



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

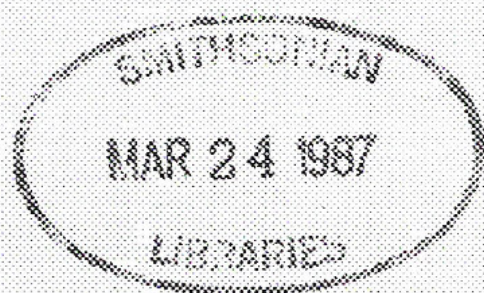
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PREFACE.

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

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

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

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

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

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

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

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

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45. *Lucania* Girard.

Lucania Girard, Proc. Acad. Nat. Sci. Phila., 1859, 118. (Type, *Limia venusta* Girard.)

Body oblong, compressed; mouth moderate, its cleft short and very oblique; lower jaw prominent; each jaw with a single series of conical teeth; scales large, usually less than 30 in the lateral series; gill openings not restricted; the dorsal fin above or slightly in advance of the anal; anal fin of male like that of female, not modified into an intromittent organ nor with first rays short and stiff.

98. *Lucania venusta* (Girard).

Limia venusta Girard, U. S. Mex. Bd. Sur., 71, pl. XXXIX, figs. 20-23, 1859; Indianola, Texas.

Lucania affinis Girard, Proc. Acad. Nat. Sci. Phila., 1859, 118; Matamoros, Tamaulipas.

Lucania venusta Günther, Cat., vi, 310, 1860; Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 665.

Lagoons and inlets along the gulf coast of Mexico, north of Tampico.

Head $3\frac{1}{4}$; depth $3\frac{1}{2}$; D. 11 or 12; A. 6 or 10; scales 3-26. Body rather strongly compressed, the dorsal and ventral outlines about equally arched; head narrow, compressed, flattened above the eyes; snout compressed, short, and vertically rounded, its height greater than its width; mouth very small, protractile forward, the lower jaw much projecting in open mouth; mandible heavy, short, and strongly convex; less than diameter of orbit; teeth small, firm and conical in a single series; eye large, 3 in head; origin of dorsal fin nearly midway between tip of snout and base of caudal; origin of anal fin opposite middle of dorsal; pectorals $1\frac{1}{4}$ in head; ventrals 1; caudal fin slightly rounded; caudal peduncle long and slender, its least depth about 2 in head.

Color of male light olive, pale on the belly; sides with some silver luster and with indistinct trace of an obsolete dusky lateral stripe. Length about 2 inches.

46. *Zoogoneticus* Meek.

Zoogoneticus Meek, Field Col. Mus. Pub. 63, 1902, 91. (Type, *Platycephalus quitzeensis* E. A. Bean.)

Body little elongate, rather deep, somewhat compressed; mouth moderate, the lower jaw projecting; jaws each with bands of pointed teeth, the outer series the larger; scales moderate; gill openings not restricted; dorsal fin usually large, of more than 12 rays; anal fin of

male with its first 5 or 6 rays short and stiff and separated from the rest of the fin by a shallow notch; dorsal fin of male higher than that of female; viviparous. The ovary is a strong membranous sack, with several infolded partitions; in this the young develop and reach a comparatively large size when they are born, which is during May and June.

KEY TO THE SPECIES OF ZOOGONETICUS.

- a. Four to six black spots about as large as eye on lower half of caudal peduncle; 7 similar black spots at base of caudal. *cuitzeoensis* 110
- an. No black spots on lower half of caudal peduncle; not more than one black spot at base of caudal.
- b. Sides of body with 7 to 8 well-defined black bars each about as wide as the interspaces. *Jugosi* 111
- bb. Sides of body without well-defined cross-bars.
- c. Anal fin longer than the dorsal; dorsal rays 12 to 14; anal rays 14 to 17.
- d. Scales large, 32 to 35 in the lateral series; head very thick and broad, $3\frac{1}{4}$ in length; dorsal rays 13 or 14; anal rays 15; scales 12-35. [*posticephalus*] 112
- dd. Scales smaller, 37 to 39 in the lateral series.
- e. Origin of dorsal fin midway between tip of caudal fin and tip of snout; head large, $3\frac{1}{4}$ in length; depth 3; dorsal rays 14; anal rays 16; scales 10-38. *robustus* 113
- ee. Origin of dorsal fin midway between tip of caudal fin and opercle. *maculatus* 113
- eo. Anal fin shorter than the dorsal; dorsal rays 17; anal rays 14.
- f. Origin of dorsal fin midway between base of caudal and posterior margin of opercle; head $3\frac{1}{4}$; depth $3\frac{1}{4}$ *diazii* 114
- ff. Origin of dorsal fin midway between base of caudal and preopercle; head $3\frac{1}{4}$; depth $3\frac{1}{4}$ *minutus* 115

99. *Zoogoneticus cuitzeoensis* (B. A. Bean).

Platyacilus cuitzeoensis B. A. Bean, Proc. U. S. Nat. Mus., 1898, 340, fig. 1; Lago de Cuitzeo, Michoacan; Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2873.

Zoogoneticus quitzeensis Meek, Field Col. Mus. Pub. 65, 1902, 91;
Ocotlan; La Barea.
Basin of the Rio Lerma.

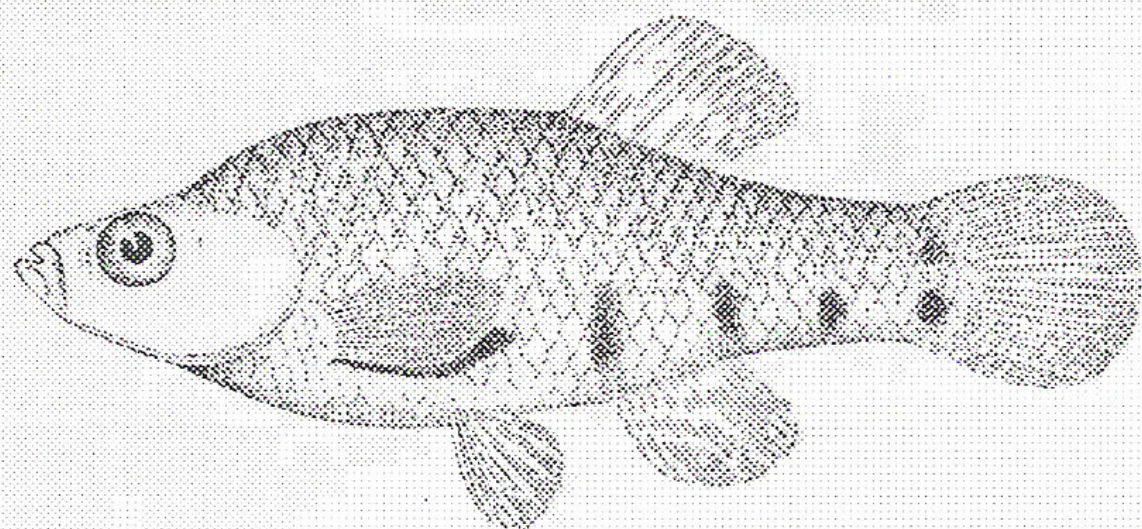


FIG. 29. *ZOOGONETICUS QUITZEENSIS* (B. A. Bean).
No. 4826 (Platycephalus quitzeensis B. A. Bean), U. S. National Museum.

Head $3\frac{3}{4}$; depth 3 to $3\frac{1}{4}$; D. 13 or 14; A. 13 to 15; scales 11-30. Body compressed, the back somewhat arched; usually in larger specimens an angle at the nape; head rather small; interorbital space flatish, its width $2\frac{1}{2}$ in head; mouth moderately large, chin prominent; lower jaw projecting; outer series of teeth large; snout $4\frac{1}{2}$ in head; eye $3\frac{1}{4}$; origin of dorsal fin midway between tip of caudal and tip of snout, and in advance of ventral; pectoral fin $1\frac{1}{2}$ in head; ventral 2; caudal fin truncate; caudal peduncle rather deep, its least depth $1\frac{1}{4}$ in head.

Color light brownish tinged with red, on the middle of sides of female to opposite tip of pectoral usually with three faint dark spots, also four to six dark bars on lower half of caudal peduncle, and a dark spot on upper portion of caudal peduncle above last bar; color of the males more uniform and much darker than that of the females; the spots or bars so conspicuous on the females being scarcely noticeable on the male; dorsal and anal fins tipped with yellow; the caudals and tips of ventrals blackish; pectorals light; fins of the female pale. Length $2\frac{1}{2}$ inches.

100. *Zoogoneticus dugesi* (Bean).

Flindulus dugesi Bean, Proc. U. S. Nat. Mus., 1887, 373, pl. xx, fig. 5; Guanajuato; Garman, Memoirs Mus. Comp. Zool., 1895, 101.

Adinia dugesi Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 661.

Zoogoneticus dugesi Meek, Field Col. Mus. Pub. 65, 1902, 92; Lagos; Patzcuaro.

Basin of the Rio Lerma.

Head $3\frac{1}{2}$; depth 3; D. 17; A. 13; scales 12-29. Body rather robust anteriorly, compressed posteriorly; back little arched; head rather large; interorbital area flattish; its width $2\frac{1}{4}$ in head; mouth

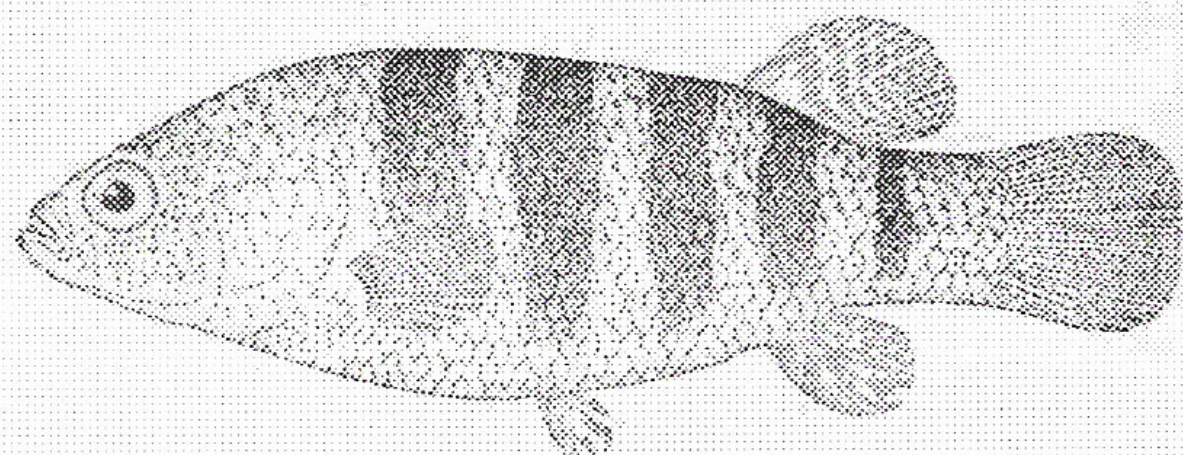


FIG. 30. *ZOOGONETICUS DUGESI* (Bean).
No. 37871, U. S. National Museum.

rather large; upper series of teeth large; lower jaw the longer, chin prominent; length of snout $4\frac{1}{2}$ in head; diameter of eye 4; origin of dorsal slightly in advance of origin of anal, midway between tip of caudal fin and posterior margin of eye; pectoral fin $1\frac{3}{4}$ in head; ventral $2\frac{1}{5}$; caudal peduncle short, its least depth 2 in head.

