6 or 7-42 or 43-1. Depth,  $3\frac{1}{2}$  in length; head about 4 in length. This is certainly the *Dionda melanops* of Girard, and several other nominal species may be identical with it.

**9. *Cyprinodon eximius* Girard.** (Girard, Proc. Acad. Nat. Sci. Phila. 1856; U. S. and Mex. Bound. Surv., Icht., 67, 1859.)

Body short and deep; back much arched; profile presenting a regularly curved line from snout to anterior margin of dorsal; dorsal fin high, light in color, and almost plain; anal, pectoral, and ventral fins dusky; caudal spotted and with a black margin, which is preceded by a light bar of about the same width. These specimens differ from Girard's description and figure of *Cyprinodon gibbosus* (= *variatus*) in that the dark caudal bar is preceded by a light stripe, and the dorsal is very light and placed slightly behind the ventrals. Head in body,  $3\frac{1}{2}$ ; depth,  $2\frac{1}{2}$ ; eye in head, 4.

Total length.	Length to caudal.	Head.	Depth.	Eye.	Dorsal.	Anal.	Lateral line.
<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>			
58	48	15+	23	4	10	11	28
56	46.5	13+	20	3.5	11	11	26
61	50.5	17+	24	4	10	11	28

**10. *Cyprinodon elegans* Girard.** (*Cyprinodon variegatus* Lacépède?; *Cyprinodon gibbosus* Girard.)

Body subelliptical; head short; nose blunt; mouth small, terminal; humeral scale large; color much variegated from the dark centers in many of the scales; these sometimes arranged on caudal peduncle and sides, so as to give a faint outline of bars; opercle silvery, iridescent; anal, ventrals, and pectorals light; caudal marked with a dusky bar near its origin; dorsal fin short and low, length about equal the narrowest place in the caudal peduncle; longest rays equal distance from snout to posterior margin of the orbit; anterior

margin of dorsal slightly nearer caudal than snout; a dark spot on the last rays of the dorsal; margin of ventrals almost under origin of dorsal. Head in body,  $3\frac{1}{2}$ ; depth,  $2\frac{1}{2}$ ; eye in head, 3. Common, but not as plentiful as *Cyprinodon eximius*. These specimens probably belong to the species called *Cyprinodon elegans* by Girard.

11. *Gambusia nobilis* Baird & Girard. The general form and color is that of *Gambusia affinis*. Notwithstanding the wide range and variability of *G. affinis* there are some constant differences in specimens from this locality that possibly amount to specific importance. The depth, although somewhat hard to determine on account of the young in the abdomen, appears to be greater than that of *G. affinis*; the scales are also smaller, there being 36 to 38 against 30 to 33 in *G. affinis*. The caudal fin is never barred, and the dark bar under the eye is faint, but always present.
12. *Tetragonopterus argentatus* (Baird & Girard). Only three small specimens taken. Color steel-blue; lateral band and caudal spot very distinct. Measurements are as follows:

Length.	Head.	Depth.	Lateral line.	Dorsal.	Anal.
<i>mm.</i>	<i>mm.</i>	<i>mm.</i>			
50	13	17+	36	10	21
48	13—	16	36	10	21
54	14	18	36	10	21

13. *Etheostoma micropterus* Gilbert. Fifteen specimens of this fish were taken from the shallow ripples above the irrigation dam below the city. They agree, in general, with the original description (Proc. Nat. Mus., XIII, 1890, pp. 289-290), but differ in a few details, such as the smaller number of dorsal spines, coloration, etc.
14. *Etheostoma australe* Jordan. (*Etheostoma scovelli* Woolman, Amer. Nat., vol. XXVI, p. 260, March, 1892.)

Body stout; head large; snout abruptly decurved; back but little elevated; caudal peduncle broad; spinous dorsal low. Body barred with about ten bars of a dark purple color, each about  $1\frac{1}{2}$  mm. in width, olive between; the first, second, and fifth extending over back. Pectoral and ventral fins plain; spinous dorsal bordered with black; also an imperfect dark stripe very near base of dorsal; soft dorsal with two broken black stripes; caudal barred. Mouth horizontal, lower jaw included; maxillary extending a little past front of orbit, nearly to edge of pupil. Lateral line incomplete, reaching to about midway of soft dorsal.

