

OCCASIONAL PAPERS OF THE MUSEUM OF  
ZOOLOGY  
UNIVERSITY OF MICHIGAN

ANN ARBOR, MICHIGAN

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FIVE NEW SPECIES OF MEXICAN POECILIID  
FISHES OF THE *GENERA* *POECILIA*, *GAMBUSIA*,  
AND *POECILIOPSIS*

BY ROBERT RUSH MILLER

This paper makes available the descriptions of five distinctive poeciliid fishes prior to the planned publication of a guide to the freshwater fishes of México. All five have been known for many years, two since 1939 when the late Clarence L. Turner first collected them and recognized that they represented undescribed species. Experimental work has been carried out on one of them (*Poecilia chica*) since 1957 and fitfully on another (*Poeciliopsis turneri*). Collaborative biological studies of both new species of *Poeciliopsis* have been made in the laboratory of R. Jack Schultz and some of these results are included herein.

*Mollienesia* is recognized as a subgenus of *Poecilia* and it is suggested that species groups of *Gambusia* be employed with caution until phyletic analyses are completed.

Methods of counting and measuring are those given by Miller (1948:9-13) except that the first predorsal scale is the enlarged one lying on the occipital region. Vertebral counts include the hypural plate as one vertebra. All gill rakers, including tiny rudiments, are recorded for the first branchial arch. Head pores are counted on both sides, as are pectoral and pelvic fin rays. The counts for both dorsal and anal rays consider the last two elements as a single ray divided through its base (for *Gambusia*, one ray must be subtracted from these counts as given by Rivas and by Fink, who recorded all rays separately).

Thanks are due the staff of the National Museum of Natural History for providing me with working space and facilities, to the John Simon Guggenheim Memorial Foundation for support as a Guggenheim Fellow while preparing this manuscript, to Mexican officials for permission to conduct the field work, and to the National Science Foundation for support of the field and experimental aquarium work over a span of more than 15 years (most recently as GB-35943X). I also thank Carl L. and Laura C. Hubbs for transshipping live fish, R. Jack Schultz and Roger Thibault for valuable information on fetal adaptations and reproductive cycles of *Poeciliopsis*, William L. Fink for fruitful discussions about *Gambusia*, Donn E. Rosen for exchange of ideas on *Poecilia* systematics and for sending Figure 2, Klaus Kallman for helpful references, William L. Brudon for retouching Figures 1, 4, and 11, James F. McKinney for painstaking enlargement of Figures 9 and 12, and Jorge Carranza, J. Van Conner, J. M. Fitzsimons, Janet Ryle Gomon, J. T. Greenbank, H. L. Huddle, Klaus D. Kallman, Malcolm Miller, W. D. Sable, R. J. Schultz, A. and P. Starrett, and T. M. Uzzell for field and technical assistance. Museum abbreviations are: KU (University of Kansas), LACM (Los Angeles County Museum of Natural History), UF (University of Florida), UMMZ (University of Michigan Museum of Zoology), and USNM (National Museum of Natural History).

*Poecilia chica*, new species

Figs. 1-2

*Mollienisia* sp.—Turner, 1940:66 (Río Maravasco, Jalisco [probably Río Resolana]; fetal adaptations).

**Types.**—Holotype (UMMZ 172134), an adult male 25.9 mm in standard length (S.L.), was collected in a tributary of Río Purificación about 2.5 km E of La Concepción (about 8.5 km E of La Huerta), Jalisco, on 5 March 1955 by Robert R. Miller and John T. Greenbank; 104° 34' W Long., 19° 30' N Lat., elevation about 305 m. Taken with the holotype were the allotype (UMMZ 195952), an adult female 29.3 mm long, and 198 paratopotypes (UMMZ 172135), 13 to 46 mm long. There are 2399 paratypes (all from Jalisco): UMMZ 166452 (14, 30-41 mm) and UMMZ 172129 (9, 11-19 mm), Arroyo Pueblo Nuevo, 30 km by road N of Santiago (Colima); UMMZ 167857 (39,

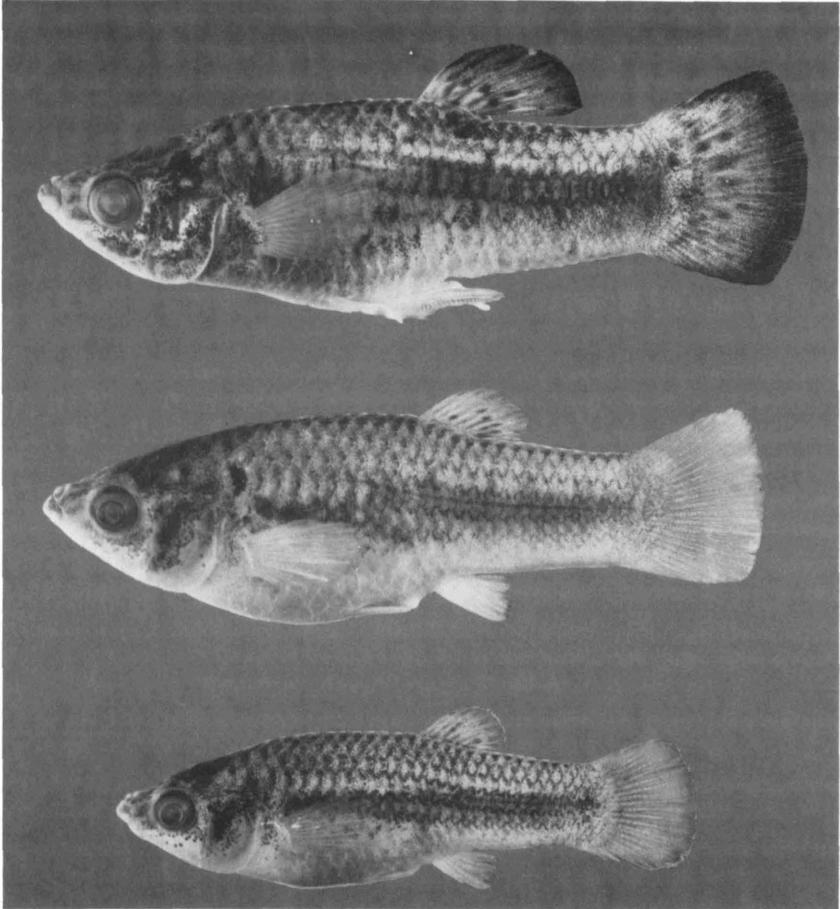


FIG. 1. Adults and juvenile paratopotypes of *Poecilia chica*, UMMZ 172135. A, male, 31 mm; B, female, 29.5 mm; C, juvenile, 23 mm. Photo by W. L. Brudon (retouched).

15-36 mm), 3.2 km SW of La Resolana; UMMZ 172213 (1016, 21-43 mm, including 5 cleared and stained), stream 4 km SW of turnoff to La Resolana and 40 km by highway SSW of Autlán; UMMZ 173583 (4, 22-31 mm), upper and lower parts of Río Maravasco above Cihuatlán (probably Río Resolana, a northern trib. to Río Cihuatlán or Chacala); UMMZ 173798 (1, 9 mm), mountain stream 3.2 km N of La Resolana; UMMZ 178370 (224, 12-32 mm), trib. Río Tempisque (in R. Cuetzmalá basin) ca. 19 km by road WNW of La Huerta (on road to Chamela); UMMZ 178374 (62, 7-37 mm), Río Apamila, 3.2 km NW of La Huerta; UMMZ 187895 (5 cleared and stained, 17-28 mm), trib.

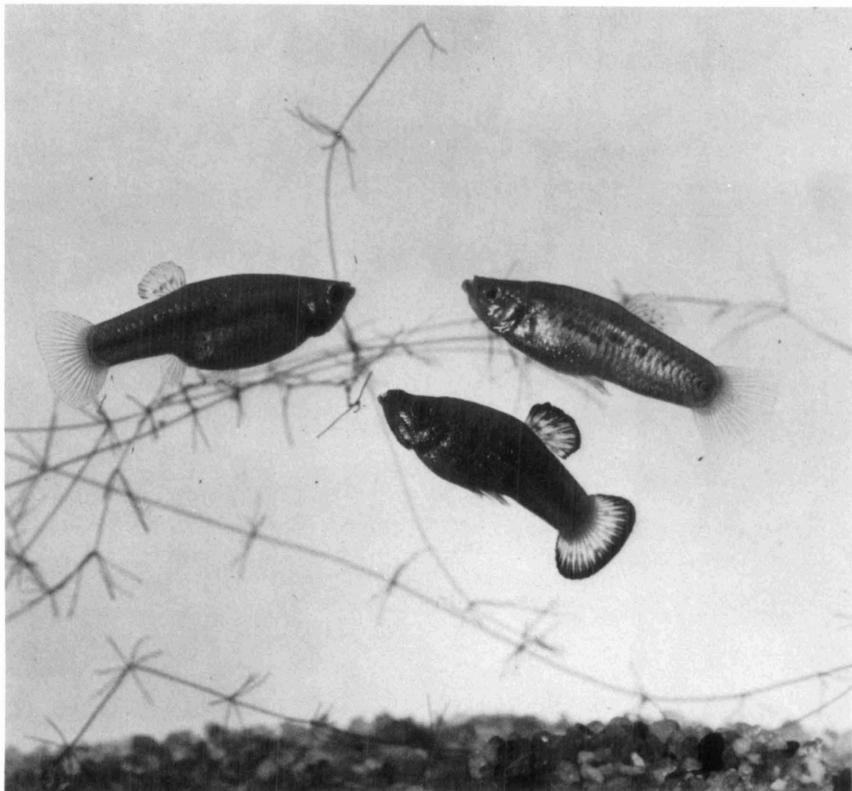


FIG. 2. Live individuals of *Poecilia chica* (from same locality as UMMZ 187895), females above and male below, born in Ann Arbor and raised to maturity in the American Museum of Natural History. Photo by Sam Dunton, N.Y. Zoological Society.

Río Apamila, 0.5 km N of turnoff to La Purificación from Hwy 80; UMMZ 192213 (843, 17-45 mm), LACM 34315-1 (20), and USNM 214088 (30), Arroyo El Arado, 5.5 km W of Hwy 80 on road to Purificación; UMMZ 192217 (122, 11-40 mm), trib. 2.5 km W Hwy 80 on road to Purificación; KU 15497 (3 males, 1 female 6 juveniles), ca. 35 km N and 10 km E of Santiago (Colima), W of Cuautitlán.