Color light brownish; sides with about 8 dark cross bands, about equal to the interspaces; the bars not always of equal width. Length about $2\frac{1}{2}$ inches.

The young are born about the last week of May.

***Zoogoneticus pachycephalus* (Günther).**

Fundulus pachycephalus Günther, Cat., vi, 321, 1866; Guatemala: Günther, Fishes Cent. Amer., 183, pl. 86, fig. 6, 1866; Guatemala.

Alania pachycephala Jordan & Evermann, Bull. 17, U. S. Nat. Mus., 1896, 666.

Zoogoneticus pachycephalus Meek, Publ. Col. Mus. Pub., 95, 1902, 94; Guatemala.

Head $2\frac{1}{2}$; depth 31 to 31; D. 13 or 14; A. 13; scales 12-15. Body rather deep, head very thick and broad; interorbital space very broad, slightly convex, its width 2 in head; snout broad, obtuse; lower jaw slightly projecting beyond upper; mandible longer than eye; eye 2 in head; origin of dorsal fin slightly in advance of anal, midway between tip of caudal and posterior margin of the orbit; caudal fin subtruncate.

Color brownish above and on sides, each scale darker on tip; an indistinct dark band along middle of tail; fins plain, anal fin with the lower margin whitish. (Günther.)

Known only from the above description.

101. *Zoogoneticus robustus* (Bean).

Fundulus robustus Bean, Proc. U. S. Nat. Mus., 1892, 285, pl. xiv, fig. 7; Guanajuato: Jordan & Evermann, Bull. 17, U. S. Nat. Mus., 1896, 641; Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 126, Lago de Chapala: B. A. Bean, Proc. U. S. Nat. Mus., 1898, 341; Lago de Cuitzeo, Michoacan.

Zoogoneticus robustus Meek, Field Col. Mus. Pub. 65, 1902, 92;
Ocotlan; Patzenaro; Zirahuén
Basin of the Rio Lerma.

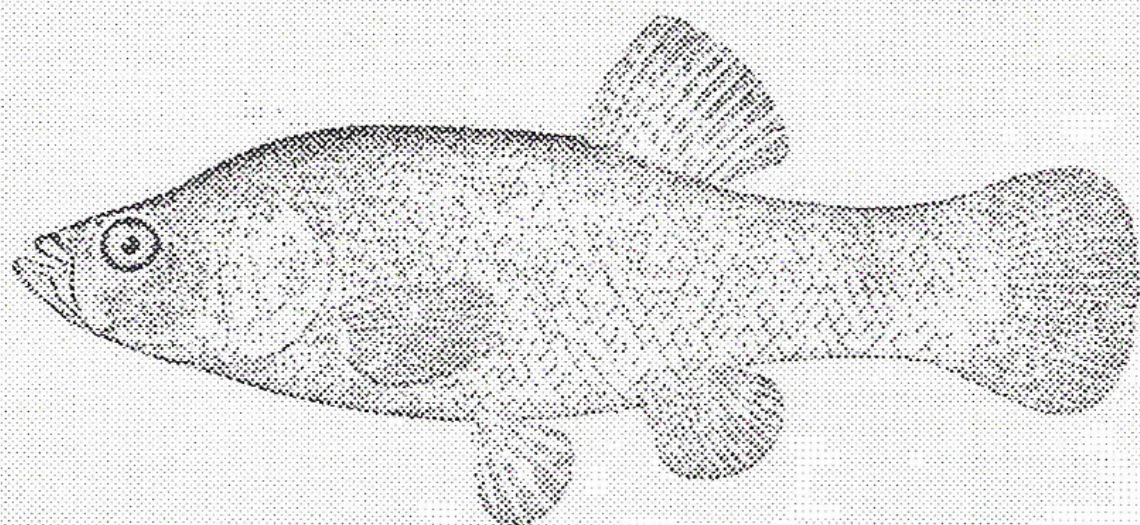


FIG. 51. *ZOOGONETICUS ROBUSTUS* (Meek).
No. 4366, U. S. National Museum.

Head 3 to $3\frac{1}{4}$; depth 3 to $3\frac{1}{2}$; D. 13 or 14; A. 14 to 16; scales 15-35. Body robust anteriorly, compressed posteriorly, head broad, interorbital area nearly flat, its width $2\frac{1}{2}$ in head; mouth rather large; lower jaw the longer; chin prominent; snout $3\frac{1}{2}$ in head; eye 4 to $4\frac{1}{2}$ in head; origin of dorsal fin slightly in front of anal and midway between tip of caudal fin and tip of snout; pectoral fin $1\frac{1}{2}$ in head; ventral fin $2\frac{1}{2}$ in head; caudal fin truncate; least depth of caudal peduncle 2 in head.

Color light brownish, much speckled and variegated with darker; on young specimens a tendency to form a narrow dark lateral band on posterior half of body; fins all plain. Length about $5\frac{1}{2}$ inches.

This species is the largest member of the genus on the Mexican Plateau. Peruales $4\frac{1}{4}$ to $4\frac{3}{4}$ inches in length, contain from 20 to 32 young, each from .67 to .75 inches in length. The young are born in May.

102. *Zoogoneticus maculatus* Regan.

Zoogoneticus maculatus Regan, Ann. & Mag. Nat. Hist., 1904, 256; Rio Santiago, Mexico.

Head 3 (in total length); depth $3\frac{1}{2}$ to $3\frac{3}{4}$; D. 13 or 14; A. 15; scales 30 to 38; mouth moderate, the lower jaw prominent; length of snout equaling diameter of eye, 4 to $4\frac{1}{2}$ in head; interorbital $2\frac{1}{2}$ to $2\frac{3}{4}$; origin of dorsal fin about midway between posterior edge of preopercle and base of caudal, its longest ray a little longer than the base of the fin, 2 in head (or less); origin of the anal a little behind that of dorsal, the first 6 rays in male, short, stiff, and of equal

length: pectoral fin $\frac{3}{4}$ to 1; the length of the head: ventrals reaching vent; caudal truncate; caudal peduncle $1\frac{1}{2}$ to 2 times as long as deep.

Color brownish above, silvery below, with dark spots which are most conspicuous posteriorly; fins immaculate; total length 84 mm.

Three specimens from the Rio Santiago, Mexico. (Kegan.)

103. *Zoogoneticus diazi* Meek.

Zoogoneticus diazi Meek, Field Col. Mus. Pub. 65, 1902, 93.

Patzcuaro; Zirahuén.

Basin of the Rio Lerma.

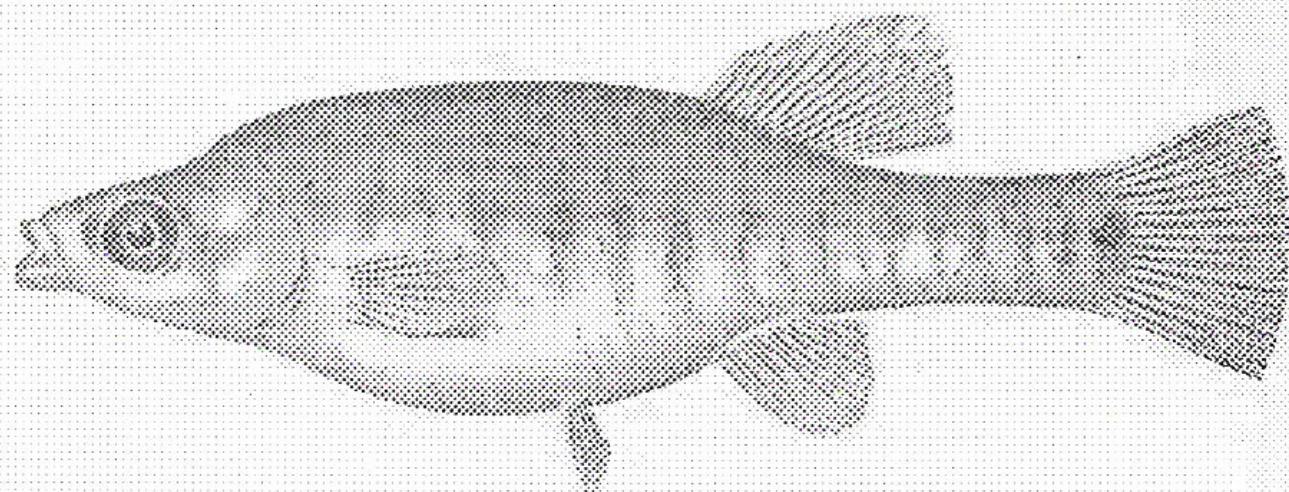


FIG. 52. *ZOOGONETICUS DIAZI* Meek.

No. 308, Field Columbian Museum.

Head $3\frac{1}{2}$; depth $3\frac{1}{2}$; D. 17; A. 14; scales 13-34. Body elongate, robust, compressed; back much elevated, forming a prominent angle at the nape; top of head slightly convex; interorbital width $2\frac{1}{2}$ in head; snout bluntish, 4 in head; mouth large, teeth conical in a band in each jaw, the outer series being the larger; lower jaw the longer; chin very prominent; eye moderate, $3\frac{1}{2}$ in head; dorsal fin slightly in advance of the anal, its origin midway between base of caudal and posterior margin of opercle; base of dorsal $1\frac{1}{2}$ in head, its height 2 (in male $1\frac{3}{4}$) in head; pectoral fin $1\frac{1}{2}$ in head; ventral $2\frac{1}{2}$; alimentary canal scarcely as long as the body; peritoneum pale.

Color light olivaceous, young much mottled with darker, the darker in form of irregular cross-bars on the sides; many of the larger specimens in life with a reddish tinge over the body, fading to nearly a uniform light olive; fins all plain; the males a little duller and of a more uniform color than the females. Length about 3 inches.

Abundant where found. One female 3 inches in length contained 28 young, each .60 inches in length. A second female 3.15 inches in length contained 47 young, each .43 inches in length. The young are born the last of May and early in June.

104. *Zoogoneticus miniatus* Meek.

Zoogoneticus miniatus Meek, Field Col. Mus. Pub. 95, 1902, 94;
Chalco.

Valley of Mexico.