#### RIO DE LERMA AT SALAMANCA, MEXICO.

The city of Salamanca is in the State of Guanajuato, about three-quarters of a mile south of the Mexican Central Railway and 150 miles northwest of the City of Mexico. It is built on the banks of the river Lerma, one of the largest streams in Mexico. This river is tributary to the Pacific Ocean, flowing first in a westerly direction some 80 or 90 miles to Lake Chapala, whence it continues in a northwesterly direction to the sea under the name of the Rio Grande de Santiago. At Salamanca the river is possibly 75 feet wide, with an average depth of from 3 to 8 feet. At the season of the year when the collection was made the stream was considerably swollen, very muddy, and had a swift current. The bed, especially in the more shallow places, is composed of fine gravel, with a few large angular stones. During the dry season the river is fordable in some places and the water becomes almost clear. The bed of the stream is about 500 feet in width and the banks low. The river drains a number of small lakes located on the plateau, and at Salamanca it is about 6,000 feet above sea level.

The fishes collected at Salamanca were as follows:

1. *Ameiurus dugesi* Bean. Several specimens of this fish were taken, and in abundance it came next after *Hybopsis altus*. Before seining the river the markets were visited and a number of specimens were there seen. Specimens taken by us differ in several particulars from Dr. Bean's original description. The largest specimen measured 145 mm. in length. The following comparative measurements are given, those in parenthesis being taken from the type, the others from specimens collected by the writer. Height of body contained 4 times in length ( $4\frac{1}{2}$  to 5); maxillary barbel can be made to reach the origin of the pectorals and is contained 4 times (5) in the length of the body; the distance between the eyes equals 3 (4) times their greatest diameter; the length of the snout is contained  $2\frac{1}{2}$  (3) times in the length of the head; the posterior nasal barbel is  $\frac{1}{2}$  ( $\frac{1}{3}$ ) the length of the maxillary barbel. The longest ray of the dorsal is contained 6 (6 to 7) times in the length of the body. The length of the base of the anal fin is contained  $2\frac{1}{2}$  (3) times in the distance of the snout to the origin of the anal. D. 1, 6; A., 18 to 19 (21 to 22); lateral line almost complete. The dorsal and caudal fins were tipped with black in some specimens.
2. *Moxostoma austrinum* Bean. Four small specimens obtained, the largest only 64 mm. long. Considering the size of the specimens they agree very well with the original description taken from fish, which, no doubt, came from the same stream and were collected by Prof. Dugès. (See Proc. U. S. Nat. Mus. 1879, 302.)
3. *Campostoma ornatum* Girard. Only a single specimen was taken. It agrees with others of the same species obtained at Chihuahua.
4. *Alganssea dugesi* Bean. (Proc. U. S. Nat. Mus. 1892, p. 283.)

This species is related to *Alganssea tincella* Girard (U. S. and Mex. Bound. Surv., 46, pl. 27, figs. 1-4), but from the very meager description and accompanying cut (drawn from a market specimen) the identity of the two can not be established. The chief difference between the specimens described by Girard and *A. dugesi* appears to consist in the size of the eye and the general form of the fish. *Alganssea tincella* is deeper and less tapering from the shoulders than *Alganssea dugesi*. In the right-hand column of the following table I quote the measurements of specimens given by Girard, while the left-hand column shows those furnished by the specimens collected by the author.

A. dugesi.	A. tincella.
Head in body, 4.	Head in body, $4-(3\frac{2}{3})$ .
Depth in body, 4.	Depth in body, $4\frac{1}{2}$ .
Eye in head, 6+.	Eye in head, $4\frac{1}{2}+$ .
Eye in snout, $1\frac{1}{2}$ .	Eye in snout, 1.
Lateral line, 69.	Lateral line, 60.
Scales above lateral line, 14.	Scales above lateral line, 12.
Scales below lateral line, 12.	Scales below lateral line, 10.
Caudal, without black spot.	Caudal, with distinct black spot.

The general outline of *Alganssea dugesi* agrees more nearly with *Alganssea australis* Jordan (Proc. U. S. Nat. Mus. 1879, 300). *Alganssea australis* has, however, a smaller eye, which is only 6 in head, and the scales are 10-55-7 or 8.