**Diagnosis.**—A small species of *Poecilia*, subgenus *Mollienesia*, related to *P. sphenops*, with very small, posteriorly-placed dorsal and anal fins, containing only 6 to 8 dorsal and 8 anal rays; tip of ray 3 of gonopodium without a membranous hook, and tip of ray 5 with only a small, retrorse spine; suspensorium with two

well developed gonapophyses but without ligastyle; inner jaw teeth tricuspid at tips, arranged in a broad, pad-like band; scales in lateral series 26, 16 around caudal peduncle; gill rakers 15 to 20; vertebrae  $13 + 15 = 28$ ; supraorbital pores 1 and 2a (Gosline, 1949: Pl. I, fig. 5) absent. Dorsal and caudal fins of nuptial, alpha males jet black, as is most of the body; both sexes with brassy-orange longitudinal rows of spots on sides.

**Description.**—Body form and coloration are shown in Figures 1 and 2 and proportional measurements are given in Table 1. Meristic data on populations from the three separate stream systems that comprise the known range of the species follow. Fin rays: dorsal, 6 (1), 7 (78), 8 (16), mean 7.16 (first ray unbranched in 40, first two rays unbranched in 17); anal, 8 (95); pectoral, 14 (10), 15 (109), 16 (1), mean 14.93; pelvic, 5 (3), 6 (117), mean 5.97; caudal, 17 (3), 18 (19), 19 (23), 20 (11), 21 (4), mean 18.90. Scales: lateral series, 26 (60); predorsal, 13 (21), 14 (43); 15 (1), mean 13.69; around body, 23 (1), 24 (51), 25 (1), 26 (7), mean 24.23; around caudal peduncle, 16 (60). Gill rakers 15 (4), 16 (12), 17 (8), 18 (14), 19 (14), 20 (7), mean 17.73. Vertebrae,  $13 + 15 = 28$  (59). Head pores: preopercular, 7 (115), 8 (5), mean 7.04; lacrimal, 3 (100), 4 (20), mean 3.17; mandibular, 0 (48), 2 (72), mean 1.20.

Measurements of 15 adults of each sex (Table 1) reveal marked sexual dimorphism (in addition to that of the anal-fin length and position) as follows: males have the origin of the dorsal fin farther forward, a much longer caudal peduncle whose depth is greater, a wider mouth, a longer dorsal fin with greater basal length, longer pectoral and, especially, pelvic fins, and a longer caudal fin. Their proportionately larger eyes are attributed to the much smaller average size of the males.

Gonopodium without a membranous hook at the tip of ray 3 and with only a small, retrorse spine at the tip of ray 5p (17 males examined). Gonopodial suspensorium with two well-developed gonapophyses that are short-based and bent sharply forward, the first one with its anterior arm strongly curved downward distally, the main shaft of the second one typically nearly straight.

Life colors were noted both in the field and laboratory. The male has 4 or 5 horizontal rows of golden to brassy orange spots along the side, from near the pectoral base to the base of the caudal fin. In the alpha male, the entire body and the dorsal and caudal fins become velvet-black, the gonopodium orange. Reflected from the scales on the sides is a purplish blue to

TABLE 1  
 PROPORTIONAL MEASUREMENTS OF *POECILIA CHICA* IN  
 PERMILLAGE OF STANDARD LENGTH<sup>1</sup>

Measurement	Holotype	15 males	15 females
Standard length	25.9	21.6-30.4 (25.7)	27.0-42.7 (33.4)
Prodorsal length	606	597-624 (610)	614-648 (636)
Dorsal origin to caudal base	432	417-446 (436)	393-431 (410)
Anal origin to caudal base	494	477-514 (496)	344-390 (367)
Body depth	328	312-357 (336)	318-363 (338)
Head, length	324	304-325 (317)	283-326 (304)
Width	216	193-222 (212)	204-226 (217)
Caudal peduncle, length	432	413-453 (434)	287-312 (302)
Least depth	193	181-213 (199)	170-195 (180)
Interorbital, least bony width	154	137-162 (146)	146-167 (155)
Mouth width	127	115-130 (124)	104-123 (116)
Snout length	108	97-110 (103)	96-109 (101)
Orbit length	93	86-96 (92)	73-89 (82)
Dorsal, depressed length	251	222-306 (255)	180-206 (191)
Basal length	120	109-137 (121)	96-115 (106)
Anal, depressed length or gonopodium	232	216-269 (235)	137-160 (147)
Basal length			59-73 (66)
Pectoral length	220	199-247 (218)	188-210 (201)
Pelvic length	181	173-201 (186)	109-119 (113)
Caudal, length middle rays	247	230-272 (246)	199-243 (217)

<sup>1</sup> Based on UMMZ 172134 (holotype), UMMZ 172135 (paratopotypes, 5 ♂♂, 4 ♀♀), UMMZ 172213 (paratypes, 9 ♂♂, 10 ♀♀), and UMMZ 195952 (allotype). Holotype included with the 15 ♂♂ and allotype with the 15 ♀♀.

turquoise sheen, when seen in strong light. The less intensely colored males have the dorsal and caudal fins broadly margined in black (Figs. 1-2), the interradial membranes milky white, and the base of the pectoral fin dusky. There are a few large, irregularly arranged, black spots on the interradial membranes of the dorsal and caudal fins; the other fins are immaculate. In the female, which is generally lighter in tone than the male, most of the anal fin is yellow-orange to golden, the dorsal fin pale yellow to yellow-orange. There are up to six horizontal rows of orange spots extending along the sides, the lowermost row at about the level of the ventral margin of the orbit. The sides have a metallic golden sheen with purplish blue to turquoise reflections from the scale centers below the darkened and often diffuse lateral stripe that runs at eye level from behind the head to near the caudal base; these reflections extend ventrally about 3 to 4 scale rows below the lateral stripe. The entire abdomen may be turquoise, the back golden olive. The dorsal fin has a few dark spots, irregularly arranged, on the interradial membranes; all other fins are immaculate.

The lateral stripe described for the female is also seen on males (other than alpha individuals) and in juveniles (Fig. 1); it resembles that observed in some platyfish, e.g., *X. gordonii* (Miller and Minckley, 1963: Fig. 1, male). Its upper and lower margins are irregular, denticulate, and with the centers of the scale pockets generally without concentrated melanophores. In both sexes there is a narrow, dark, middorsal streak before the dorsal fin that fades out on the occiput, a similar one on the ventral surface of the caudal peduncle, and a third along the midaxis of the side that fades out above the pectoral fin.

The complete blackening of the dominant nuptial male in a mixed group of males and females is a particularly striking feature of the reproductive biology of this species and may be unique for the subgenus *Mollienesia*. In this feature, *P. chica* resembles the alpha males of the *Leptorhaphis* species group in the distantly related genus *Poeciliopsis* (Miller, 1960).

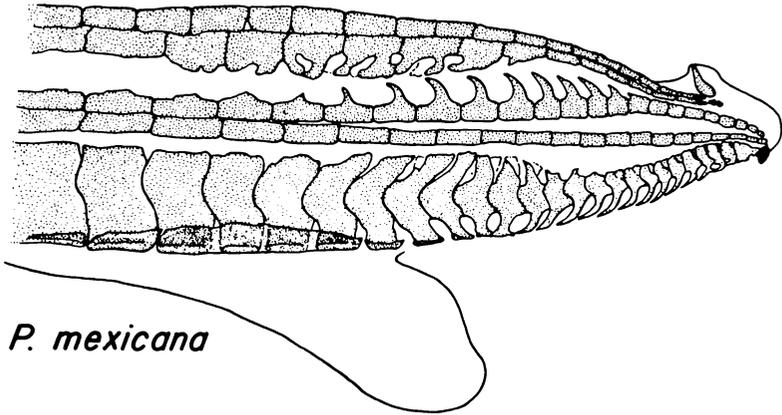
The subgenus *Mollienesia* (type species, *M. latipinna* Lesueur) may be defined on the basis of a gonopodial trait (Fig. 3) that separates it from *Poecilia* (type species, *P. vivipara* Bloch and Schneider), namely, the lack of serrae on the posterior surface of ray 4a (the lack of a hook or a spine at the tip of the gonopod is not diagnostic since it is common to *P. vivipara* and at least two species of mollies). Subgenus *Mollienesia* is almost

restricted to Middle America, with only a few species found outside that area (in southern United States, the West Indies, and northern South America). It includes 16 recognized species and probably several more.

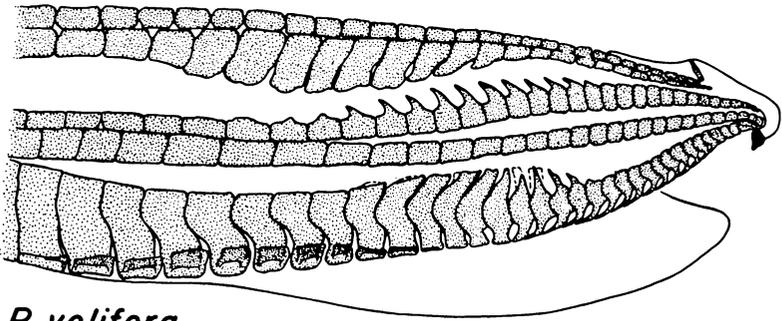
**Variation.**—The chief variation noted for *P. chica* is in the number of dorsal rays, gill rakers, and mandibular pores. The one sample available from the basin of Río Cihuatlán (UMMZ 166452) has more dorsal rays and gill rakers (modes at 8 and 19, respectively) and no mandibular pores. There are, however, only 14 specimens in that collection, varying from 29 to 40 mm, and this may have influenced the mandibular-pore development if not the other traits. Gill-raker number shows a strong mode at 16 (range 15-18) in the one sample from the basin of Río Cuetzmalá (UMMZ 178370), but this collection contains much smaller fish (19-35 mm, mean 25.8, in those counted) than the specimens counted from the other two drainages; this may account for the lower raker number. Measurements were made of specimens from the Purificación basin only, because of small sample size or dwarfing in the material from the other two drainages; consequently, interbasin variation in morphometry has not been studied.

Marked variation in the size attained by mature males occurs within and between the collections from the three separate drainages. This phenomenon is probably of general occurrence in the Poeciliidae and is genetically determined (Borowsky, 1973a, b; Kallman et al., 1973). The following data give the standard length (in mm) of these males, with frequencies in parentheses, followed by the total number and mean. Río Tempisque (Río Cuetzmalá basin), 18 (5), 19 (22), 20 (20), 21 (6), 22 (7), 23 (1), 24 (1), 25 (2) in 64, 20.08; trib. to Río Purificación, 19 (1), 20 (1), 22 (1), 23 (1), 25 (1), 26 (1), 31 (1) in 7, 23.71 (11 immature males had lengths of 15-24 mm); Arroyo Pueblo Nuevo (Río Cihuatlán basin), 32 (2), 33 (1), 34 (1), 39 (1), in 5, 34.00 (3 of the remaining males were immature, with lengths of 33, 35, and 37 mm).