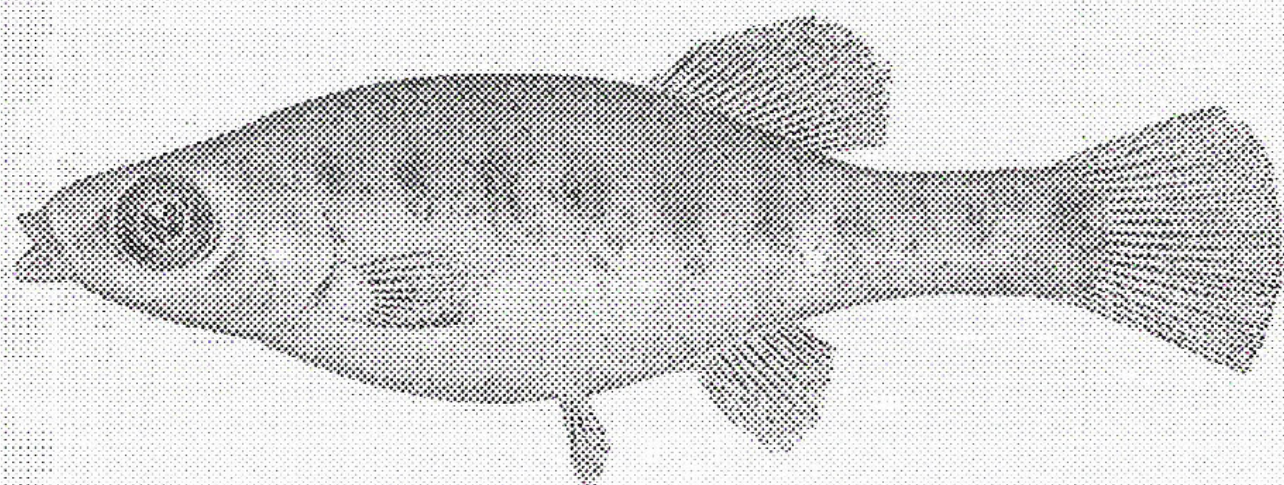


FIG. 33. *ZOOGONETICUS MINIATUS* MECK.
No. 128a, Field Columbian Museum.

Head $3\frac{1}{2}$; depth $3\frac{1}{4}$; D. 17; A. 14; scales 14-32. Body elongate, compressed; head rather narrow, interorbital width 3 in head; mouth rather large; lower jaw slightly the longer; teeth conical in a band, the outer series being the larger; snout $4\frac{1}{2}$ in head; eye $2\frac{1}{2}$ in head; dorsal fin slightly in advance of anal, its origin midway between base of caudal fin and the middle of preopercle; intestinal canal short, about as long as body.

Color olivaceous, much mottled with darker; no distinct lateral band; sides with irregular dark blotches, the last one forming an indistinct black caudal spot. Length about $1\frac{1}{2}$ inches. Known only from the type locality.

47. *Girardinichthys* Bleeker.

Girardinichthys Bleeker, Cyprin., 481, 1860. (Type, *Girardinichthys innominatus* Bleeker.)

Linnargus Günther, Cat., vi, 309, 1866. (Type, *Linnargus variegatus* Günther = *Girardinichthys innominatus* Bleeker.)

Body robust; mouth small, its cleft nearly vertical; teeth small, pointed, in one or more series in each jaw; dorsal and anal fins long, the former slightly in advance of the latter; intestinal canal on left side, not coiled, about the length of the body; peritoneum spotted, not wholly black; gill membranes partly united, free from the isthmus; anal fin of the male with its first 6 to 8 rays short and stiff and separated from the rest of the fin by a shallow notch; viviparous.

105. *Girardinichthys innominatus* Bleeker.

Lacania sp. Girard, Proc. Acad. Nat. Sci. Phila., 1850, 118; City of Mexico.

Girardinichthys innominatus Bleeker, Cyprin., 484, 1860; City of Mexico.

Limniscus variegatus Günther, Cat., vi, 300, 1866; City of Mexico.

Girardinichthys innominatus Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1866, 660; Garman, Memoirs Mus. Comp. Zool., 1893, 39, pl. 1, fig. 11 (teeth); City of Mexico; Moench, Field Col. Mus. Pub. 65, 1902, 95, Chalco, Texcoco; Nachimko.

Characodon goldesi Regan, Ann. & Mag. Nat. Hist., 1904, 257; Texcoco, Mexico.

Valley of Mexico. Abundant in the lakes, canals, and ditches. (Viga Canal.)

Head 4; depth 3 to $3\frac{1}{2}$; D. 16 to 23; A. 20 to 26; scales 16 to 34. Body rather robust, deep, compressed, back not much elevated; head flat above, usually in larger specimens an angle at the nape, interorbital 2 on head; snout 4; eye 4; mouth small, lower jaw the longer, chin prominent; teeth rather strong, conical, in a band rather than in a single series; origin of dorsal fin midway between base of caudal and posterior half of opercle ($\frac{2}{3}$) or eye ($\frac{1}{2}$), and slightly in advance of origin of anal fin; the fins all small, pectoral ($\frac{1}{2}$) in head; ventrals 3; caudal fin rounded; least depth of caudal peduncle $\frac{1}{4}$ in head, gill rakers short and stiff, about 15 on first gill arch.

Color grayish to dark brownish, some males being almost entirely black; sides variegated with darker, usually in the form of indefinite bars; young specimens usually with a dark spot slightly in advance and a little above anal, the color of this species is extremely variable. Length about 22 inches.

My attention has been called by Dr. Theo. Gill to the fact that the viviparity of this fish was noticed as early as 1769, a published account of it appearing in 1772. The reference to this account, and a translation of it by Dr. Theo. Gill, appears in his Bibliography of the Fishes of the Pacific United States, Bull. 11, U. S. Nat. Museum, 1882, 8, which I here quote in full.

"Voyage en Californie pour l'observation du passage de Vénus sur le disque du soleil, le 3 juin, 1769; contenant les observations de ce phénomène et la description historique de la route de l'auteur à travers le Mexique. Par feu M. Chappe d'Auteroche . . . Rédigé et publié par M. de Cassini fils . . . A Paris: chez Charles-Antoine Jombert. 1772." (4°, half title, title, 170 (2) pp., plan, and 2 pl. Sabia.)

"Translated as follows:

"A voyage to California, to observe the Transit of Venus. By Mons. Chappe d'Auteroche. With an historical description of the author's route through Mexico, and the natural history of that province. Also, a voyage to Newfoundland and Sallee, to make experiments on Mr. Le Roy's timekeepers. By Monsieur de Cassini. London: Printed for Edward and Charles Dilly, in The Poultry, 1778. (8°. 4p. l., 313 pp., with 'plan of City of Mexico.')

"Extract of a letter from Mexico addressed to the Royal Academy of Sciences at Paris, by Don Joseph Anthony de Alzate y Rianvrez, now a correspondent of the said academy, containing some curious particulars relative to the natural history of the country adjacent to the City of Mexico. Pp. 77-105.

"It is undoubtedly this work that is meant in the statement that has so largely gone the rounds of the periodical press, to the effect that the Californian viviparous fishes were observed during the voyage for the observation of the transit of Venus to Lower California, 1769. A perusal of the accounts given, however, renders it evident that the fishes in question were not Embiotocids, but rather Cyprinodontids, probably of the genus *Mollienisia*. The account by Don Alzate (pp. 89-91) is as follows:

"I send you some viviparous scaly fishes, of which I had formerly given you an account. What I have observed in them this year is, 'If you press the belly with your fingers, you force out the fry before their time, and upon inspecting them through the microscope, you may discern the circulation of the blood, such as it is to be when the fish is grown up.' If you throw these little fishes into water, they will swim as well as if they had been long accustomed to live in that element. The fins and tail of the males are larger and blacker than those of the females, so that the sex is easily distinguished at first sight. These fish have a singular manner of swimming; the male and the female swim together on two parallel lines, the female always uppermost and the male undermost: they thus always keep at a constant uniform distance from each other, and preserve a perfect parallelism. The female never makes the least motion, either sideways or towards the bottom, but directly the male does the same.'

"To this account is added a footnote (p. 92) containing the following additional information:

"Don Alzate has sent those fishes preserved in spirits; their skin is covered with very small scales; they vary in length from an inch to eighteen lines, and they are seldom above five, six, or seven lines in the broadest part. They have a fin on each side near the gills.

two small ones under the belly; a single one behind the anus, which lies between the fin and the single one; the tail is not forked; lastly, this fish has a long fin on the back, a little above the fin which is under the belly.

"We know of some viviparous fishes in our seas, such as loach, etc.; most of these have a smooth skin without any scales. The needle of Aristotle is viviparous, and yet covered with broad and hard scales. I have caught some that had young ones still in their womb. As to these viviparous fishes, it is a particular and new sort, and we are obliged to Don Alzate for making us acquainted with it. It breeds in a lake of fresh water near the City of Mexico."

"This is, so far as known, the earliest notice of the viviparity of Cyprinodontids. The mode of consorting together (exaggerated in the account) is common to a number of representatives of the family, and is alluded to by Prof. Agassiz in a name (*Zygocetes*; i. e., swimming in pairs) conferred on one of the genera of the family."

Subfamily Orestiinae.

48. *Characodon* Gunther.

Characodon Gunther, Cat., vi, 308, 1860. (Type, *Characodon lateralis* Gunther.)

Body rather deep, compressed; mouth small, teeth small, fixed, the outer series bicuspid, with a villiform band behind them; origin of dorsal fin nearly opposite that of the anal; anal fin with its first 5 or 6 rays short and stiff and separated from the rest by a shallow notch; alimentary canal short, 1 to $1\frac{1}{2}$ times the total length of the fish; species viviparous.

KEY TO THE SPECIES OF CHARACODON.

- | | | | |
|-----|---|----------------------|-----|
| a. | Dorsal and anal fins very long, each of more than 20 rays..... | <i>multiradiatus</i> | 110 |
| aa. | Dorsal and anal rays shorter, each of less than 20 rays. | | |
| b. | Scales large, 30 to 35 in the lateral series. | | |
| c. | Dorsal fin slightly in advance of origin of anal, its origin about midway between tip of caudal and tip of snout. | | |
| d. | Anal rays 13; scales 30 to 32; about 9 teeth in the upper jaw and about 14 in the lower..... | <i>elstoni</i> | 119 |
| dd. | Anal rays 15 or 16; scales 35; about 14 teeth in the upper jaw and about 16 to 18 in the lower..... | <i>variatus</i> | 120 |

- cc. Dorsal fin slightly behind origin of the anal, about midway between tip of caudal fin and opercle.
- e. Head $3\frac{1}{5}$; dorsal rays 10 or 11; anal rays 13 to 16, scales 12-35 *latralis* 121
- ce. Head 3 to $3\frac{3}{5}$; dorsal rays 12; anal rays 12 or 13; scales 11 or 12-32 *garmani* 121
- bb. Scales small, 50 in the lateral series, origin of dorsal fin midway between base of caudal and base of pectoral, anal fin inserted below seventh ray of dorsal *puridens* 127

106. *Characodon multiradiatus* sp. nov.