5. *Hybopsis altus* (Jordan). *Whitefish*. (*Hudsonius altus* Jordan, Proc. U. S. Nat. Mus. 1879, 301.)
- General form elongate, very regular, subfusiform, the profile presenting a gentle curve from the snout to the front of the dorsal; the belly about as much deurved as the back is arched; eye and lateral line on axis of body. The following measurements were made from a specimen 150 mm. long: Dorsal fin over ventrals, and midway between the snout and the end of the scales; length of base of dorsal 18 mm., which equals depth of caudal peduncle at its narrowest place; it also equals the distance from the end of the snout to the posterior margin of the orbit; longest ray of dorsal 30 mm., 5 in body, equal to distance from the anterior edge of orbit to posterior edge of opercle; ventral 24 mm., not reaching vent, about the same in length as anal; pectorals low, reaching within three scales of ventrals. Head small, conical, 40 mm., a little less than 4 in body, half distance (80 mm.) from snout to insertion of dorsal. Mouth medium, terminal, and slightly oblique; maxillary reaching anterior margin of orbit; barbel very short, but distinct. This barbel was overlooked by Dr. Jordan,

who therefore placed the genus in *Hudsonius*. Orbit almost circular (7 mm.),  $1\frac{1}{2}$  in snout,  $5\frac{1}{2}$  in head. Teeth 4, 4, hooked, one or more grooved; grinding surfaces narrow. Teeth in very large specimens more blunt. Color, olive above; sides pale; belly white; sides slightly silvered to fourth row of scales above lateral line, which is slightly decurved; cheeks and opercles silvery and without striations; fins all light and plain; 18 scales before dorsal.

The measurement of a few medium-sized specimens are as follows:

Length.	Head.	Depth.	Lateral line.	Dorsal.	Anal.
<i>mm.</i>	<i>mm.</i>	<i>mm.</i>			
112	28	31	42	8	8
98	25	25	48	8	8
66	25+	24	44	8	8
95	24+	24	45	8	8
96	26—	25	48	8	8
97	26—	23	48	8	8
90	24—	24	45	8	8
88	21—	22	46	8	8

This is one of the largest minnows and is about the only food-fish taken from this stream except *Ameiurus dugesi*. It is abundant and reaches a length of 15 inches. It is caught in nets or by hook and line, preferring worms or other dead bait. The fish is commonly known to the natives as "whitefish."

6. *Gambusia infans*, sp. nov. This little *Gambusia* bears but a slight general resemblance to other species of the genus. The color is light (due in large part, no doubt, to the muddy water), except the back, which is a light olive-green; but few scales have dark edges or other marking except a very narrow hair line along the middle of the caudal peduncle from the dorsal to end of scales; and another line of about equal length and breadth, but more distinct, which extends along the lower edge of the caudal peduncle from the last rays of the anal to the caudal fin. The total length of the largest specimen is 37 mm.; length, exclusive of caudal fin, 32 mm.; head, 7 mm.; depth, 7 mm.; first rays of dorsal midway between snout and end of caudal, or midway between the posterior margin of opercle and end of scales; insertion of anal in male almost directly beneath first rays of dorsal; base of dorsal very short, slightly more than length of orbit; diameter of orbit a little greater than length of snout, about  $2\frac{1}{2}$  in head; modified anal of males about  $1\frac{1}{2}$  times length of head, or about equal the distance from insertion of dorsal to end of scales. Ventral fin short, not reaching vent. D. 8, A. 1-8; scales, 26.
7. *Characodon variatus* Bean. Specimens collected by the writer agree with the original description of this species by Dr. Bean (Proc. U. S. Nat. Mus. 1887, 370), except in length of head, color, and profile of body. The color is light olive-green and plain throughout, except faint traces of a lateral band on caudal peduncle; no dark spots appearing on either body or fins. The head is 4 in body, exclusive of caudal fins. In the type of *Characodon variatus* the head is given as 4 in body, including the caudal fin. The nape in specimens that I collected is depressed instead of elevated, as shown in the cut of *Characodon variatus* accompanying the original description. In this cut the dorsal is also placed nearer the caudal than it is in my specimens. Numerous other specimens collected by me agree almost perfectly with the original description of *Characodon ferrugineus* Bean (Proc. U. S. Nat. Mus. 1887, 373, plate xx). The largest of my specimens measured as follows: Length, exclusive of caudal fin, 46 mm.; head,  $13\frac{1}{2}$  mm.; depth, 15 mm.; scales, 29; in type, 35. Dr. Bean has since referred this species to the synonymy of the preceding, the difference being a matter of age and sex. I am not able, however, from an examination of my specimens, to arrive at this conclusion.
8. *Chirostoma jordani*, sp. nov. Body elongate, slender, compressed; head medium, conical; mouth very oblique; upper premaxillary protractile but not produced; maxillary not reaching eye; first rays of anterior dorsal over posterior end of ventrals and slightly in advance of the insertion of the anal; first rays of second dorsal over middle of anal, the rays when depressed reaching as far toward caudal as the rays of anal; length of base of second dorsal about half that of base of anal, or equal the distance from snout to posterior edge of orbit; longest rays of second dorsal slightly exceed in length longest rays of anal or about equal the greatest depth, and about one-fourth greater than the length of the base. Pectoral fins