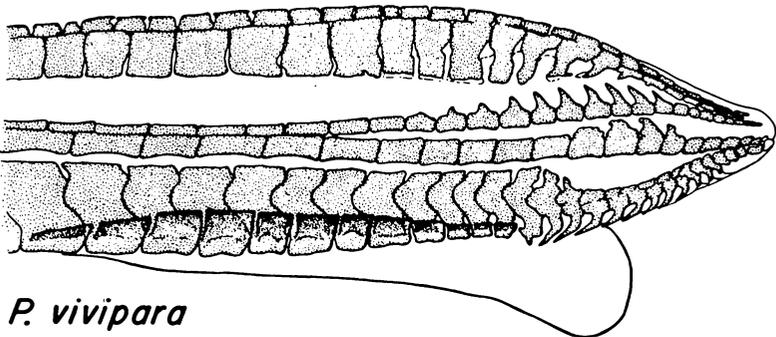
**Habitat and Associates.**—The species was collected only near the end of the dry season in March and April. Water and air temperatures at those times varied from 22.8° to 25.6° C and from 25.0° to 29.4° C, respectively. Depth of capture of adults varied from 0.30 to 1.05 m, the young occurring in shallower water; current was none to moderate, generally slight; streamside tree growth was usually well developed, producing abundant



*P. mexicana*



*P. velifera*



*P. vivipara*

FIG. 3. Gonopodia of three species of mollies. *P. mexicana* (UMMZ 189006), Río Guayalejo just E of Llera, Tamaulipas; *P. velifera* (UMMZ 143099), ciénega S of Progreso, Yucatán; *P. vivipara* (UMMZ 172752), Puerto Rico. Drawn by Carole Wrigley Christman.

shade. Vegetation comprised dense beds of *Ceratophyllum*, green algae, some water hyacinth and other unidentified emergent plants, but one station had only sparse green algae; the bottom consisted of sand, silt, rocks, some mud, leaves, and brush; water was recorded as clear and very easily roiled except at one station; one stream averaged only 1.2 m wide but the width of most averaged from 3.6 to 4.5 m or more, with one stream attaining a maximum width of 9 meters. A shaded habitat with flowing water about 0.3 to 0.6 m deep over rocky-gravelly bottom seems to be the preferred habitat of adults; the young occur in quiet, shallow areas in or near beds of vegetation.

The following fishes were taken with *Poecilia chica*: *Poeciliopsis turneri* (see this paper) and *Poeciliopsis* sp., of the Poeciliidae, and *Xenotaenia resolanae* Turner and *Ilyodon xantusi* (Hubbs and Turner) of the Goodeidae. Conspicuous by its absence is the ubiquitous characin, *Astyanax fasciatus* (Cuvier), which reaches its northern limit on the Pacific Coast of Middle America in the Río Armería basin, just to the southeast of the range of *P. chica*.

**Comparisons.**—No fewer than 12 species of mollies (subgenus *Mollienesia*, see above) are now known from México, including the gynogenetic all-female *P. formosa* (Girard).<sup>1</sup> Three of the 11 bisexual species belong to the *P. latipinna* complex, with a large and more anteriorly-placed dorsal fin (rays typically 12-18) and with 9 or fewer scales between the origin of the dorsal fin and the occiput. The remainder are members of the *P. sphenops* complex (Schultz and Miller, 1971), which comprises at least seven species (Miller, 1973, and the present work). Only three or four species in this complex have the tips of the inner tooth rows tricuspid; in México these include only *P. sphenops* Valenciennes, *P. chica*, and *P. catemaconis* (this paper). *Poecilia chica* is easily separated from *P. sphenops* by having smaller dorsal and anal fins, with only 7 (6-8) and 8 rays, respectively, a reduced number of lateral scales (26 vs. 27 or more), and in consistently lacking a membranous hook at the tip of ray 3 of the gonopodium. Black nuptial males of *P. sphenops* have been collected on the Pacific slope of México in the Río Balsas basin, but the systematic status of these populations is as yet undetermined.

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<sup>1</sup>According to the terminology favored by Schultz (1969), this "species" would be called *P. latipinna-mexicana*.

As far as now known, *Poecilia chica* is one of three species of mollies that consistently have only 8 anal rays; the other two, each with conic inner teeth, are *P. butleri* Jordan (see Schultz and Miller, 1971) and *Poecilia caucana*, of Panamá, Colombia, and Venezuela. *Poecilia vivipara*, peripheral in range and relationships to the true mollies, has 8 anal rays and a small, posterior dorsal fin of 6 or 7 rays, but it has neither a spine nor a membranous hook at the tip of the gonopodium and possesses from 2 to 8 serrae on the posterior margin of ray 4a of this organ (Fig. 3), conic inner jaw teeth, and usually a round, dark spot high on the side of the body about halfway between the tip of the snout and the base of the caudal fin.

**Experimental Studies.**—Records of the number of offspring born and the brood interval between births for six females (five wild-caught fish and one  $F_1$  reared in Ann Arbor) held in the aquarium facility of the Museum of Zoology yielded the following results: the number of young per brood varied from 1 to 50, the largest broods from wild-caught females occurring from March to November and the smallest (except, sometimes, for the initial brood) from late October into February. The one  $F_1$  female produced 11 broods of 2 to 34 young between 21 October 1966 and 16 November 1967; she was 163 days old and only 26.0 mm S.L. when the first brood was produced and 36.0 mm when the last was born. This female, preserved 5-1/2 months after her last brood, was 38.0 mm long and contained eggs but no embryos. Number of offspring and intervals between broods were more irregular, as Turner (1937:147) also found for laboratory-reared poeciliids.

The brood interval varied from 25 to 43 days in wild-caught females, the longest intervals occurring between 25 December and 4 February (41 days) and 21 November and 3 January (43 days). The retardation of reproduction is probably much more marked in nature than it is in the laboratory (see also Turner, 1937:147). The  $F_1$  female's brood intervals varied from 28 to 72 days. The sex ratio of a brood of 28  $F_1$  young was equally divided between males and females.

Morphological evidence strongly supports the view that *P. chica* is most closely related to Pacific-slope stocks of *P. sphenops* and was presumably derived from a population of that species or its progenitor. Hybridization experiments, involving no-choice or forced matings between *P. chica* and three other species of *Poecilia*, while only constituting a test of the com-

patibility of the reproductive and sex-determining systems, nevertheless are consistent with the phylogenetic relationship just suggested. The data follow.

When the male of *chica* was mated with the female of *butleri* (M66-18 stock from near Tepic, Nayarit), 6 of 8 matings produced a male-female sex ratio of 180:18. In the reciprocal cross, this ratio (from 8 matings) was 619:47. When the male of *chica* was mated with the female of *sphenops* (M59-50 stock from trib. Río Papagayo—see Schultz and Miller, 1971), 3 of 4 matings produced a sex ratio of 54:51 and in the reciprocal cross, this ratio (from 8 matings) was 37:59. Although not all the young survived to maturity, these ratios give a clear indication of a highly skewed sex ratio when *P. chica* and *P. butleri* are crossed and a more nearly normal ratio when *P. chica* and *P. sphenops* are hybridized. Furthermore, in the cross ♀ *chica* × ♂ *butleri*, one of the males produced took 12 months to mature, another one 16 months (normal transformation time for mollies of this size is about 1 to 4 months); several females examined had thin, degenerate-looking gonads. In the one mating of this cross that produced 23 of the 47 females, only one female had embryos even though many were with males for long periods of time. Only one of the 10 matings was really productive. Since all mollies will intermate in no-choice situations (even between the *latipinna* and *sphenops* complexes), the fact that artificial hybridization is successful is not critical to the determination of species validity. Very few hybrids have been identified in nature so it is evident that premating isolating mechanisms are maintaining species integrity wherever mollies are sympatric. This hypothesis needs experimental verification.

When the male of *chica* was mated with the female of *mexicana* (*P. m. limantouri* Jordan and Snyder, M66-3 stock from Río Guayalejo, Llera, Tamps.) only males resulted but only one mating was made and yielded only 4 offspring; the reciprocal mating also produced all males but just one brood of 6 fish was born. When the same cross was made (using *P. m. mexicana*, M66-29 stock from 33 km N of San José Cardel, V.C.), the sex ratio was 133:158, with 32 of 323 fish missing (died but not recovered), indicating a more or less normal sex ratio. However, in one mating (that produced 130 mature fish), seven males had abnormal testes, 24 females showed “arrested” ovaries, and there were three intersexes (with degenerate ovary and trace of testis). In the reciprocal mating of this cross, however, with *chica* as the female, the sex ratio was 138:7 (with only 9 of

the 154 fish not accounted for); this clearly indicates an abnormal sex ratio.

A possible explanation for the different results (more unbalanced sex ratios, etc.) in the hybrid crosses when the female (rather than the male) of *P. chica* was used is that there may be too great a differential between the egg size and the size of the foreign sperm. This hypothesis has not been tested.

**Range.**—This species is known thus far only from three small, separate drainages along the Pacific slope of southwestern México: Río Cuetzmala (or Cuixmala), Río Purificación, and a northern tributary to Río Cihuatlán (or Chacala)—all in southern Jalisco. These streams lie between the city of Colima and the coastal town of Chamela; two (Cihuatlán and Purificación) are crossed by Hwy 80 between Manzanillo, Colima, and Autlán, Jalisco. The altitudinal distribution of *P. chica* is probably between 250 and 450 meters. All of the known records are inland at least 25 km from the sea; Río Cihuatlán (possibly the only one of the three drainages with a large, permanent flow to the ocean) contained no mollies at Cihuatlán, about 15 km inland, and none about 20 airline km farther upstream; at both places the river is completely exposed with a predominantly sandy bottom, a habitat wholly unsuited to *P. chica*.

It is unlikely that the species occurs farther to the east of its present known range limit (the basin of Río Cihuatlán) because the next stream, the well-worked Río Armería, has yielded only one molly, *Poecilia butleri*. *P. chica* may occur to the northwest, however, between Río Cuetzmala and Cabo Corrientes, where there are several independent Pacific tributaries that have not been carefully examined.

**Etymology.**—The specific name is taken directly from the Spanish word *chica*, meaning little or small, in reference to the small fins and size of this species.