Type, No. 4523, F. C. M., 1.50 inches in length: Lerma, Mexico.

Guardinichthys innominatus Evermann & Goldsborough, Bull.

U. S. Fish Comm., 1902, 140; Lago de Lerma, Mexico.

Basin of the Rio Lerma. (Lerma.)

Head $3\frac{1}{4}$ to 4; depth $2\frac{3}{4}$ to $3\frac{1}{4}$; D. 26 to 30; A. 26 to 30; scales about 45. Body moderately elongate, somewhat compressed; head small, mouth moderate; jaws with incisor-like bicuspid teeth, diameter of eye slightly greater than the length of the snout, $3\frac{1}{4}$ in head; dorsal fin long, its base equaling length of head (♂) to $\frac{1}{2}$ longer (♀); origin of dorsal in advance of anal, midway between base of caudal and eye (♀) to nearer tip of snout than base of caudal (♂); pectoral fin small, its length $1\frac{1}{2}$ in head; ventral 2 in head; gill rakers short, less than diameter of the eye, about 15 on first gill arch.

Color dark olivaceous, the darker markings with a tendency to form crossbars; a dark blotch on side above space between ventral and anal fins; margins of median fins on male black. Length about 1.50 inches.

This species in general form and color resembles *Guardinichthys innominatus* Bleeker, with which it has been previously identified.

107. *Characodon eiseni* Rutter.

Characodon eiseni Rutter, Proc. Cal. Acad. Sci., 1896, 266; Rio

Santiago, Tepic; Jordan & Evermann, Bull. 47, U. S. Nat.

Mus., 1898, 283; Tepic.

Lowland streams of Jalisco and Tepic.

Head $3\frac{1}{2}$; depth $3\frac{1}{4}$; D. 11 to 13; A. 13; scales 12-30 to 32. Body rather deep, somewhat compressed; mouth almost vertical when closed; anterior teeth bicuspid, the villiform teeth not developed; about 9 teeth in the upper jaw and 14 in the lower; eye 3 in head; insertion of the dorsal in the middle of the total length; origin of anal

under the fourth ray of the dorsal; caudal fin broad, truncate; depth of caudal peduncle 2 in head.

Color, male with a broad indefinite lateral band; female with dark blotches on sides usually forming distinct cross bands (J. & E.). Length about $2\frac{1}{4}$ inches. Known only from the type locality.

108. *Characodon variatus* Bean.

Characodon variatus Bean, Proc. U. S. Nat. Mus., 1887, 370, pl. XX, fig. 10; Guanajuato: Bean, Proc. U. S. Nat. Mus., 1892, 286, Guanajuato: Woolman, Bull. U. S. Fish Comm., 1894, 67; Rio Lerma, Salamanca, Queretaro: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 669; Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 120; Rio Verde, Aguas Calientes: Meek, Field Col. Mus. Pub. 65, 1902, 36; Aguas Calientes: Lagos, Ocotlan, Celaya; Huingo.

Characodon ferrugineus Bean, Proc. U. S. Nat. Mus., 1887, 372, pl. XX, figs. 3 and 4, Guanajuato.
Basin of the Rio Lerma.

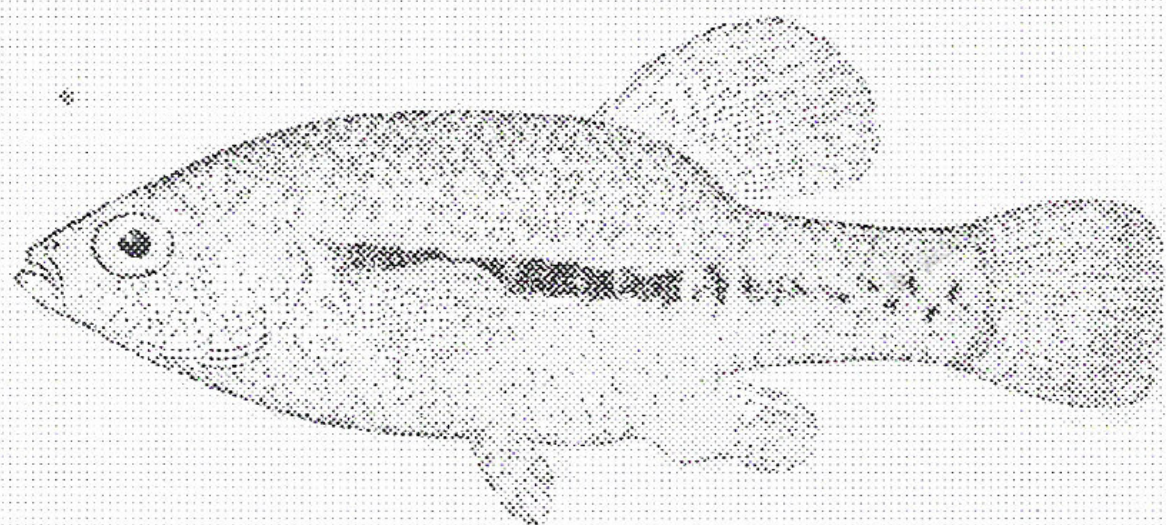


FIG. 34. *CHARACODON VARIATUS* Bean.
No. 3502, U. S. National Museum.

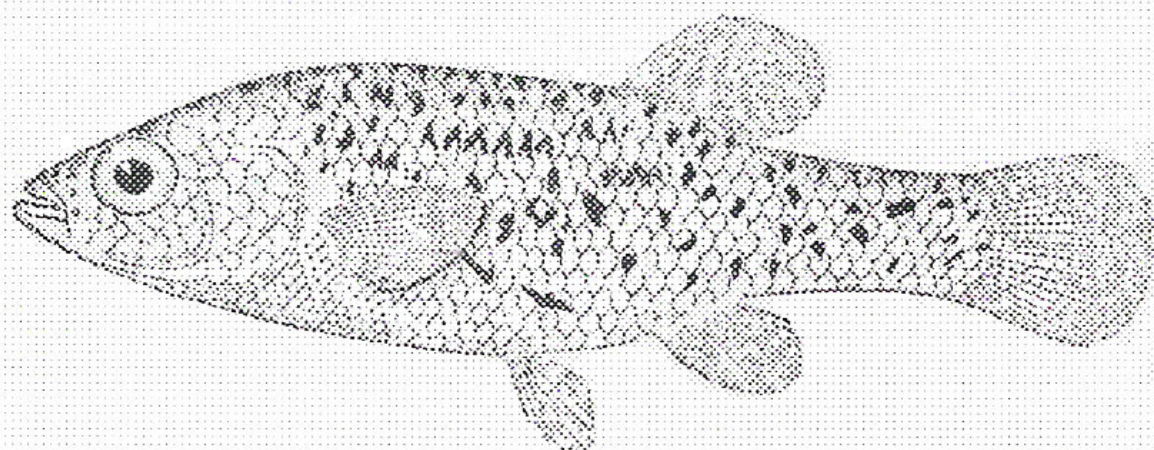


FIG. 35. *CHARACODON VARIATUS* Bean.
No. 3302 (*Characodon ferrugineus* Bean), U. S. National Museum.

Head $3\frac{1}{2}$; depth 3; D. 13 or 14; A. 15 or 16; scales 15-35. Body elongate, somewhat compressed; head broad, usually a slight angle at the nape; mouth small, lower jaw projecting; chin prominent; snout $3\frac{1}{4}$ in head; teeth fixed, outer series bicuspid; eye $3\frac{1}{4}$ in head; origin of dorsal fin midway between base of caudal and middle of opercle (2) or posterior margin of eye (3), slightly in advance of origin of anal; pectoral fin $1\frac{1}{2}$ in head; ventral fin $2\frac{1}{2}$; caudal fin emarginate; least depth of caudal peduncle 2 in head.

Color light brownish, the male with a more or less prominent dark lateral band usually broken into blotches; dorsal and caudal fins black with a light yellow border; scales of upper part of body with dark centers forming lateral stripes along the rows of scales; color of female more variegated; sides with spots and blotches; a row of black spots on the lower half of the caudal peduncle; fins all pale; young specimens spotted and much resembling the young of *Zoogoneticus robustus* (Bean), but with larger spots. Length about $3\frac{1}{2}$ inches.

The most abundant and the best known species in the genus. The young are born the last of May. The alimentary canal in some specimens is scarcely the length of the fish, in others about $1\frac{1}{4}$ times its length. One female 2.20 inches in length contained 11 young, each .35 inch in length; a second one 2.50 inches in length contained 23 young, each .46 inch in length; a third 2.70 inches in length contained 37 young, each .40 inch in length.

109. *Characodon lateralis* Günther.

Characodon lateralis Günther, Cat., vi, 308, 1866; Central America; Günther, Fishes of Cent. Amer., 480, pl. 82, fig. 2, 1869; Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 668; Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Estado de Jalisco.

Lowland streams from Central America north to the State of Jalisco.

Head $3\frac{1}{4}$; depth 3; D. 12 or 13; A. 13 (2) to 15 or 16 (3), scales 12-35. Body elevated, the neck somewhat arched; head thick and broad, the snout obtuse, as long as the eye, about 20 teeth in each jaw, their tips indistinctly notched; eye 4 in head; origin of the dorsal fin a little nearer end of caudal than of occiput, a little behind anal; caudal fin small, truncate or slightly convex.

Color brownish olive with a darker band running from eye to the root of the caudal; this band sometimes broken up into a more or less regular series of brownish spots. (Günther.)

110. *Characodon garmani* Jordan & Evermann.

Characodon lateralis Garman, Mem. Mus. Comp. Zool., xix, 1895, 36, pl. 1, fig. 9 (not *Characodon lateralis* Günther); Parras, Coahuila, Mexico.

Characodon garmani Jordan & Evermann. Bull. 47, U. S. Nat. Mus., 1898, 2831.

Spring and headwaters of the Rio Mezquital near Durango, spring at Labor and the Rio Nazas at Parras. (Durango: Labor.)

Head $3\frac{1}{4}$; depth $2\frac{1}{4}$ to 3; D. 13; A. 13; scales 13-33. Body robust, somewhat compressed; snout short, 4 in head; lower jaw the longer, chin prominent; diameter of eye $3\frac{3}{4}$; interorbital area $1\frac{1}{4}$ in head; origin of dorsal to base of caudal about $2\frac{1}{4}$ in its distance from tip of snout; origin of anal slightly in advance of that of dorsal; pectoral fin 2 in head; ventrals $3\frac{1}{4}$; caudal fin rounded; least depth of caudal peduncle 2 in head.