large, inserted above axis of body and reaching to middle of the ventrals, or about equal length of longest dorsal rays; origin of ventrals midway between snout and last rays of anal, extending beyond vent almost to anal; length equal distance from snout to posterior edge of orbit. Eye large and full, longer than snout, about 3 in head; cheeks and opercles scaled, the former with three rows of scales. Color, light olive-green, with narrow but distinct and complete lateral stripe; the three rows of scales on back thickly sprinkled with minute dark-brown dots which extend from the snout to the caudal fin. Head in length, 4; depth, 5. Measurements of five adult specimens were as follows:

Length.	Head.	Depth.	Eye.	Lateral line.	Dorsal.	Anal.
<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>			
53	12.5	11	3+	36	IV, 10	I, 16
49	12-	10	3	36	IV, 10	I, 16
46	11	9	3-	37	IV, 10	I, 16
46.5	11+	9+	3	37	IV, 9	I, 16
46.5	11+	9+	3	35	IV, 9	I, 16

Numerous specimens also taken from the canals at Salamanca and in the City of Mexico. In the City of Mexico this species, with a small cyprinodont (which unfortunately I did not secure alive), was sold in the market, imbedded in meal and baked in corn husks. This species differs from *C. brasiliensis* in having the first dorsal placed farther forward and with fewer rays in the anal. Specimens from Salamanca have 17 rays in the anal. This is evidently the same species sent with a number of other fishes to the National Museum at Washington by Prof. A. Dugès, from Lake Chapala and the stream of Guanajuato, Mexico, and listed by Dr. Jordan as doubtfully *Chirostoma brasiliensis*, in Proc. Nat. Mus. 1879, 299.

#### CITY OF MEXICO.

But little fishing was done at the City of Mexico. From recent heavy rains the lakes had been filled with water and all the low land flooded; most of the canals connecting the larger lakes were bank-full of water. Over these and the neighboring ponds and bayous quantities of algæ, lemna, and other water vegetation grew in great luxuriance, so that drawing a seine for specimens was laborious and uncertain work. The markets were visited, but few fresh fish excepting those brought from the coast were seen, and we were informed that very little fishing was carried on by the local fishermen at this season of the year, although during the dry season many fish are taken from the lakes and canals. Three species only were obtained in these waters, and one other was seen in the market, a specimen of which, in suitable condition for identification, could not be secured.

1. *Notropis aztecus*, sp. nov. This fish was obtained in great numbers from the canal in the City of Mexico. The specimens from which the following measurements were taken were of an average size, about 77 mm. long.