*Poecilia catemacensis*, new species

Fig. 4

*Mollienesias [sic] sphenops*.—del Campo, 1938:226 (counts and measurements of four adults from L. Catemaco).

**Types.**—Holotype (UMMZ 195953), an adult male 50.9 mm S.L., was collected in Laguna Catemaco at Playa Azul, about 3.2 km E of Catemaco, Veracruz, on 29 March 1957 by Robert R.

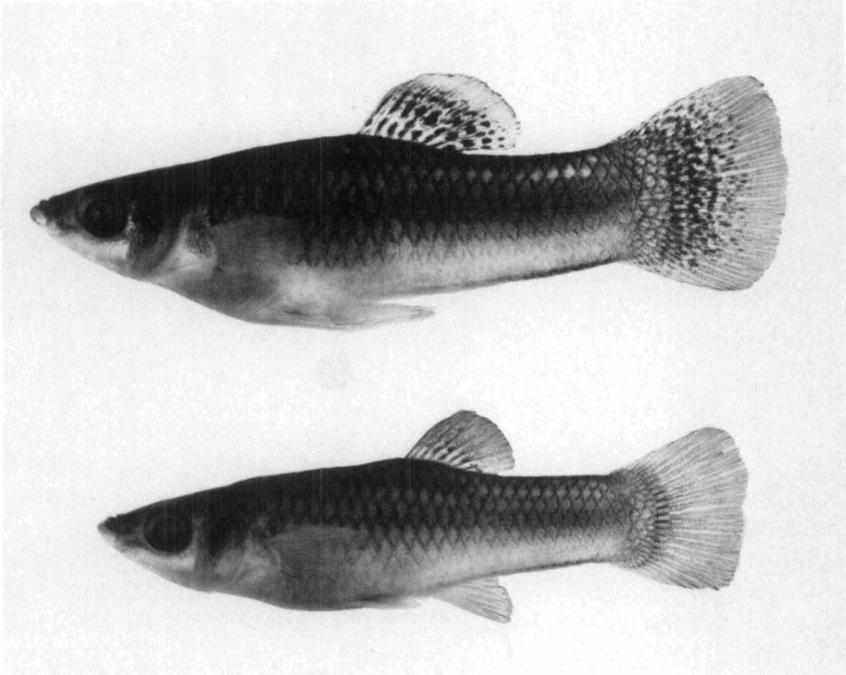


FIG. 4. Holotype (UMMZ 195953, 50.9 mm) and female paratopotype (UMMZ 178555, 44.5 mm) of *Poecilia catemaconis*. Photo by the University of Michigan Photographic Services (retouched).

and Malcolm Miller; 95° 05' W. Long., 18° 25' N Lat., elevation about 340 m. Taken with the holotype were 67 paratopotypes (UMMZ 178555), 11-69 mm long, including one male and two females. There are 122 paratypes (all from Veracruz): UMMZ 176976 (26 young to immatures, 11-42 mm), small beach 1/4 km S of bridge at outlet of L. Catemaco; UMMZ 184541 (23 young and one large adult female, 19-93.5 mm), L. Catemaco 0.8 km S of Catemaco; UMMZ 196392 (17 adults, 58-93 mm), taken by commercial fishermen in L. Catemaco and purchased in the market at San Andrés Tuxtla; and UMMZ 196395 (55 young to immatures, 13-41 mm, including 3 cleared and stained), Arroyo Escuinapan, about 2 km S of Catemaco. In addition, two immature females taken in this same arroyo on 29 March 1957 were sent to México (as *Poecilia* sp.) in 1961.

**Diagnosis.**—A large, semipelagic, narrow-bodied species of *Poecilia* (maximum S.L. ca. 94 mm, females; taken as adults by commercial fishermen), subgenus *Mollienesia*, related to *P. sphenops* (inner teeth tricuspid in both), with long and slender

body (especially caudal peduncle of male), and short caudal and dorsal fins (in nuptial male, dorsal when depressed not reaching half-way to base of procurvent caudal rays); body strongly bicolored in adults; horizontal rows of spots (one per scale) along side orange in males, brassy in females; gill rakers numerous (25-28 in adults 58-94 mm); scales in lateral series 27 or 28, 18 around caudal peduncle; supraorbital pores 1 and 2a absent (as in *P. sphenops*); distance from anal origin to vent stepped from vent to pelvic insertion varies from about 2.0 to 3.0 in adult females (usually more than 4.0 in *P. sphenops* from México; Schultz and Miller, 1971:284).

**Description.**— Form and coloration are shown in Figure 4, and proportional measurements of adults and immatures are given in Table 2. Meristic data follow. Fin rays: dorsal, 9 (29), 10 (2), mean 9.06 (first ray unbranched in 16, first two rays unbranched in 6); anal, 8 (1, probably abnormal), 9 (30), mean 8.97; pectoral, 15 (19), 16 (42), mean 15.69; pelvic, 6 (62); caudal, 18 (2), 19 (3), 20 (12), 21 (9), 24 (4), mean 20.33. Scales: lateral series, 27 (15), 28 (17), mean 27.53; predorsal, 13 (12), 14 (20), mean 13.63; around body, 23 (2), 24 (21), 25 (7), 26 (1), mean 24.23; around caudal peduncle, 18 (32). Gill rakers, 22 (3), 23 (6), 24 (2), 25 (3), 26 (13), 27 (3), 28 (1), mean 24.96 (25-28, mean 26.01, in 20 adults, 58-93.5 mm). Vertebrae, 13 + 16 = 29 (2), 14 + 15 = 29 (29), 15 + 14 = 29 (20), 14 + 16 = 30 (1), 15 + 15 = 30 (1), 29 (8), mean 29.00. Head pores: preopercular, 7 (64); lacrimal, 3 (2), 4 (58), mean 3.97; mandibular, 2 (61).

Measurements (Table 2) indicate strong sexual dimorphism (additional to that of the position and length of the anal fin) in the position of the dorsal fin (farther forward in males), length and depth of the caudal peduncle (longer and deeper in males), interorbital width (narrower in males), length of dorsal fin (longer in males), and length of pelvic and caudal rays (longer in males). The proportionately larger eye of the male is attributed to the smaller size (S.L. mean 63.8 vs. 85.7 for adult females).

Gonopodium (7 males examined) with a small, membranous hook at the tip of ray 3 and a slender retrorse spine at the tip of ray 5p. Retrorse spines on posterior border of ray 4p numerous, 12 to 16, the number of segments from first spine-bearing one to tip of ray 5p, 24 to 28. Gonopodial suspensorium with two well-developed gonapophyses, short-based and bent obliquely forward and downward, both nearly straight. There is no ligastyle.

TABLE 2  
 PROPORTIONAL MEASUREMENTS OF *POECILIA CATEMACONIS*  
 IN PERMILLAGE OF STANDARD LENGTH<sup>1</sup>

Measurement	Holotype	7 males	6 females	3 immature males	2 immature females
Standard length	50.9	50.9-70.5 (63.8)	72.4-90.5 (85.7)	37.5-40.6 (39.6)	40.4,44.0 (42.2)
Predorsal length	538	509-547 (530)	572-593 (583)	571-579 (575)	569,580 (575)
Dorsal origin to caudal base	483	469-509 (484)	443-459 (451)	440-451 (446)	438,450 (444)
Anal origin to caudal base	574	571-612 (588)	393-412 (402)	443-453 (447)	420,426 (423)
Body depth	295	286-309 (298)	290-316 (303)	272-286 (280)	262,275 (269)
Head, length	279	270-282 (278)	265-287 (275)	288-304 (295)	277,295 (286)
Width	169	154-169 (160)	164-190 (177)	187-197 (190)	178,193 (185)
Caudal peduncle, length	503	503-548 (524)	327-347 (336)	355-362 (359)	322,336 (329)
Least depth	198	191-205 (197)	165-180 (173)	172-177 (175)	158,170 (164)
Interorbital, least bony width	114	113-119 (115)	124-133 (128)	128-133 (131)	134,134 (134)
Mouth width	102	94-103 (98)	97-109 (105)	116-120 (117)	114,114 (114)
Snout length	92	88-98 (93)	84-94 (89)	94-99 (96)	93,94 (93)
Orbit length	88	79-88 (84)	68-75 (73)	86-88 (87)	84,89 (87)
Dorsal, depressed length	285	258-299 (274)	209-219 (213)	219-222 (221)	213,220 (217)
Basal length	143	138-155 (147)	124-139 (131)	123-123 (123)	123,124 (123)
Anal, depressed length or gonopodium	202	168-202 (179)	160-174 (167)	144-153 (147)	171,175 (173)
Basal length			63-73 (69)	71-74 (72)	80,82 (81)
Pectoral length	218	215-235 (227)	211-238 (221)	203-212 (208)	198,216 (207)
Pelvic length	177	145-177 (159)	126-133 (129)	118-123 (121)	121,123 (122)
Caudal length, middle rays	267	248-271 (257)	203-229 (220)	224-234 (227)	220,236 (228)

<sup>1</sup> Based on adults: UMMZ 195953 (holotype), 196392 (paratypes); immatures 176976, 178555, and 196395 (paratypes). Holotype included with the 7 adult ♂♂.

Life colors were noted in the field. The nuptial male has the outer half of the dorsal and caudal fins bright orange, the basal half bluish black; the caudal also has a narrow black margin. The gonopodium is milky white to orange. The lower sides and venter of both the head and the body, as far back as the extended tip of the dorsal fin, are golden. The sides are marked by horizontal rows of orange spots, one per scale. The female lacks bright colors on her fins or body, and has horizontal rows of dull brassy spots along the scales on the side of the body.

**Habitat and Associates.**—Laguna Catemaco, cradled in the isolated volcanic mountain range called Los Tuxtlas, in south-eastern Veracruz, lies about 340 m above sealevel, is about 9 by 14 km in major dimensions, of irregular outline with several small islands, and is said to be 12 to 15 m deep (Goldman, 1951:269). Its area is approximately 12,950 ha (=50 sq. mi.). Its outlet, Río Grande or Bravo, which exits near the northwestern end, is part of the Río Papaloapan drainage basin, descending to the low country in a series of four waterfalls of which the highest (Salto Eyipantla) was estimated by me to have a vertical fall of at least 60 m. Only one major stream (difficult of access), Río Cuescalapa, enters the lake. The bottom of the lake is composed of volcanic sand, with some muck and volcanic boulders along the western shore. Skies are often cloudy and there is much rain, for most of the lake lies within the Humid Tropical area; only along the western border are the low hills and valleys relatively dry, covered with the small and sparse arboreal vegetation of the Arid Tropical Zone. Mahogany and Spanish cedar are included in the forest trees of the eastern side. Water was somewhat murky from rains in late March, 1957, but was clear and brownish in early February, 1959. Vegetation was virtually nil, with *Ceratophyllum* and *Nymphaea* locally. Air temperatures were 20.5° to 27.6° C and water varied from 24° to 24.8° C on my three visits.