Color olive reddish to light brownish; males uniform or with bars on caudal peduncle, sides of females more or less barred or blotched and lighter in color than males; usually on sides a dark broad lateral band, more broken up in bars on females than on males; on males the dorsal and caudal fins with a dark band near tip bordered with lighter; in life the larger males red, occasionally males with only one or two black blotches on the sides; the color very variable. Length about $1\frac{1}{2}$ inches.

The young are born early in June. It is quite probable that the specimens described by Prof. Garman are from Durango instead of Parras.

III. *Characodon fuscidens* Jordan & Gilbert.

Characodon fuscidens Jordan & Gilbert, Proc. U. S. Nat. Mus., 1887, 351; Cape San Lucas, Lower California: Garman, Memoirs, Mus. Comp. Zool., xix, 1895, 36; Cape San Lucas (probably from the lagoons at La Paz). Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 670; Cape San Lucas; Colima: Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901; Rio San Pedro, Tuxpan, Jalisco.

Lowland streams of Jalisco and Colima and the southern portion of Lower California.

Head 4; depth $3\frac{1}{2}$; D. 15 to 17; A. 15; scales about 15-30. Body comparatively elongate, not much compressed, the head rather low and broad, depressed, interorbital area slightly more than two in head, anterior teeth large, firmly fixed and bicuspid, a band of minute teeth behind them; eye rather large, $3\frac{1}{2}$ in head, origin of dorsal fin midway between base of caudal and pectoral; origin of anal under seventh dorsal ray; pectoral fin $1\frac{1}{2}$ in head; ventral fin 2; caudal fin obliquely truncate, very slightly emarginate; caudal peduncle comparatively long and slender.

Color of males profusely mottled with darker; sometimes nearly plain; vertical lines each with several brownish bars or blotches and

each with a dusky subterminal bar; a narrow dark line along middle of each row of scales on the back; females with several short dark bars on the posterior half of the body; some dark specks on caudal peduncle. (Jordan & Evermann.)

49. *Chapalichthys* Meek.

Chapalichthys Meek, Field Col. Mus. Pub. 65, 1902, 97. (Type, *Characodon encrastus* Jordan & Snyder.)

Body rather deep, compressed; caudal peduncle long and slender; about half to three-fourths of the dorsal fin in front of origin of anal; origin of dorsal fin midway between base of caudal and anterior margin of the orbit; dorsal fin of male higher than that of female; anal fin with its first five or six rays short and stiff and separated from the rest of the fin by a shallow notch; teeth in 2 series, the outer enlarged, bicuspid and firmly attached; the inner series small, and in small patches; alimentary canal elongate, convolute or irregularly in 3 coils on the right side, its length nearly twice the length of the fish; peritoneum black, caudal fin truncate; gill rakers long and slender; vertebrae $18+19=37$; viviparous.

This genus has the long alimentary canal of *Goodea* and the firm bicuspid teeth of *Characodon*; the dorsal fin is considerably more advanced in this genus than either *Goodea* or *Characodon*.

112. *Chapalichthys encrastus* (Jordan & Snyder).

Characodon encrastus Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 126, fig. 7; Lago de Chapala, Ocotlan, Jalisco: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1901, 3150; Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Estado de Jalisco.

Chapalichthys encrastus Meek, Field Col. Mus. Pub. 65, 1902, 97; La Barca: Ocotlan: La Palma Basin of the Rio Lerma.

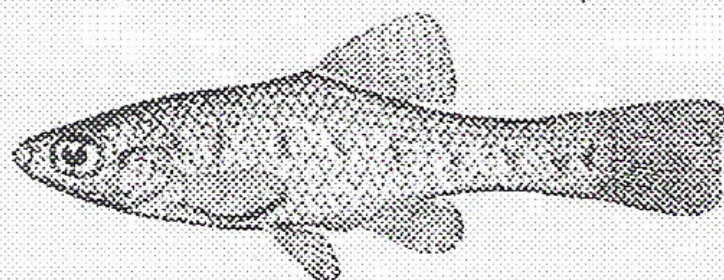


FIG. 98. *CHAPALICHTHYS ENCRASTUS* (Jordan & Snyder).
No. 6133, Leland Stanford Jr. University.

Head $3\frac{1}{2}$ to $3\frac{1}{4}$; depth $3\frac{1}{3}$ to $3\frac{2}{3}$; D. 16; A. 15 or 16, scales 13-34 or 35. Body oblong, compressed; head moderate; interorbital area nearly flat, its width $2\frac{1}{2}$ in head; lower jaw the longer, chin promi-

ment; outer series of teeth enlarged, firm, and bicuspid; snout 4 in head; eye 3; dorsal fin high, its origin slightly nearer base of caudal than tip of snout; about half of the fin in front of origin of anal; pectoral fin $1\frac{1}{2}$ in head; ventral fin $1\frac{1}{4}$; caudal peduncle long and slender, its least depth 2 in head; the caudal fin slightly emarginate.

Color light brownish with 8 or 9 spots along the middle of the sides occasionally forming short bars, each sometimes broken in the middle forming two bars; usually a large black spot about the size of pupil above and a little forward of the origin of the anal; fins all plain. Length about 4 inches.

One female 2.75 inches in length contained 21 young, each .40 inch in length. The young are born the latter part of May.

50. *Cyprinodon* Lacépède.

PURSEY MINNOWS.

Cyprinodon Lacépède, Hist. Nat. Poiss., v, 456, 1803. (Type

Cyprinodon variegatus Lacépède.)

Prionodon Rafinesque, Analyse de la Nature, 1813, 83. (Type

Cyprinodon variegatus Lacépède.)

Body very short and stout, the dorsal region elevated, mouth small; teeth incisor-like, bicuspid, in a single series; scales large, dorsal fin inserted in advance of anal; ventrals small or wanting; gill openings restricted; the opercle above adnate to shoulder girdle; alimentary canal little longer than the body. Oviparus. Spawning time June and July.

This genus comprises a group of small chubby fishes inhabiting fresh or brackish waters. They are found living in small springs and isolated bodies of water in the desert regions of southwestern United States and northern half of Mexico, where no other fishes are found. The species are very variable. It would perhaps be quite as well to regard the species listed below as varieties of *Cyprinodon elegans*.

KEY TO THE SPECIES OF CYPRINODON.

- | | | |
|-----|--|--------------------|
| a. | Color markings on the side with a tendency to form cross-bars. | PAGE |
| b. | Scales 25 in the lateral series; dorsal rays 8 or 9; anal 8 to 10. | |
| c. | Dorsal fin yellow; caudal fin light, much speckled with darker | <i>eximius</i> 125 |
| cr. | Dorsal fin dark, or with anterior half yellowish; caudal fin plain, not speckled with darker | <i>elegans</i> 125 |

band of villiform teeth, those of the outer series being largest and somewhat movable; the integuments of eye divided into an upper and lower portion by a dark colored transverse band of conjunctiva; pupil also incompletely divided into two pair of lobes projecting from each side of the iris; nasal opening produced into a short tubule depending from each side of the mouth; dorsal fin behind anal; anal fin of male modified with a thick and long scaly conical organ with an orifice at its extremity; alimentary canal but little convoluted; vertebrae about 16.

126. *Anableps dowii* Gill. Four-eyes; Cuatro Ojos.

Anableps dowii Gill, Proc. Acad. Nat. Sci. Phila., 1861, 4; Panama.

Anableps dowii Günther, Cat., vi, 338, 1860; Jordan & Evermann,

Bull. 47, U. S. Nat. Mus., 1896, 685; Chiapam, Guatemala; B. A.

Beau. Proc. U. S. Nat. Mus., 1898, 541; Tequisitlan, 40 miles

from the sea; Evermann & Goldsborough, Bull. U. S. Fish

Comm., 1901, 150; Tehuantepec River at Tehuantepec.

Rio Tehuantepec to the Isthmus of Panama.

Head 4; D. 9; A. 10; scales 65 to 70. Body elongate, head flat, depressed.

Color blackish brown, with a well-defined broad golden band along the sides from axis of pectoral to the base of the caudal; fins pale. Length 7 or 8 inches.

According to Mr. E. W. Nelson, the individuals of this species swim always at the surface and in little schools arranged in platoons or abreast. They swim headed against the current and feed upon floating matter which the current brings them. They may make slight headway up stream or may gradually float down stream at a speed less than that of the current. They are easily frightened, and when a school becomes scattered, and after the cause of their fright has disappeared, the individuals will soon rejoin each other. The species is viviparous. A female 7 inches in length, collected in April, was examined by Dr. Evermann, who found it to contain 9 young, each 1.5 inches in length.

Subfamily Goodiinae.

57. *Goodia* Jordan.

Goodia Jordan, Proc. U. S. Nat. Mus., 1870, 290. (Type *Goodia atripinnis* Jordan.)

Xenentodon Jordan & Snyder, Bull. U. S. Fish Comm., 1899, 117.

(Type, *Xenentodon caliente* J. & S. = *Goodia atripinnis* Jordan.)

Body elongate to rather robust; dorsal fin posterior, about over anal fin; anal fin of males with its first 5 or 6 rays short and stiff and sepa-

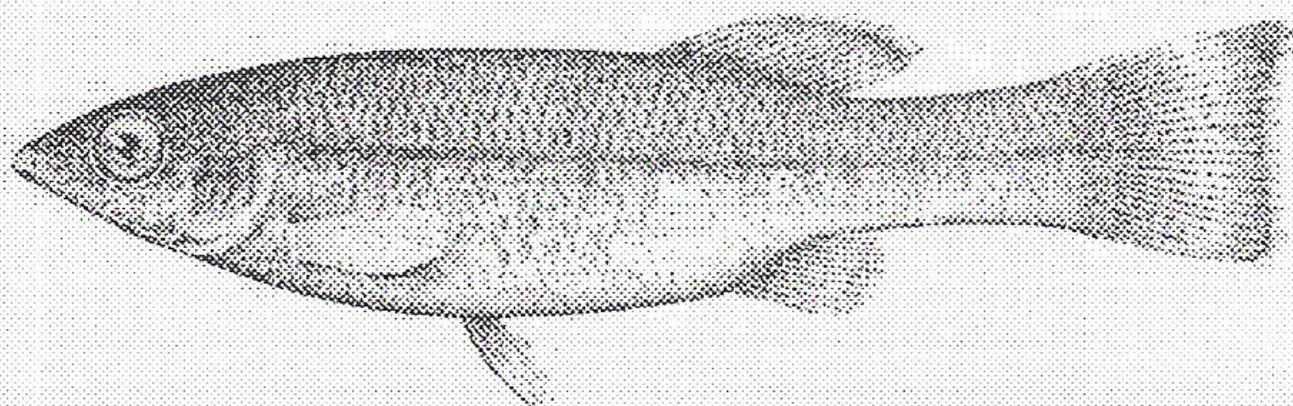
rated from the rest of the fin by a shallow notch; teeth in two series, the outer very loose and bicuspid, intestinal canal long, coiled on right side, about four times the length of the body; peritoneum black; gill rakers numerous, about 40 on first arch.