Body short and compressed; contour gently arched from snout to dorsal, decurved below; lateral line almost straight, lying along axis of body. Head short and blunt, 18 mm.; snout blunt but not decurved; mouth terminal slightly oblique; maxillary reaching line of orbit. Eye very small, 3 mm., about 6 in head; orbit circular; dorsal behind ventral, somewhat nearer end of scales than snout; base very short, 8 mm., about depth of caudal peduncle in narrowest place; fin low, 10 mm. in height, a little less than longest caudal ray or distance from posterior margin of orbit to end of opercle; insertion of anal two scales nearer caudal than end of dorsal ray when compressed; base short, 5 mm., equally distant from snout to orbit; longest rays 8 mm., same as base of dorsal; ventrals midway between snout and base of caudal, short, not reaching vent; longest rays 8 mm., equal half the distance from the origin to the first rays of anal. Upper part of body of a slaty or iron gray; some of the scales with a metallic blue luster, somewhat lighter below lateral line; belly

light or pale yellow; sides covered with a thin coat of silvery pigment; a wide dark lateral stripe visible in some specimens, in others overshadowed by the general darker color; no darker caudal spot; opercles and cheeks silver. Lateral line nearly straight; scales, 8-54-7. Head, in length, 4; depth,  $3\frac{2}{3}$ . Lateral line somewhat broken and interrupted on caudal peduncle. Measurements from six adult specimens are as follows:

Length.	Head.	Depth.	Lateral line.	Dorsal.	Anal.
<i>mm.</i>	<i>mm.</i>	<i>mm.</i>			
78	20	23	53	8	8
81	20	23+	54	8	8
77	18.5	20+	53	8	8
73	18	20-	55	8	8
72	17+	20	54	8	8
73	18	20	54	8	8

2. *Evarra eigenmanni*, gen. and sp. nov. Body elongate, somewhat fusiform; back little elevated, giving an even curve to the profile from above eye to dorsal; belly slightly curved. Head small and long; snout thick and blunt, decurved; mouth small, terminal, horizontal; edge of lower lip somewhat hardened; lower jaw included; the upper jaw slightly projecting; maxillary falling a little short of orbit; no barbel; eye small, 5 in head,  $1\frac{1}{2}$  in snout, and 2 in interorbital space. Body plump; the greatest thickness just behind the extremity of pectorals is 10 mm., which equals  $\frac{2}{3}$  the greatest depth. First rays of the dorsal placed behind ventrals, midway between snout and fork of caudal; base of dorsal short, 7 mm., equaling distance from snout to middle of pupil, or a little more than depth of caudal peduncle at its narrowest place; longest dorsal ray, 10 mm., equals depth of head; depth of the body at last dorsal ray equals distance of snout to opercle, or thickness of body. Anal placed far back, 18 mm., from end of caudal peduncle, a little more than half the distance from dorsal to end of scales (34 mm.); base of anal, 5 mm., equaling distance from snout to anterior edge of orbit, its longest rays 8+mm., equaling length of base of dorsal, or distance from snout to posterior part of orbit. Ventrals short, 7 mm., equal in length  $\frac{1}{2}$  distance from origin of anal to anal opening. Pectorals inserted midway between lateral line and lower line of body; length, 10 mm., about the same as the longest dorsal rays.

Color, in spirits, smoky brown above; a narrow stripe somewhat lighter on either side of back, followed by a narrow and darker lateral band; vertebral stripe very dark; much lighter below the lateral line; belly light, tinged with yellow; scales silvered from belly to lighter shade on back. Fins almost plain; dorsal and caudal dusky; the latter with a dark spot at base; pectorals, ventrals, and anal, pale; opercles silvery; snout dusky; lateral line straight and complete, with 88 scales, 17 rows above and 14 below; head in length of body, 4; depth, 5. Three specimens measured as follows:

Length.	Head.	Depth.	Lateral line.	Dorsal.	Anal.
<i>mm.</i>	<i>mm.</i>	<i>mm.</i>			
71	17	14	88	8	1.7
64	14.5	13	86	8	1.7
55	13	11	88	8	1.7

Teeth 0, 4-4, 0. The intestine is but a little more than the total length of the body.

This species seems to be the type of a distinct genus allied to *Tiaroga*, *Phenacobius*, and *Agosia*, for which I suggest the name *Evarra*. *Evarra* is distinguished from *Tiaroga* by its protractile premaxillary; from *Phenacobius* by the form of the mouth and lips, which, with its small scales, also distinguish it from *Notropis*. *Agosia* differs in the presence of a barbel.

3. *Chirostoma jordani* Woolman.