Although we have seined to as deep as 1.5 m with a 4.6-m seine of 6.35-mm mesh in attempts to catch adults, only two adult males and three adult females were obtained. Nocturnal seining was not attempted, however. Commercial fishermen capture both sexes.

Other fishes taken in the lake included *Dorosoma petenense* (Günther), *Astyanax fasciatus*, *Rhamdia guatemalensis* (Günther), *Poeciliopsis catemaco* (described herein), *Xiphophorus helleri* Heckel, *Heterandria bimaculata* (Heckel), *Cich-*

*lasoma fenestratum* (Günther), and *Cichlasoma* sp. Some of these were mentioned by del Campo (1938). Also present in the lake is the freshwater crocodile, *Crocodylus moreleti* Duméril (Campbell, 1972).

I do not know another Mexican species of *Poecilia* in which the adults are restricted to deep water (1.2 to more than 2 m). In the one readily accessible tributary to Laguna Catemaco, Arroyo Escuinapan (2 km S of Catemaco), which is up to 1.2 m deep at its mouth, only young and immatures have been taken between Hwy 140 and the lake during three visits (1957, 1959, 1974). We have seined only 5 adults (2 males and 3 females) from the lake, in water 1.2 m deep; the 17 large adults (UMMZ 196392) taken by commercial fishermen came from the open waters of the lake.

**Comparisons.**—The status of the subgenus *Mollienesia*, comprising the mollies, is discussed above under the account of *Poecilia chica*. Only three species of mollies with the inner jaw teeth tricuspid at their tips are presently known from México. *P. catemaconis* differs sharply from the Pacific species, *P. chica*, in its larger size, more dorsal and anal rays, more scales in lateral series and around caudal peduncle, more gill rakers and vertebrae (28 in *chica*, 29 or 30 in *catemaconis*), etc. (See Diagnosis of *P. chica*)

*P. catemaconis* is clearly most closely related to and derived from an Atlantic-slope stock of *P. sphenops*. Comparison with a large series of that species (UMMZ 196386) taken from a lagoon in the floodplain of Río Papaloapan, about 35 km WSW of Cosamaloapan, Veracruz (in the same drainage basin as Laguna Catemaco), indicates the following diagnostic differences: in the male of *P. catemaconis*, the anal fin is much farther forward, the caudal peduncle is much longer, and the dorsal fin is shorter and more anterior in position. In both sexes, the body (including caudal peduncle) is slenderer, the head shorter and narrower, the interorbital and mouth narrower, and the caudal fin shorter. Measurements in permillage of standard length of six males (41.1–53.9 mm long, mean 47.1) and six females (49.4–56.9, mean 52.3) of *P. sphenops* (UMMZ 196386) for comparison with the adults of *P. catemaconis* in Table 2, gave the following values (males first, with range followed by mean in parentheses): predorsal length ( $\delta\delta$ ), 571–592 (577); anal origin to caudal base ( $\delta\delta$ ), 484–505 (496); body depth, 342–384 (363) and 322–341 (334); head length, 314–328 (321) and 313–326 (321); head

width, 195–219 (209) and 204–217 (209); caudal peduncle length, 430–438 (434) and 312–330 (318); least caudal-peduncle depth, 217–228 (224) and 192–211 (203); least bony interorbital width, 132–141 (137) and 134–144 (140); mouth width, 111–123 (118) and 115–121 (118); depressed dorsal length, 302–382 (331) and 239–255 (248); depressed anal length (♀♀), 172–193 (182); gonopodium length (♂♂), 204–225 (217); basal length of anal (♀♀), 81–92 (86); middle caudal-ray length, 294–334 (310) and 291–320 (303). Gill rakers of 30 adult specimens of *P. sphenops* (31.5–54.0 mm) numbered 20 (2), 21 (7), 22 (10), 23 (6), 24 (4), and 25 (1), barely overlapping these counts in adults of *P. catemacensis* which, in turn, attain a much larger size than any population of *P. sphenops* known to me from México. The high gill-raker number in *catemacensis* is not unique for the genus for I have counted 25 to 29 in Mexican specimens of *P. mexicana* (UMMZ 196402, Río Tonalá basin, Veracruz).

**Range.**—This species is evidently confined to Laguna Catemaco, its tributaries and the outlet, Río Grande or Bravo (Van Conner, pers. comm., 1965) above the falls, in Veracruz.

**Etymology.**—The specific name refers to the known distribution of this molly only within the drainage of Laguna Catemaco.

### *Gambusia eurystoma*, new species

Figs. 5–7

**Types.**—The holotype (UMMZ 197600), a mature male 24.5 mm S.L., was taken from Arroyo del Azufre at Baños de Azufre, 10 km W of Teapa, Tabasco, on 15 February 1959 by R. R. Miller and R. J. Schultz; 93° 01' W Long., 17° 34' N Lat., elevation about 150 meters. The allotype (UMMZ 197601), an adult female 28.8 mm long, and 290 juvenile to adult paratypes (260, UMMZ 184717, and 30, USNM 211263), 12 to 36 mm, are from the same collection.

**Diagnosis.**—A species of *Gambusia* most closely related to *G. sexradiata* Hubbs and *G. luma* Rosen and Bailey, from both of which it differs sharply in having a very broad mouth, a fan-shaped caudal fin with numerous prominent black spots, a broad interorbital region, very short fins (especially the caudal), the anal fin rounded or truncate posteriorly, a short caudal

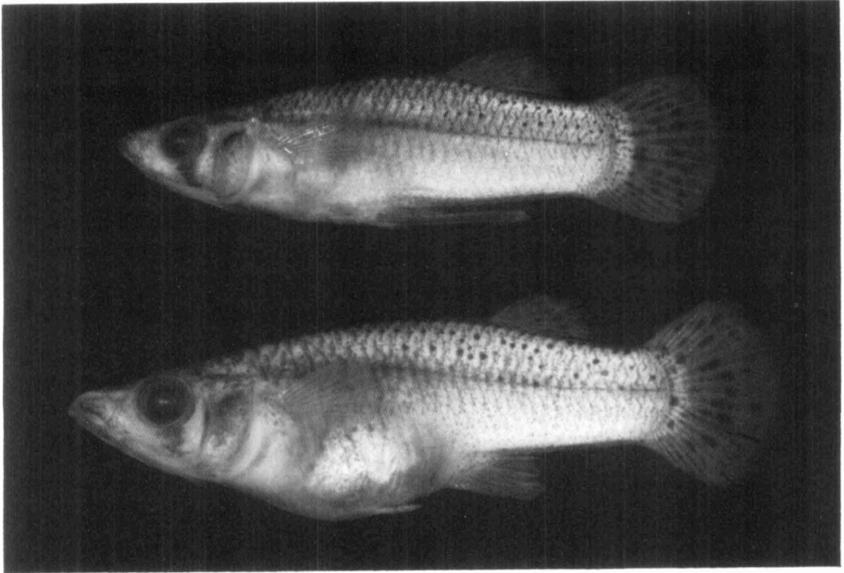


FIG. 5. Holotype (UMMZ 197600, 24.5 mm) and allotype (UMMZ 197601, 28.8 mm) of *Gambusia eurystoma*. Photo by Louis P. Martonyi.

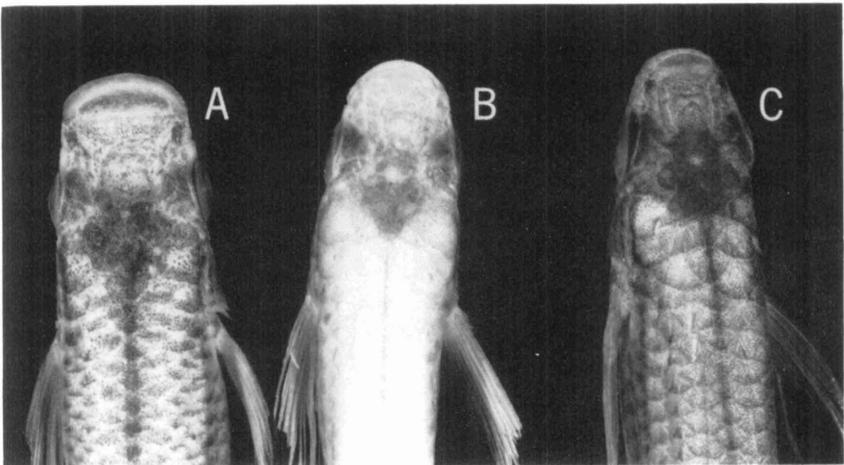


FIG. 6. Dorsal view of anterior end of adult females of three species of *Gambusia*. A, *G. eurystoma* (UMMZ 184717), 35.7 mm; B, *G. luma* (UMMZ 143566), 35.5 mm, Bahía Pto. Barrios, Guatemala; C, *G. sexradiata* (UMMZ 184550), 36.3 mm, Lago de Sontecomapan, Veracruz. Photo by Louis P. Martonyi.

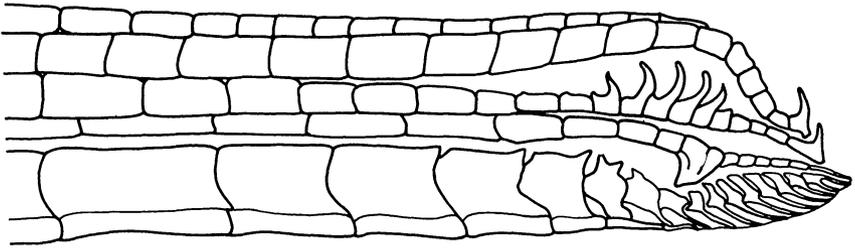


FIG. 7. Gonopodium of *Gambusia eurystoma* (UMMZ 184717). Drawn by Jack Schroeder.

peduncle, 30 scales in lateral series, and in the following gonopodial feature: longest spines along anterior margin of ray 3 only slightly longer than longest serrae of ray 4p (Fig. 7).