KEY TO THE SPECIES OF GOODEA.

- | | PAGE |
|---|-----------------------|
| a. Dorsal fin longer than the anal; dorsal rays 15; anal rays 12; scales small, more than 40; about 19 in a cross series; body elongate, its depth $3\frac{1}{4}$ to 4; scales 20-55; a prominent dark lateral band; vertical fins with black bars. | <i>whitei</i> 137 |
| aa. Anal fin equal to or longer than the dorsal; scales larger, less than 30 in the lateral line; no prominent dark lateral band; no black bars on vertical fins. | |
| b. Body rather slender, its depth $3\frac{1}{2}$ in length, scales moderate, 15-45; dorsal rays 11; anal rays 15; caudal peduncle slender, its least depth $1\frac{1}{2}$ in head | <i>toreri</i> 138 |
| bb. Body rather deep, its depth 3 to $3\frac{1}{4}$ in body; scales large, 35 to 44; dorsal rays 13; anal rays 14; caudal peduncle deep, its least depth about 2 in head. | |
| c. Dorsal fin slightly in advance of anal, its origin to base of caudal $1\frac{1}{2}$ in its distance from tip of snout | <i>luispoldi</i> 139 |
| cc. Dorsal fin slightly behind ventrals, its origin from base of caudal 2 in its distance from tip of snout | <i>stripiatus</i> 140 |

127. *Goodea whitei* sp. nov. MEXICAPATI.

Type, No. 4547, F. C. M., 2.8 inches in length; Yautepec, Morelos. Upper tributaries of the Rio Balsas. (Cuautla, Yantepac.)

FIG. 40. *GOODEA WHITEI* Heck.

Head $4\frac{1}{2}$; depth $3\frac{1}{2}$ to 4; D. 14 to 16; A. 12; scales 18-35. Body rather elongate, not much compressed, back not much elevated; inter-orbital space slightly convex, its width 2 in head; snout $3\frac{1}{4}$ in head; diameter of eye 3; origin of dorsal in advance of anal midway between tip of caudal and tip of snout; distance from origin of dorsal to base of caudal $\frac{1}{2}$ in its distance to tip of snout; fins rather large; pectorals $1\frac{1}{4}$ in head; ventrals 2; caudal fins slightly emarginate; caudal peduncle slender, its least depth 2 in head.

Color brownish above, the posterior portion of each scale darker, giving a finely speckled appearance; a narrow blackish lateral band extending from above the opercle nearly to base of caudal, the posterior portion of the band more distinctly defined posteriorly; beneath this band the body is mostly straw color with a variable number of small brown specks; dorsal dusky, with a submarginal line of black, the margin plain; base of caudal fin dotted with several transverse rows of dark dots and usually a clearly defined narrow black sub-marginal band, the tips plain; anal with a central short black bar; ventrals usually plain, sometimes with black tips. I take pleasure in naming this fish for Mr. E. A. White, of the city of Mexico, in recognition of many favors received through his courtesy.

328. *Goodea toweri* sp. nov.

Type, No. 4310, F. C. M., 2.38 inches in length; Río Verde, San Luis Potosí.

Upper tributaries of the Río Panuco. (Río Verde.)

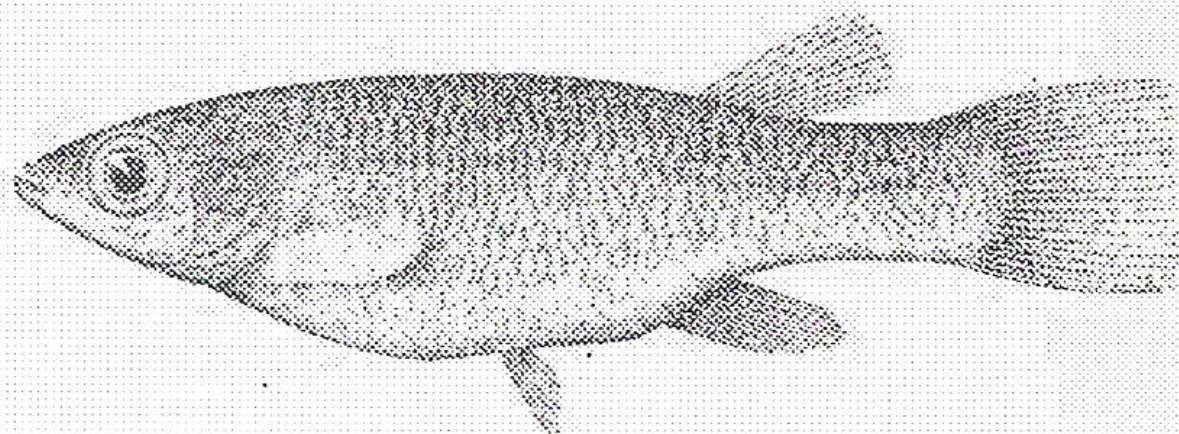


FIG. 41. *GOODEA TOWERI* MEER.

Head 4; depth $3\frac{1}{2}$; D. 11; A. 13; scales 15-45. Body elongate, moderately compressed, back little elevated; head rather small; inter-orbital flat, 2 in head; snout 4 in head; mouth rather small, the anterior series of teeth bicuspid; eye 3 in head; origin of dorsal fin behind ventrals, midway between tip of caudal and middle of opercle; the distance from origin of dorsal to base of caudal $2\frac{1}{2}$ in its distance to tip of snout; fins small, pectoral $1\frac{1}{2}$ in head; ventrals 2; the dorsal

fin in the male higher than in the female, and its position slightly more forward; caudal fin slightly truncate; caudal peduncle slender, its least depth $1\frac{1}{2}$ in head.

Color dark brownish above, lighter below; where the light and dark colors meet the side more or less speckled; a narrow dark shade on middle of caudal peduncle. Length about 3 inches. Named for its discoverer, Dr. W. L. Tower, of the University of Chicago.

129. *Goodea huitpoldi* (Steindachner).

Characodon huitpoldi Steindachner, Einige Fischarten, Mex., 1895, 12, pl. 3, figs. 3-3b.; Lago de Patzcuaro, Michoacan; Garman, Memoirs Mus. Comp. Zool., 1895, 37; Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1898, 2832; Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Lago de Zacoalco, Estado de Jalisco. *Xenodum xaliscoe* Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 128, fig. 9; Lago de Chapala, Ocotlan, Jalisco; Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3153.

Goodea huitpoldi Meek, Field Col. Mus. Pub. 65, 1902, 161; Ocotlan; La Barca; La Palma; Patzcuaro.

Basin of the Rio Lerma.

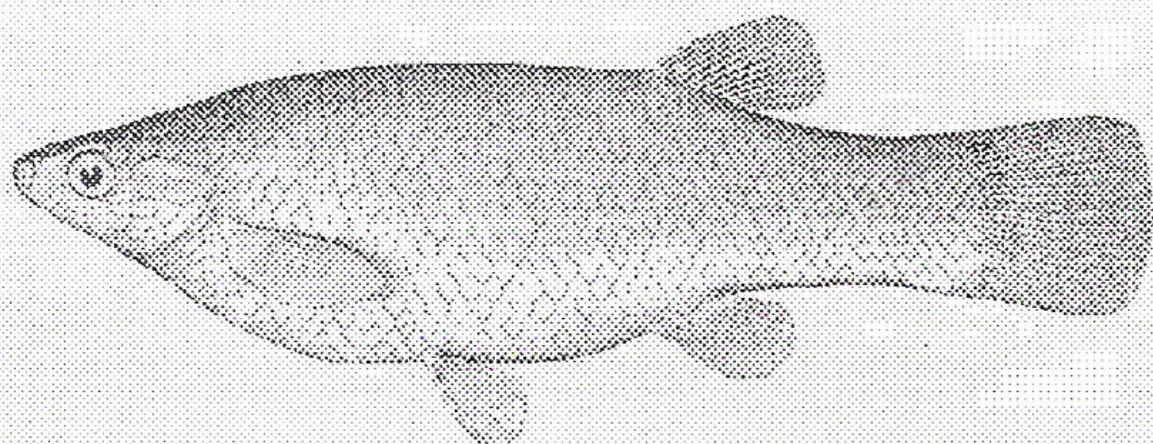


FIG. 42. *GOODEA HUITPOLDI* (Steindachner).
No. 1145 (*Xenodum xaliscoe*), Leland Stanford Jr. University.

Head $4\frac{1}{2}$ to $4\frac{3}{4}$; depth 3 to $3\frac{1}{4}$; D. 12 or 13; A. 14 or 15; scales 17-40 to 42. Body rather robust, much compressed posteriorly; head small; interorbital area slightly convex, $1\frac{1}{2}$ in head; snout $3\frac{1}{4}$; eye $3\frac{1}{4}$; origin of dorsal fin midway between tip of caudal and posterior margin of eye, in advance of ventrals; distance from origin of dorsal to base of caudal equals $1\frac{1}{2}$ distance to tip of snout; fins rather large, pectorals $1\frac{1}{4}$ in head; ventrals $1\frac{1}{2}$; caudal fin slightly rounded; caudal peduncle deep, much compressed, its least depth $1\frac{1}{2}$ in head.

Color dark brownish above, lighter below; fins all plain. Length about 3 inches.

One female 3.15 inches in length from Patzcuaro contained 31 young, of about equal length, longest 1.14 inches. There was no

modification of the anal fin in any of these young, as found in the adult male. This modification of the anal fin is probably found with the development of the sexual organs. The young are born the last of May.

130. *Goodea atripinnis* Jordan.

Goodea atripinnis Jordan, Proc. U. S. Nat. Mus., 1879, 290; Leon, Guanajuato: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 685.

Xenentodon caliente Jordan & Snyder, Bull. U. S. Fish Comm., 1900, 127, fig. 8; Rio Verde, Aguas Calientes: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1900, 3152.

Goodea calientis Meek, Field Col. Mus. Pub. 65, 1902, 100; Aguas Calientes; Lagos; Celaya; Acambaro; Huingo; San Juan del Rio.

Basin of the Rio Lerma, and of the Rio San Juan, a tributary of the Rio Pannoo on the Mexican plateau.