## RIO BLANCO AT ORIZABA.

Orizaba is a city in the central part of the State of Vera Cruz, on the Mexico and Vera Cruz Railway, about 175 miles southeast of the City of Mexico and 65 miles northwest of Vera Cruz. It has possibly 10,000 inhabitants, and is situated about 4,000 feet above sea level, in the foothills of Mount Orizaba, or Citlaltepētēl, the highest mountain in Mexico. It is located on a branch of the Rio Blanco, which flows nearly due east to the Gulf of Mexico. This branch of the river rises a short distance north of the town of Orizaba, in large deep springs, which, during the wet season, spread over several acres of ground. The stream flows a distance of about 120 kilometers before reaching the gulf, and in this distance falls more than 4,000 feet. It passes for the most part over a series of rapids at an average rate of possibly 6 miles an hour, in many places making perpendicular descents, and in one instance falling more than 100 feet in a single leap. That the fishes found in this locality have inhabited these waters for a very long time is evident, since it would be impossible for them to ascend from the lower lands. Only a single species was taken at this place, and it was very abundant. It was taken from the mill race about the water wheels, and in the bath house. Whenever a nook of quiet water occurred this little fish could be seen in great numbers, swimming near the surface of the water. A Spanish boy who assisted in capturing the specimens insisted that much larger ones were sometimes found, and were frequently taken during times of low water; and it is due to his ingenuity that the largest and finest specimens that I brought away were obtained.

1. *Pseudoxiphophorus bimaculatus* (Hæckel). (*Xiphophorus bimaculatus* Hæckel, Sitzgsber. Akad. Wiss. Wien, 1848, p. 196.)

The genus *Pseudoxiphophorus* differs from *Gambusia* chiefly in the long dorsal, and this characteristic is of doubtful value since the number of rays range from 12 to 15, those of *Gambusia* ranging from 7 to 10. Hæckel describes two species of *Pseudoxiphophorus* from the Orizaba region. These he distinguishes by the form of the anal process, hooked in *bimaculatus* and straight in *reticulatus*. *Bimaculatus* has dorsal 14, anal 10. *Reticulatus* has dorsal 16 and anal 10. I find both forms in my collection, but doubt the value of the distinctions, as it is not unlikely that they represent simply extremes of variations. *P. bimaculatus* (the variety with the longer anal) is by far the more abundant. The form of the anal process seems to be of slight importance. The length, however, is quite variable, but whether or not the end is curved seems rather to depend upon the length. The longer the organ the more liable it is to be curved. In most of my specimens, however, the organ is nearly straight.

The general color in *P. bimaculatus* is uniform olive-brown with the posterior part of each scale marked with a crescent-shaped spot; a large steel blue spot on the opercle just behind the eye; cheeks, lower part of the opercle, and breast from the pectorals down, and anterior part of the belly, orange; humeral scale black, but not enlarged; a large dark ocellus, about the size of the eye, on the upper posterior margin of the caudal peduncle. Dorsal fin with a row of dark spots on membrane, at about midway of rays; also a second row of spots near base of fin. The anal fin is marked similarly, except the anterior part is plain, giving it the appearance of a dark spot on anal; pectoral, ventral, and caudal fins almost plain. Body moderately elongated, slightly but regularly arched above; head very broad and low, so that the upper margin of the orbit is nearly on a level with top of head between the eyes; belly much decurved; line of curvature quite regular from the upper margin of the lower lip to origin of ventrals; upper margin of lower lip, when mouth is closed, on a level with top of pupil; also on a level with the second row of scales from dorsal. Eye medium, orbit circular, the diameter of which is about the length of snout,  $3\frac{1}{4}$  in head, or  $2\frac{1}{4}$  in interorbital area. Scales large, deeper than long; 12 rows with from 29 to 31 scales in length of body; 13 or 14 before dorsal.