**Description.**—Body form, coloration, sexual dimorphism and gonopodial characters are illustrated in Figures 5 to 7. Proportional measurements are given in Table 3. Meristic data, based on 15 males and 15 females, follow. Fin rays: dorsal, 7 (30); anal, 10 (30); pectoral, 13 (1), 14 (36), 15 (23), mean 14.37; pelvic, 6 (60); caudal, 15 (21), 16 (9), mean 15.30. Scales: lateral series, 29 (8), 30 (19), 31 (3), mean 29.83; predorsal, 16 (2), 17 (19), 18 (9), mean 17.23; around caudal peduncle, 16 (30); around body, 25 (2), 26 (10), 27 (8), 28 (9), 29 (1), mean 26.90; scales on top of head rather small and very irregularly arranged, the pattern not matching that for species of *Gambusia* illustrated by Rosen and Mendelson (1960: fig. 4, A-K). Gill rakers, 12 to 16, fewer in males, 12 (2), 13 (3), 14 (6), 15 (4), mean 13.80, than in females, 13 (3), 14 (3), 15 (6), 16 (3), mean 14.60, perhaps because males are smaller (S.L. mean 21.6 vs. 28.6 for females). Vertebrae, 31 (2), 32 (15), 33 (2), with 13 abdominal and 18 to 20 caudal, mean 32.00. Caudal rays contacting hypural plate (practically divided in half by a broad suture), 8 (1), 9 (4), 10 (15), mean 9.70, as determined from radiographs. Cephalic lateral-line system consists mostly of open canals and pits (or neuromasts) as in other species of *Gambusia* (Rosen and Mendelson, 1960: figs. 2, 4); mandibular canal composed of two close-set grooves in tandem order, the posterior one almost roofed over in larger fish, with a neuromast anteriorly on each side of the symphysis; pre-

TABLE 3  
 PROPORTIONAL MEASUREMENTS OF *GAMBUSIA EURYSTOMA*  
 IN PERMILLAGE OF STANDARD LENGTH<sup>1</sup>

Measurement	Holotype	10 males	10 females
Standard length	24.2	18.2-25.2 (21.6)	22.1-35.8 (28.6)
Predorsal length	661	651-673 (660)	695-729 (714)
Prepelvic length	446	446-477 (465)	516-554 (533)
Precanal length	533	506-535 (524)	631-656 (643)
Dorsal origin to caudal base	376	376-394 (386)	322-348 (338)
Anal origin to caudal base	537	530-548 (540)	402-421 (412)
Body depth	302	275-313 (289)	312-385 (345)
Head, length	343	324-350 (338)	328-362 (339)
Width	194	186-198 (193)	199-218 (209)
Caudal peduncle, length	455	442-473 (459)	304-314 (309)
Least depth	202	189-210 (197)	163-188 (179)
Interorbital, least bony width	124	122-137 (128)	153-167 (158)
Mouth width	145	128-151 (143)	144-164 (154)
Snout length	128	113-128 (119)	123-138 (132)
Orbit length	103	99-112 (104)	92-106 (98)
Dorsal, depressed length	248	236-254 (243)	187-210 (202)
Basal length	120	113-123 (118)	94-114 (101)
Anal, depressed length or gonopodium	351	337-363 (346)	170-185 (178)
Basal length			95-111 (102)
Pectoral length	219	205-226 (215)	182-198 (190)
Pelvic length	95	87-97 (92)	92-102 (97)
Caudal, length middle rays	231	205-247 (229)	199-218 (210)

<sup>1</sup> Based on UMMZ 197600 (holotype), UMMZ 184717 (paratypes, 9 ♂♂, 9 ♀♀), and UMMZ 197601 (allotype). Holotype included with the 10 ♂♂ and allotype with the 10 ♀♀.

opercular canal typically closed (with 1-3, commonly 2, pores) below the check but ascending branch behind eye represented by an open groove except in the two smaller of 30 fish in which the lower arm of the canal was open to well past the preopercular angle; lacrimal and supracephalic canals open.

Proportional measurements (Table 3) show sharp sexual dimorphism in position of dorsal fin (predorsal length, dorsal origin to caudal base), anal fin, pelvic fins (prepelvic length), body depth, head width, caudal peduncle length and least depth, least bony interorbital width, depressed dorsal length, basal length of dorsal, and pectoral length, in all of which measurements there is no or only slight overlap between males and females. Less sexually dimorphic are mouth width, snout length, orbit length, and length of middle caudal rays (orbit length certainly may be influenced by the difference in average size between the sexes).

The gonopodium (Fig. 7) is distinguished from that of related species by having the spines of ray 3 only slightly longer than the serrae of ray 4p, whereas in *G. luma* and *G. sexradiata* they are much longer (Rosen and Bailey, 1963: Fig. 40B; Hubbs, 1926: Pl. II, as *G. nicaraguensis* Günther). There are 9 to 12 spines along the anterior margin of the tip of ray 3, most of which are notably tilted downward toward the tip of the ray, as in both *G. luma* and *G. sexradiata*; ray 4p bears 5 to 7 retrorse serrae; the elbow of ray 4a is opposite the last serrae of ray 4p and is composed of 2 to 4 segments (fused or unfused), with 5 to 8 segments distal to it; 4 or usually 5 segments (including that of the terminal retrorse hook) are distal to the last serrae of ray 4p; ray 5p covers 2 to 4 serrae of ray 4p.

There are three strong gonapophyses, of which the first lacks uncini but the second and third have these structures well developed. The shaft of gonapophysis I forms an angle of about 45° with the vertebral column, but the succeeding two gonapophyses are variable in orientation, about intermediate between that shown for *G. luma* and for *G. atrora* Rosen and Bailey (1963: Pl. 2), in both of which the gonapophyses are tilted sharply forward.

**Coloration.**—Adult females have a subocular bar varying in width from slightly greater than to slightly less than the eye diameter, extending downward and backward from the orbital rim toward the angle of the preopercle; sometimes, especially in smaller fish, its shape is roughly triangular, with the base of the

triangle at the orbital rim. There are large, black, oval spots on 9 to 15 branched caudal rays, with 1 to 3 spots per ray, not aligned in vertical rows (as the caudal-fin spots so often are in species of *Gambusia*). There are small, inconspicuous, dark spots arranged in 2 to 5 longitudinal rows along the side from the median axial streak to the base of the dorsal fin and onto the dorsal surface of the caudal peduncle; the uppermost row drops out just anterior to the dorsal fin, and the others, except the axial row, drop out between there and the tip of the extended pectoral fin, the axial row often continuing to or close to the upper angle of the opercular opening; these lateral spots are not infrequently reduced and/or faint in smaller fish. A predorsal stripe is well developed between the occiput and the origin of the dorsal fin. There is also a narrow streak similar to the lateral one under the caudal peduncle. The rostrum, upper and lower lips, and intermandibular region are coarsely pigmented. The dorsal fin also has much melanin arranged in irregular spots or wedges along the rays and, less conspicuously, on the interradial membranes. There is a concentration of melanophores that forms a dark, oval or wedge-shaped spot or bar just mesial to a line connecting the anterior and posterior nostrils, with a narrow extension of pigment into the unroofed canal representing supraorbital pores 1 and 2a. The anal fin has small, black spots on the rays and interradial membranes, but lacks the intense concentration of melanophores that are so conspicuous on the interradial membranes and rays of the anterior part (especially rays 4–6) of the anal fins of *sexradiata* and *luma*. Pigmentation about the anal region lies anterior to the urogenital sinus. A concentration of melanophores rings the anus in a broad arc from the insertion of the pelvic fins to the anal opening and continues posteriorly in two parallel lines (usually rather narrow) to or nearly to the anterior margin of the sinus. Anal pigment is rather variable and may be most intense when eggs are present in the ovaries, as suggested for other species of *Gambusia* by Peden (1973b). The pelvic fins show a few, small and irregular spots on the rays, especially the outer ones. The pectoral fins are generally immaculate except for a few spots along the outer margin of the uppermost ray and sometimes at the base of the fin.

Male coloration is much like that of the female. The subocular bar and the numerous large, black spots on the caudal-fin rays are just as in the female. The dorsal fin has a few large

spots on the rays and numerous smaller spots scattered over the interradiial membranes. The head pigmentation is essentially the same as described for the female. The predorsal stripe is like that of the female but sometimes a bit weaker. The axial streak on midside and the streak on the midline of the caudal peduncle are also like that of the female. There are fewer longitudinal rows of spots on the upper side than in the female, occurring in no more than 3 to 4 weak rows between back and midlateral streak; rarely there may be up to 8 large spots anteriorly along the axial streak, starting about below the origin of the dorsal fin and extending more or less to the upper angle of the gill opening, but more often just a few small spots occur in this area as in the female. The gonopodium is well pigmented along the rays and, posteriorly, on the interradiial membranes; occasionally there are prominent black spots along most of ray 3 and along the margins of the posterior rays of the gonopodium. The pectoral fins are clear.

In life, as observed on 10 March 1974, the brightest males are turquoise on the upper sides, greenish on the back, and golden yellow on the lower sides and abdomen posteriorly to about half the extended tip of the gonopod; that structure lacks bright colors. The female is yellowish on the abdomen only, pale silvery on the upper sides, and dark on the back.

**Habitat and Associates.**—Arroyo del Azufre at Baños de Azufre is a warm, sulfurous, spring-fed stream, averaging 6 m wide, that is clear in the source springs but milky bluish gray in the outflow. At the time of our first visit, 15 February 1959, the temperature of the source springs was 32° C and that of the outflow stream and air was 26° C. Vegetation was virtually absent; sparse green algae were developed locally. The bottom consisted of marl and clayey mud, the current was moderate to almost none, the depth of water was mostly 0.3 to 0.9 m but attained a maximum depth of 1.4 m. The adjacent shore was a grassy park with many trees (the area is visited for its thermal properties). Capture was made with a 3.7-m "common sense" minnow seine. The outflow creek flows west and south, meandering greatly, and is very difficult to seine because of poor visibility (only about 7.5-15 cm) and the many scattered clumps of marl. How far down the arroyo this species occurs was not determined. Associated with the abundant *Gambusia eurystoma* were *Poecilia sulphuraria* (Alvarez), *Heterandria bimaculata*, and *Xiphophorus helleri*.

**Comparisons.**—Since the reviews by Rivas (1963) and Rosen and Bailey (1963:90-107), nine additional forms of *Gambusia* have been described: *G. krumholzi* Minckley (1963) from Coahuila, México (Río Grande basin), *G. (Toluichthys) meadi* Dahl and Medem (1964) from near Tolu to the mouth of the Río Sinú in northwestern Colombia (= *Gambusia lemaitrei* Fowler?), *G. georgei* Hubbs and Peden (1969) from the San Marcos River, Texas, *G. pseudopunctata* Rivas (1969) from Haiti, *G. rhizophorae* Rivas (1969) from southeastern Florida and northwestern Cuba, *G. aurata* Miller and Minckley (1970) from Tamaulipas, México (Río Tamesí basin), *G. puncticulata monticola* Rivas (1971) from eastern Cuba, *G. hispaniolae* Fink (1971) from the West Indian island of the same name, and *G. amistadensis* Peden (1973a) from now eliminated Goodenough Spring, Texas (Río Grande basin).