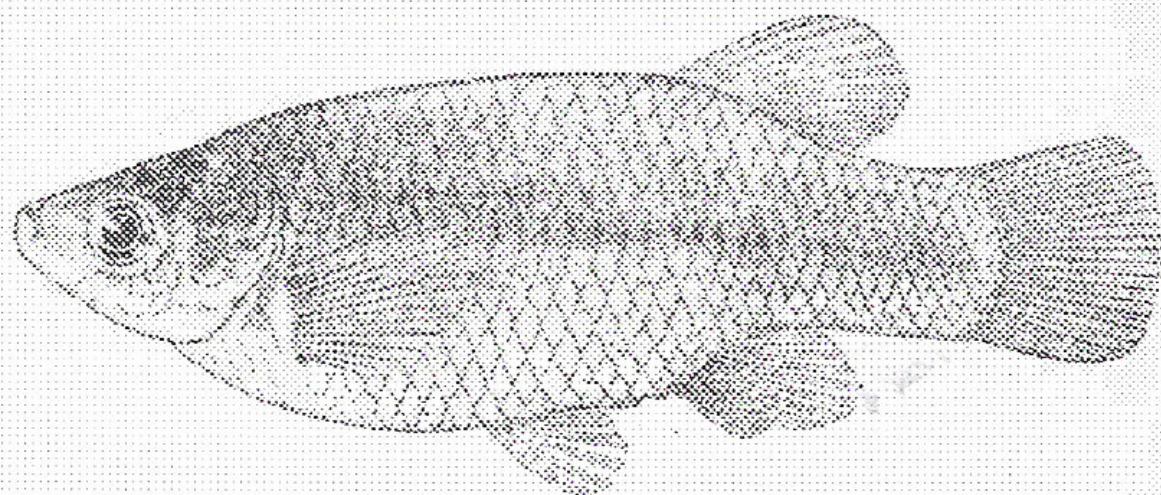


FIG. 43. *GOODEA ATRIPINNIS* JORDAN.

26, 612. *Xenentodon calientis* J. & S. (Lateral Standard B. University).

Head $3\frac{1}{4}$ to 4; depth $2\frac{3}{4}$ to 3; D. 13; A. 14; scales 13 or 14-35 to 38. Body rather robust, much compressed posteriorly; interorbital space slightly convex, $1\frac{1}{4}$ in head; snout 4 in head; eye $3\frac{1}{4}$ to 4 in head; origin of dorsal fin midway between tip of caudal and nape; distance from base of caudal to origin of dorsal 2 in distance from the latter point to tip of snout; origin of dorsal slightly behind that of anal fin; fins rather large; pectorals $1\frac{1}{4}$ in head; ventrals 2 in head; the caudal fin slightly rounded at tip; caudal peduncle deep, much compressed, its least depth $1\frac{1}{2}$ in head.

Color dark olive brown, lighter below, each scale with a dark angular band, giving the fish a somewhat speckled appearance; the young are slightly mottled in color; fins all plain; color of the sexes practically alike. Length about 4 inches.

One female 3.50 inches in length contained 44 young, each .53 inch in length. The young are born during the last half of May.

38. *Skiffia* Meek.

Skiffia Meek, Field Col. Mus. Pub. 65, 1902, 107. (Type, *Skiffia lernae* Meek.)

Body compressed, deep; dorsal fin in advance of the anal, its middle over anal; teeth loose, outer series large, bicuspid, followed by a band of small villiform teeth; alimentary canal elongate, its length 2 to $3\frac{1}{2}$ times the length of the body; peritoneum black; gill rakers long, rather stiff, about 20 on the first arch; vertebrae about $16+13=34$; anal fin of male with its first 5 or 6 rays short and stiff, and separated from the rest of the fin by a shallow notch; dorsal fin of male higher than that of female.

A group of small fishes with much compressed bodies.

KEY TO THE SPECIES OF SKIFFIA.

- | | | |
|-----|---|--------------------------|
| a. | A black bar at base of caudal (inconspicuous in some males of <i>lernae</i> , which have a uniform coloration and a very dark head). | PAGE |
| b. | Body light olivaceous in females; a dark spot on hinder margin of each scale on upper half of the body, these spots forming lines along the rows of scales; dorsal fin usually black, margined with yellow; D. 16; A. 15; scales 12-33 | <i>multipunctata</i> 141 |
| bb. | Body light olivaceous in females, mottled with dark, nearly plain on lower half of body; males nearly plain; head usually quite dark; D. 13; A. 14; scales 14-37 | <i>lernae</i> 142 |
| aa. | No black bar at base of caudal. | |
| c. | Body much variegated; no dark lateral band; D. 14 or 15; A. 13 or 14; scales 13-34; alimentary canal 3 times total length of the body | <i>variegata</i> 143 |
| cc. | Color uniform with a dark lateral band bifurcated on the anterior third of body; D. 16; A. 16; scales 11-32; alimentary canal 2 to $2\frac{1}{2}$ times total length of body; origin of dorsal fin midway between base of caudal and nape | <i>bilineata</i> 144 |

39. *Skiffia multipunctata* (Pellegrin).

Xenoderm multipunctatum Pellegrin, Bull. Mus. Hist. Nat. Paris, 1901, 205; Estado de Jalisco.

Skiffia multipunctata Meek, Field Col. Mus. Pub. 65, 1902, 103; Ocotlan.

Basin of the Rio Lerma.

Head 4; depth $2\frac{1}{2}$; D. 16; A. 15; scales 12-32. Body deep, much compressed; interorbital slightly convex, 2 in head; snout short, rather pointed, 4 in head; mouth small, lower jaw slightly the longer; eye large, 3 in head; dorsal fin slightly in advance of the anal, its origin midway between base of caudal and eye; base of dorsal $1\frac{1}{2}$ in head; height (in female) $1\frac{1}{2}$, somewhat higher in the male; anterior portion of dorsal shortened as in *Skiffia lermae*; pectoral $1\frac{1}{2}$ in head; ventral 2; alimentary canal coiled on right side, its length $3\frac{1}{2}$ times total length of the fish; peritoneum black; gill rakers long and rather stout, 20 on the first gill arch; vertebrae $16+18=34$.

Color of female light olivaceous; a dark spot on hinder margin of each scale on upper half of body, forming lines along the rows of scales much as in species of *Mallinnesia*; a prominent black bar at base of caudal fin; male nearly uniform in color, with the anal and dorsal fins black, margined with yellow; black caudal bar indistinct. Length about 2.5 inches.

This species reaches a length of 2.50 inches, and is known only from the Lerma basin, near Ocotlan. The young are born during the latter half of May.

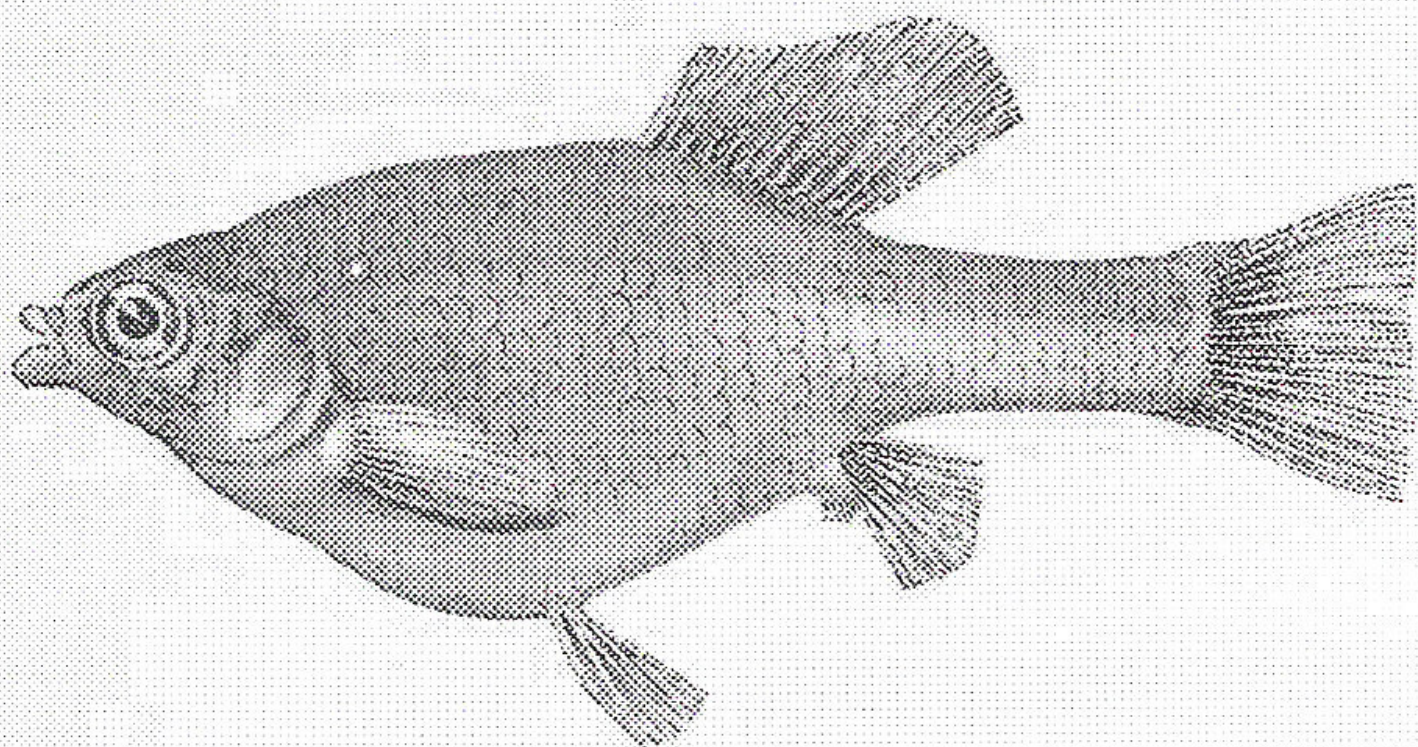
132. *Skiffia lermae*: Meek.

Skiffia lermae Meek, Field Col. Mus. Pub. 65, 1902, 102; Celaya, Patzcuaro.

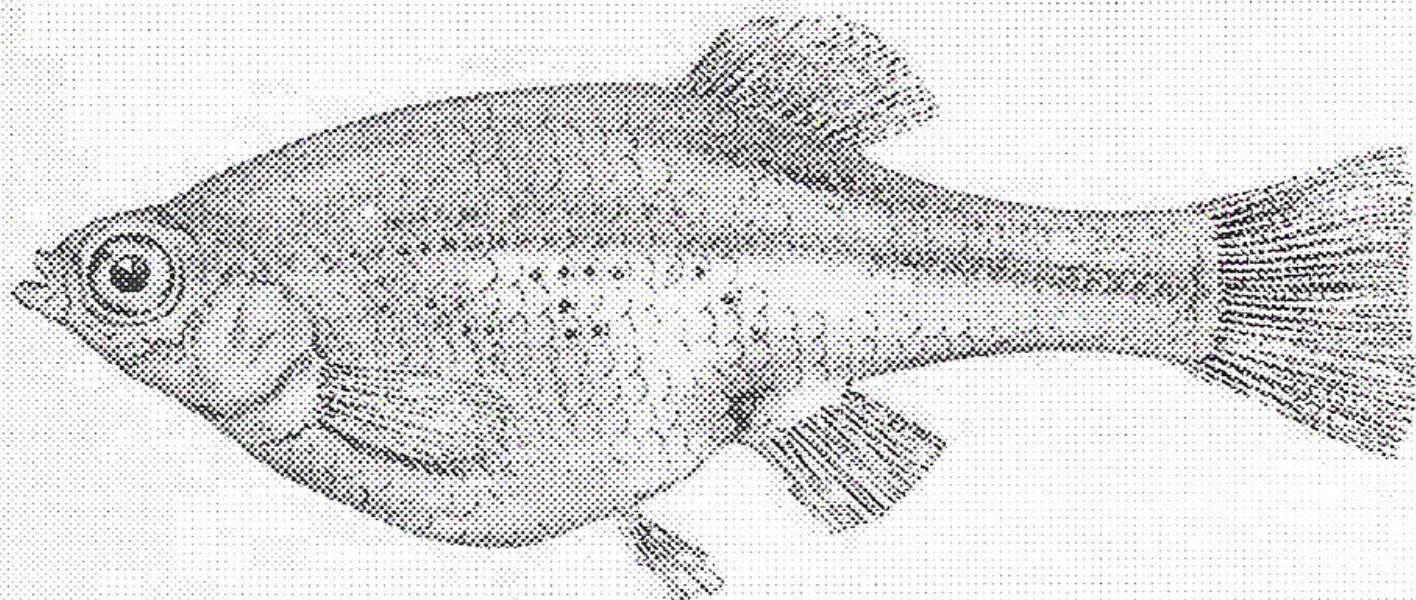
Basin of the Rio Lerma.