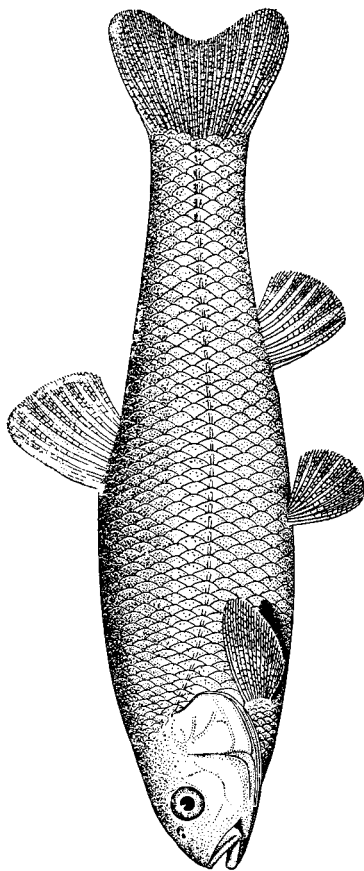
Head in adult specimens about  $4\frac{1}{2}$  in body, not including caudal; in depth,  $3\frac{1}{2}$ ; base of dorsal half as long as the distance to the insertion of the fin and one-fourth the length of the body; the first rays of dorsal about midway between base of caudal and line between cheek and opercle, or half way between snout and extremity of caudal; the dorsal is low, the rays about as long as the interorbital space. Pectoral fins are broad and short, inserted about the axis of the body and reaching origin of the dorsal and almost to anal, which is nearly under the first rays of the dorsal. Anal fin short; the first two rays undeveloped, the fourth being the longest; this equals distance from snout to opercle; when the fin is depressed the rays reach as far as the origin of the last rays of the dorsal. The measurements of six large specimens are as follows:

Total length.	Length to caudal.	Head.	Depth.	Eye.	Dorsal.	Anal.	Lateral line.
<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>			
88	77	19	*23	5	13	†8	29
82	71	18	19	4.5	11	8	36
79	69	17	*24	4+	11	8	31
79	69	17	19	4+	13	8	31
75	65	15	18	4-	12	8	31
64	73	16	18	3+	12	8	31

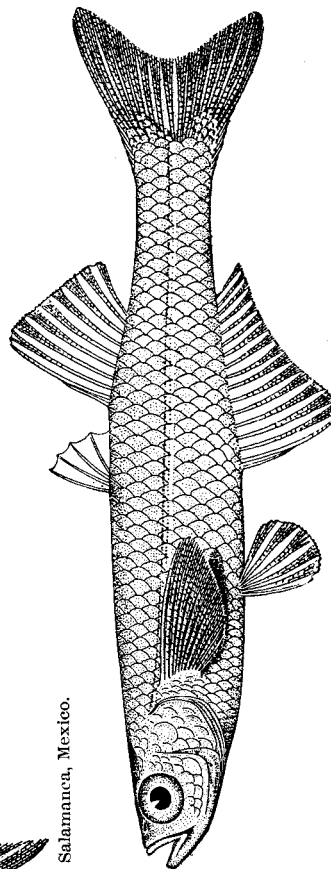
\*Abdomen distended with young. †The two undeveloped rays were not included.

In some specimens corresponding to *P. reticulatus* there are 14 or 15 dorsal rays; the color of the male specimens is practically the same as that of the females, excepting that the spot on the anal is lacking; size much smaller, the largest male taken having a total length of only  $46\frac{1}{2}$  mm. The pectorals reach to the middle of the ventrals and the ventrals beyond the anal opening; the insertion of the anal is much further forward than in the females and is nearer the snout than the dorsal, the long modified rays reaching as far toward the caudal as do the longest dorsal rays when depressed.