I believe that *Gambusia eurystoma* is closest to *G. sexradiata* and *G. luma*, species that Rivas (1963:342-343; 1969:778) placed in his *nobilis* species group and that Rosen and Bailey (1963:98-101) placed in their *punctata* species group.

The new species differs from *G. sexradiata* and *G. luma* as stated in the Diagnosis. It further differs in the orientation of gonapophyses II and III, as described above. Recognition has been given (Peden, 1972a, b, 1973b) to two useful systematic traits of the female, namely the size and shape of the urogenital papilla and the pigmentation about the urogenital and anal openings, that have heretofore been largely ignored in *Gambusia* and in poeciliids in general, except for observations on *Poeciliopsis* by Miller (1960) and Schultz (1966). The papilla is weakly developed in *G. eurystoma*, as it is in *luma* and *sexradiata*, but the latter species virtually lack melanophore development about the anal region, another feature that readily distinguishes *eurystoma* from these two relatives.

I am in full agreement with Peden (1970) that a thorough reevaluation of the evolutionary relationships of *Gambusia* is needed to reconcile the conflicting data that have arisen from attempts to assign newly described species of *Gambusia* to currently recognized groupings. Number of dorsal and anal fin rays, scales in the lateral series, presence or absence of a subocular bar, number of vertebrae, pigmentary characters (fin coloration, nature of midlateral stripe, spots on body, pigmentation about vent region), details of dentition, body form (including fin shape), and other features (e.g., karyotypes, biochemical

traits) should also be utilized in attempting to assess the interrelationships of this genus. I am pleased to see that although Hubbs and Springer (1957) "virtually omitted proportional measurements" in their revision of the *Gambusia nobilis* species group, because they found that many body proportions were environmentally influenced, subsequent workers in the same laboratory are using these characters. In the evaluation of relationships in *G. eurystoma* I find certain body proportions (e.g., head shape and size) useful to indicate which species of *Gambusia* are its closest relatives. Until a thorough phyletic analysis of a diversity of characters is used throughout the genus, I feel that species groups in *Gambusia* should be employed with caution.

**Range.**—This species is known only from the sulfurous springs and outflows at and near Baños de Azufre, Tabasco.

**Etymology.**—The specific name is from the Greek (*eurý*, wide, and *stoma*, mouth) in reference to the notably broad mouth of this species.

*Poeciliopsis turneri*, new species

Figs. 8–10

*Poecilistes* "D".—Turner, 1940:73–75 (fetal adaptations; superfetation).

**Note on Synonymy.**—*Poecilistes* Hubbs (1926:63, 68) was synonymized with *Poeciliopsis* by Miller (1955:50; 1960:1) and Rosen and Bailey (1963:131) and, by implication, also by Hubbs and Miller (1954:2, in range statement for *Poeciliopsis*). One of the traits thought to be characteristic of *Poecilistes*, but not of *Poeciliopsis*, was jaw teeth confined to a single series (e.g., see Hubbs, 1936:233, item 5b); since *Poeciliopsis turneri* lacks jaw teeth behind the outer series, this might explain why Turner referred it to *Poecilistes*.

The type species of *Poecilistes*, *Heterandria lutzi* Meek, has minute inner jaw teeth, especially laterally, which I have also observed in various populations of *P. gracilis*, formerly called *P. pleurospilus* (Günther). Hildebrand (1925:258) also noted these teeth in *Priapichthys letonai* Hildebrand, a synonym of *P. gracilis*. At least three species of *Poeciliopsis* appear to have lost the inner teeth: *P. retropinna* (Regan), *P. paucimaculata* Bussing, and *P. turneri* here described. These teeth are also lacking in

occasional individuals of *P. occidentalis* (Baird and Girard) in Arizona. Hildebrand (1938:307) was correct in his observation that *P. elongata* (Günther) has biserial dentition, for I find inner teeth well developed on numerous specimens from Panamá in the National Museum of Natural History.

**Types.**—Holotype (UMMZ 183942), a mature male 25.9 mm S.L., was taken from Río Apamila, 4.5 km WNW of La Huerta, Jalisco, on 7 April 1965 by R. R. Miller and W. D. Sable; 104° 39' W Long., 19° 29' N Lat., elevation about 280 m. La Huerta is a small town on Hwy 80 SW of Autlán. The allotype (UMMZ 183943), an adult female 36.9 mm long, came from the same collection, as did the 374 paratopotypes (UMMZ 183941), 14 to 49 mm long. Paratypes, totalling 708 specimens, are from the following localities: UMMZ 160926 (1, 28 mm), Río Maravasco, 10 km SSE of Purificación, Jalisco; UMMZ 167859 (2, 13–24 mm), 3.2 km SW of La Resolana, Jalisco; UMMZ 172137 (32, 18–29 mm), creek 2.4 km E of La Concepción (8 km E of La Huerta), on road between Cihuatlán and Autlán, Jalisco; UMMZ 172212 (56, 16–40 mm), stream 4 km SW of turnoff to La Resolana and 40 km by highway SSW of Autlán, Jalisco; UMMZ 173582 (133, 13–35 mm, including 3 cleared and stained), upper and lower parts of Río Maravasco above Cihuatlán [probably Río Resolana], Jalisco; UMMZ 178373 (152, 10–38 mm), Río Apamila, 3.2 km NW of La Huerta, Jalisco; UMMZ 173796 (2, 11–25 mm), mountain stream 3.2 km N of La Resolana, Jalisco; UMMZ 192215 and USNM 214087 (266, 20–38 mm), Arroyo El Arado 5.5 km W of Hwy 80 on road to Purificación, Jalisco; UMMZ 192219 (19, 14–34 mm), trib. 2.5 km W of Hwy 80 on road to Purificación, Jalisco; KU 15496 (45), about 35 km N and 10 km E of Santiago, Jalisco.

**Diagnosis.**—A species of *Poeciliopsis* with outer jaw teeth conic, movable, slender, close-set, arranged in one heart-shaped row of 32 to 48 teeth; inner teeth lacking. No mandibular pores or even neuromasts. Gill rakers 19 to 24. Placenta present, developing embryos entirely dependent on mother for nutrition and excretion, each brood consisting of no more than four large young 12 to 17 mm in total length. Color pattern consisting of 6 to 10 chocolate-brown to black spots and bars crossing midside from above and just behind pectoral fin to base of caudal fin, the terminal mark often crescent-shaped or semi-circular and darker than the others.

**Description.**— Body form, coloration, and sexual dimorphism (Fig. 8), the suspensorium (Fig. 9), and a newborn young (Fig. 10) are illustrated. Proportional measurements are given in Table 4. Meristic data, based on 20 males and 20 females (UMMZ 183941), follow. Fin rays: dorsal, 7 (1), 8 (39), mean 7.97 (first ray unbranched in 36, first two rays in 4); anal, 9 (40); pectoral, 12 (1), 13 (69), 14 (10), mean 13.11; pelvic, 6 (80); caudal, 17 (2), 18 (32), 19 (5), mean 18.08. Scales: lateral series, 28 (10), 29 (27), 30 (3), mean 28.83; predorsal, 15 (12), 16 (28), mean 15.70; around caudal peduncle, 16 (40); around body, 20 (3), 21 (10), 22 (11), 23 (14), 24 (1), 25 (1), mean 22.07. Gill rakers, 19 to 24, fewer in males, 19 (2), 20 (5), 21 (8), 22 (4), 23 (1), mean 20.85, than in females, 19 (2), 20 (5), 21 (14), 22 (9), 23 (8), 24 (2), mean 21.55, perhaps because the males are smaller (S.L. mean 26.4 vs. 36.1 mm for females). Vertebrae, 31 (38) or 32 (2), with 13 (40) abdominal and 18 (38) or 19 (2) caudal, mean 31.05. Head pores: preopercular, 6 (1), 7 (79), mean 6.99; lacrimal, 3 (3), 4 (77), mean 3.96; mandibular lacking (not even represented by neuromasts). The lacrimal bone is scaleless on both sides in 37 specimens; one

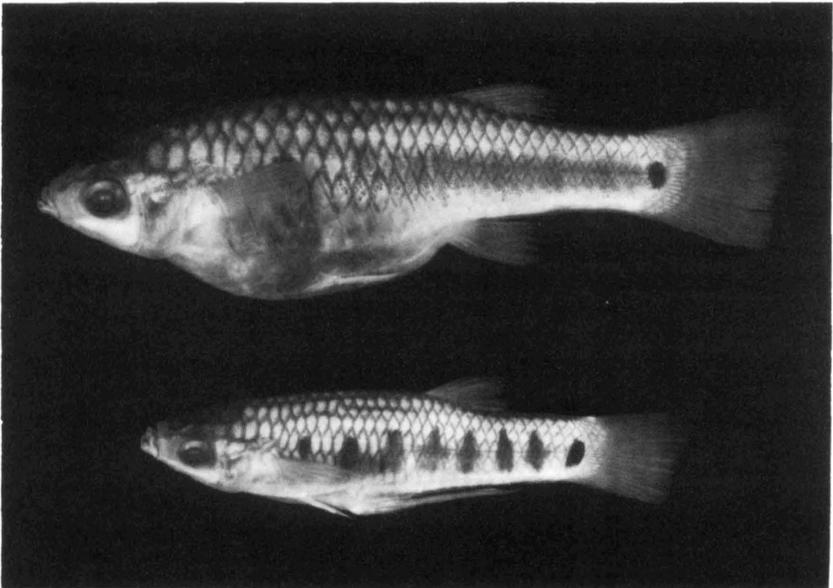


FIG. 8. Allotype (UMMZ 183943, 36.9 mm) and holotype (UMMZ 183942, 25.9 mm) of *Poeciliopsis turneri* from Río Apamila, Jalisco. Photo by Louis P. Martonyi, retouched by Mark Orsen.