Head 4; depth $2\frac{1}{4}$ to $3\frac{1}{4}$; D. 13; A. 14; scales 14-37. Body deep, much compressed; head small; snout pointed, 4 in head; mouth small, the lower jaw the longer; eye large, 3 in head; interorbital slightly convex, its width $2\frac{1}{4}$ in head; dorsal fin slightly in advance of anal, midway between base of caudal and posterior margin of the orbit; base of dorsal 2 in head, its height in females $1\frac{1}{2}$, slightly higher in the males; pectoral $1\frac{1}{4}$ in head; ventrals 2 in head; gill rakers stout, 20 on the first arch; alimentary canal coiled on right side, its length $3\frac{1}{4}$ times the total length of the body; peritoneum black; vertebrae $16+18=34$.

Color of females light olivaceous above, much mottled with darker, nearly plain on lower half of the body; young with a few faint brownish bars on lower half of caudal peduncle; a narrow dark lateral band and a prominent black bar at base of caudal, the color of the males nearly uniform dark-olivaceous, the anterior half of some specimens being nearly black; the black caudal bar much less conspicuous than on the females; a dark line on the under side of the caudal peduncle in both sexes. Length about 2.50 inches.



SKIFFIA LERMÆ, Mack. ♀
No. 3721, Field Columbian Museum.



SKIFFIA LERMÆ, Mack. ♂
No. 3722, Field Columbian Museum.

This species probably occurs throughout the Lerma basin. One female taken about May 20 contained 30 young, each of which was about .34 inches in length.

133. *Skiffia variegata* Meek.

Skiffia variegata Meek, Field Col. Mus. Pub. 65, 1902, 104, Zirehuen; Chalco.

Basin of the Rio Lerma.

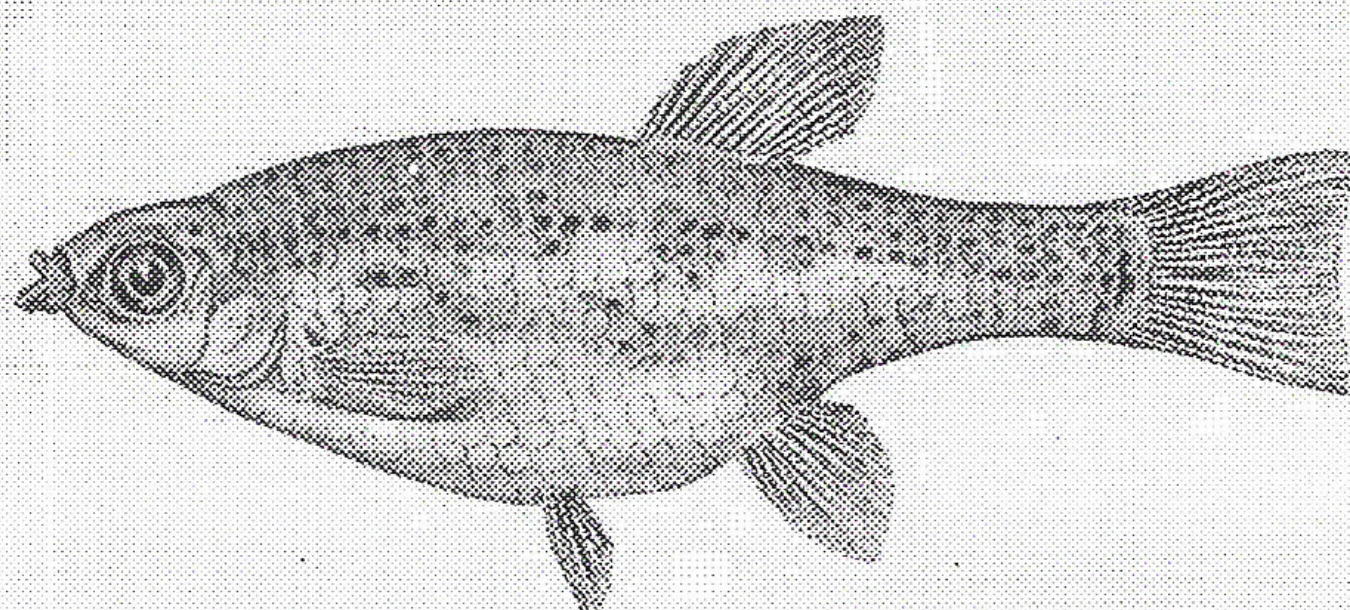


FIG. 49. *SKIFFIA VARIEGATA* Meek.
No. 412, Field Columbian Museum.

Head $3\frac{2}{3}$; depth $2\frac{1}{3}$; D. 14; A. 13; scales 13-24. Body deep, compressed; top of head convex; interorbital $2\frac{1}{4}$ in head; mouth small, lower jaw the longer; chin rather prominent; snout 4 in head; eye large, 3 in head; origin of dorsal slightly in advance of anal; its origin midway between base of caudal and posterior margin of orbit; base of dorsal fin $1\frac{1}{4}$ in head; height (in male) $1\frac{1}{4}$ in head, being somewhat lower in the female; anterior dorsal rays short, increasing gradually to the eighth or ninth; pectoral $1\frac{1}{3}$ in head; ventral 2; caudal fin truncate; abdominal canal coiled on the right side, its length 3 times total length of the body; peritoneum black.

Color olivaceous, much mottled, an indistinct dark lateral band, more or less broken in some specimens; four or five light brownish spots on the lower portion of the caudal peduncle, the under surface dark; color of the male more uniform and darker than that of the female; no black bar at base of caudal; chin black. Length about 1.75 inches.

The young of this species are born about the middle of May. A female about two inches in length will give birth to about 20 young, each being about .50 inch in length.

134. *Skiffia bilineata* (Bean).

Choracodon bilineatus Bean, Proc. U. S. Nat. Mus., 1867, 371, pl. 20, fig. 2; Rio Lerma, Guanajuato: Jordan & Evermann, Bull. 47, U. S. Nat. Mus., 1896, 668.

Skiffia bilineatus Meek, Field Col. Mus. Pub. 65, 1902; Huango. Basin of the Rio Lerma.

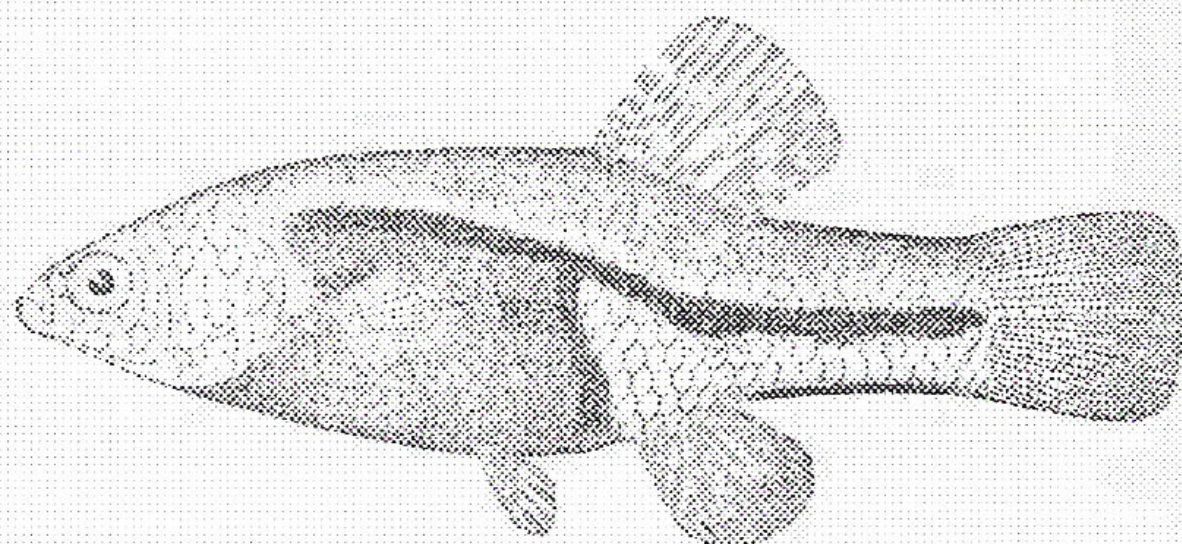


FIG. 45. *SKIFFIA BILINEATA* (Bean).
No. 2751, U. S. National Museum.

Head $3\frac{1}{2}$; depth 3; D. 16; A. 16; scales 11-32. Body robust, dorsal region somewhat elevated; head broad, depressed; interorbital space nearly flat, 2 in head; snout short; outer series of teeth bicuspid, loose, but less so than in other species of the genus; origin of dorsal fin in advance of anal, midway between base of caudal and the nape; opercle connected by a membrane to the shoulder; pectoral fin $1\frac{1}{2}$ in head; ventral 2; alimentary canal elongate, slightly less than $2\frac{1}{2}$ times the total length of the body; peritoneum black.

Color brown above, lighter below; a dark lateral band divided on anterior third of body, the posterior half more or less broken into 12 to 15 short, irregular bars, a few extending almost to dorsal fin; the upper half of the body with a few fine punctulations. Length about 1.60 inches.

A female 1.50 inches in length contained 27 young, white and very slender, each being .32 inch in length. The young of this species are evidently born the last of May and early in June.

Subfamily Poeciliinae.

59. *Platypristis* Günther.

Platypristis Günther, Cat., vi, 350, 1860. (Type, *Platypristis maculatus* Günther.)

Body deep, compressed; dorsal fin slightly in advance of anal; teeth loose, movable, in a single series in each jaw; alimentary canal