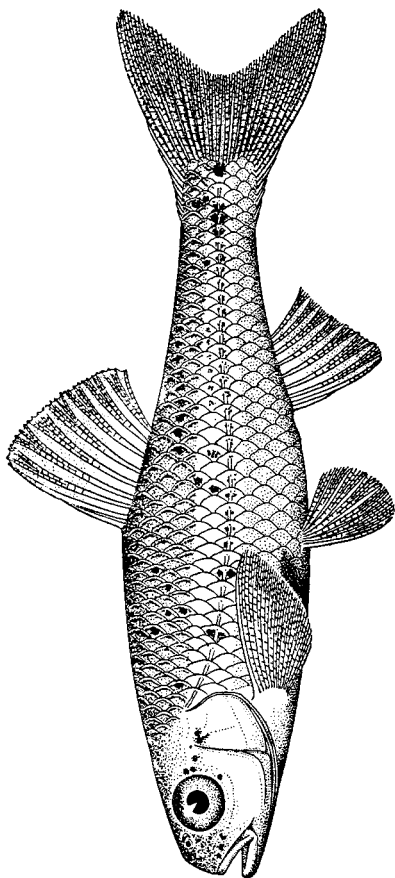
Several specimens seem to correspond with *P. reticulatus*. These may be described in the following manner: Snout broad, spatulate, the lower jaw projecting. Eye equal to snout,  $3\frac{1}{2}$  in head, 2 in interorbital space. Anal process in male  $1\frac{1}{2}$  in head, ordinarily with a slight curve at the tip. Caudal peduncle short. Anal fin inserted in front of dorsal. Dorsal long, its length 3 in body. Coloration as in *Pseudoxiphophorus bimaculatus*, but darker and more profusely dotted with brown. A larger black spot on upper half of root of caudal and a trace of another behind gill-opening. Occiput and snout dark brown. Scales on back and sides with a dark-brown crescent. These do not appear on scales of lower parts, as in *P. bimaculatus*. Dorsal fin with dark-brown cross streaks made of dark spots. Fins, scales, cheeks, and opercles profusely dotted with brown. Head,  $3\frac{1}{2}$ ; depth, 4; D. 15; A. 8. Scales, 31-8. Length,  $2\frac{1}{2}$  inches. It is my opinion that these specimens represent individual variation only and that but one species of the genus *Pseudoxiphophorus* is known. The validity of *Pseudoxiphophorus* in distinction from *Gambusia* is also brought in question, since the length of the dorsal is made the principal basis of generic distinction, and this is quite variable in the specimens collected.



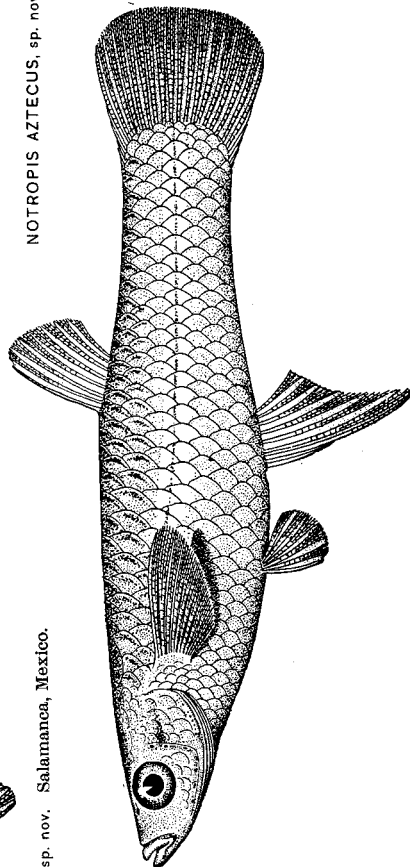
NOTROPIS AZTECUS, sp. nov. Mexico City, Mexico.



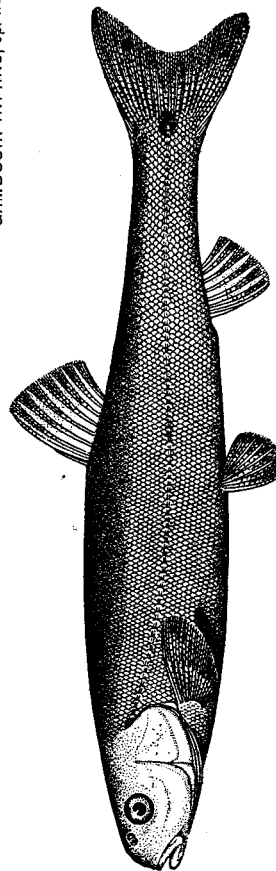
CHIROSTOMA JORDANI, sp. nov. Mexico City, Mexico.



NOTROPIS CHIHUAHUA, sp. nov. Salamanca, Mexico.



GAMBUSIA INFANS, sp. nov. Salamanca, Mexico.



EVARRA EIGENMANNI, gen. et sp. nov. Mexico City, Mexico.