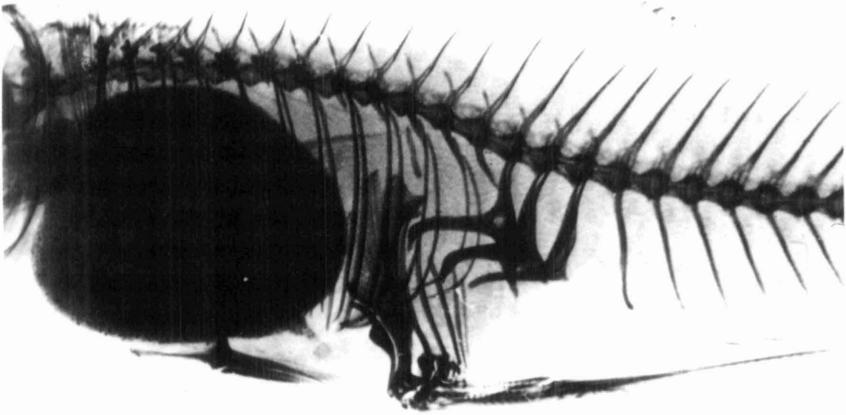


FIG. 9. Enlargement of radiograph of trunk region of *Poeciliopsis turneri* (UMMZ 172212, 28.9 mm) to show gonopodial suspensorium. Prepared by J. F. McKinney.

fish has an embedded scale between the 2nd and 3rd pores on one side, another has a tiny scale between the two lower pores on both sides, and a third has a minute scale (scarcely larger than largest pore) between the two lower pores on one side. Thus the lacrimal is virtually naked. On top of the head, only infraorbital pores 6b and 7 are developed (with roofed canal between) on the 40 fish examined; other pores are represented by neuromasts and the inter-connecting canals by open grooves. This is a more extreme reduction of pores and canals than usual in *Poeciliopsis*.

Proportional measurements (Table 4) reveal sharp sexual dimorphism (in addition to the obvious difference in length and position of the anal fin) as follows: males have the origin of the dorsal fin much farther forward, the caudal peduncle longer and deeper, the dorsal fin longer (both in depressed and basal lengths), and the caudal fin longer. Other differences in measurements, such as interorbital width, snout length, orbit length, and pectoral and pelvic lengths, may be due to the much smaller size of the males (whose standard-length range does not overlap that of the females measured).

Life colors, essentially the same in adults of both sexes, were noted on fish freshly preserved in the field. The interspaces

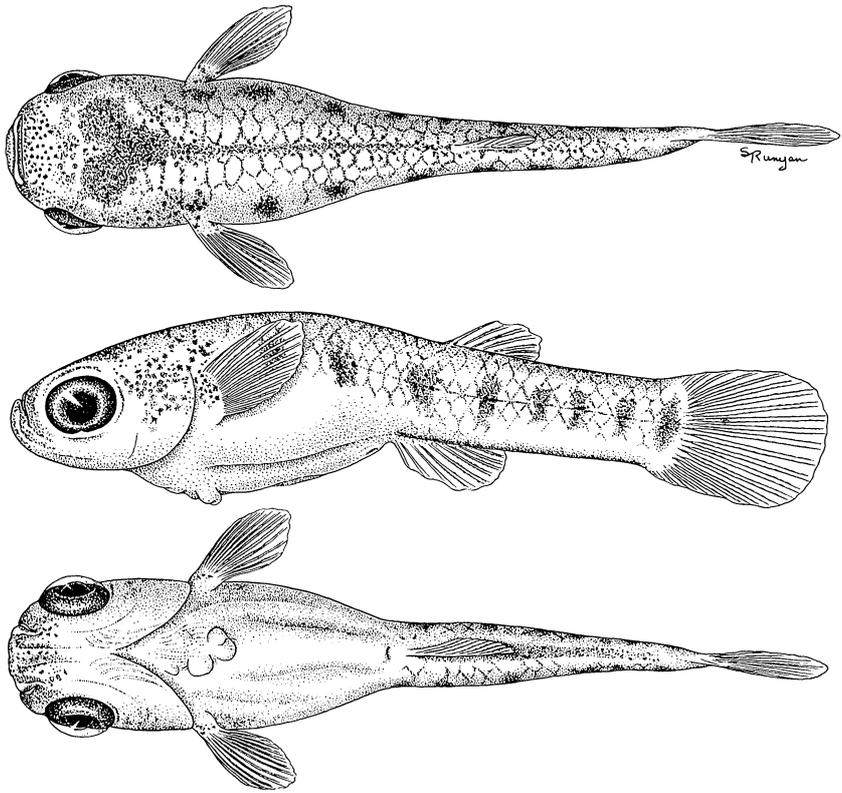


FIG. 10. Newborn young, 10.3 mm T. L., of *Poeciliopsis turneri* (born in Ann Arbor from Río Apamila, Jalisco. Drawn by Suzanne Runyan Moore.

between the chocolate-brown to black lateral spots and bars, the sides of the head, and the lower sides and abdomen are overlain by rich golden yellow. The lower half of the caudal peduncle and venter of the head are metallic blue, and the cross-hatching is light brown over a metallic sheen of bright blue-silver. The gonopodium is pale, but there may be a chocolate-brown blotch at its origin. A narrow, metallic golden stripe may be seen along the side just above the lateral markings. The back is olive-brown, the scales sharply outlined here and on most of the side. Both sexes may show a chocolate-brown lateral stripe replacing the lateral spots, running from about the anal origin posteriorly.

There are 6 to 10 chocolate-brown lateral markings of irregular shape and size, some round, others elongate, semicircular,

TABLE 4  
 PROPORTIONAL MEASUREMENTS OF *POECILIOPSIS TURNERI*  
 IN PERMILLAGE OF STANDARD LENGTH<sup>1</sup>

Measurement	Holotype	10 males	10 females
Standard length	25.9	23.7-28.5 (26.3)	28.7-42.4 (35.8)
Predorsal length	618	614-629 (622)	656-682 (667)
Postdorsal length	405	402-419 (411)	352-382 (368)
Postanal length	541	541-575 (559)	349-381 (369)
Body depth	282	269-297 (288)	295-344 (320)
Head, length	266	253-270 (262)	250-279 (263)
Width	181	175-194 (185)	190-205 (195)
Caudal peduncle, length	479	477-493 (484)	283-318 (302)
Least depth	162	149-169 (160)	133-150 (141)
Interorbital, least bony width	135	127-137 (134)	134-153 (143)
Mouth, overall width	100	97-107 (102)	100-112 (105)
Snout length	81	78-89 (84)	92-105 (97)
Orbit length	81	81-94 (86)	72-85 (78)
Dorsal, depressed length	212	204-223 (215)	176-190 (184)
Basal length	116	105-122 (114)	89-106 (99)
Anal, depressed length or gonopodium	398	391-423 (403)	153-167 (160)
Basal length			59-70 (65)
Pectoral length	201	196-217 (207)	180-203 (189)
Pelvic length	116	111-131 (120)	104-121 (111)
Caudal, length middle rays	232	228-237 (233)	187-218 (199)

<sup>1</sup> Based on UMMZ 183941-43. Holotype included with the 10 ♂♂ and allotype with the 10 ♀♀.

or crescent-shaped. The terminal mark had a crescent or semi-circular shape in 40 of 56 fish examined from UMMZ 183941 and, in preserved specimens at least, it is definitely blacker than are the other marks. The lateral markings number slightly fewer in 19 mature males (6–9) than in 19 mature females (7–10), and in 17 juveniles 13.0 to 24.0 mm long they varied from 7 to 9. Anteriorly these markings tend to lie below the dark, fine, midaxial line but from near the dorsal origin posteriorly they are about equally developed above and below this mark. In the one newborn (Fig. 10) there are 8 oval lateral marks.

**Habitat and Associates.**—This fish abounds in small, generally clear streams at depths of 0.5 to 1.1 m, in slight to moderate current in and near pools with fallen tree trunks and similar protective cover, associated with submergent vegetation (*Ceratophyllum*, green algae), and generally in habitats that are moderately to well shaded. At one station (UMMZ 172212, a steep-banked stream 80% shaded by a large canopy of trees), there were only sparse green algae growing on the rocks and, scattered over the bottom of sand, silt and rocks, was an abundance of leaves and brush that had fallen from the canopy. The water had a pH of 7.2 with an acid phenolphthalein reaction, 130 ppm methyl orange alkalinity, 100 ppm hardness, and 0.3 ppm fluoride.

The only fish associates of *Poeciliopsis turneri* are another species of *Poeciliopsis* belonging to the *latidens-fasciata* complex (see Hubbs and Miller, 1954: Pl. 1), *Poecilia chica* (described herein), and the goodeids *Xenotaenia resolanae* and *Ilyodon xantusi*.

**Comparisons.**—The new species differs sharply in a number of features from any other species of the subgenus *Poeciliopsis* (for definition, see Rosen and Bailey, 1963:135–136). In lacking inner jaw teeth it resembles the Costa Rican and Panamanian species *P. paucimaculata* and *P. retropinna*, both of which, however, belong to subgenus *Aulophallus* (Bussing, 1967). Also, some northern populations of *P. occidentalis* have the inner teeth weak, obsolete, or lacking. The color pattern alone is diagnostic. The extreme dependence of the developing embryo on the mother is akin to the situation in mammals, including the development of a placenta, and is matched only in *Heterandria formosa* Agassiz and three other species of *Poeciliopsis* (*prolifera* Miller, *presidionis* (Jordan), and *elongata*)—see Schultz and Thibault, M.S. It is not closely related to the species of the

*latidens-fasciata* complex; possibly it is more nearly related to *P. gracilis* than to any other living species.

**Superfetation.**—Turner (1940:75, pl. 4, figs. 21-22) described the fetal adaptations of this species but was mistaken about how many different stages of embryos may be observed in a single ovarian follicle, and his figures are probably of *P. prolifica* (Roger Thibault, pers. comm.). There are three stages rather than five. The mature ova are about 1 mm in diameter and the developing embryos grow very rapidly to reach a large size at birth (Schultz and Thibault, MS: Fig. 3). The specialized type of follicle in which they develop was designated by Turner as a “follicular pseudo-placenta”, but is called a placenta by Schultz and Thibault. The newborn young is very large, varying from 12 to 17 mm in total length in those few that we succeeded in rearing in the UMMZ aquarium facility; only 1 or 2 young are usually produced in each brood, but a maximum number of 4 advanced embryos has been found in the ovary. In contrast to most poeciliids, the number of embryos does not increase with age of the mother in *P. turneri* (Schultz and Thibault, MS).

A curious fact was revealed from a collection of *P. turneri* made by Roger Thibault on 26 May 1973 in Río Apamila near La Huerta. None of the females contained embryos, whereas in the other sympatric species of *Poeciliopsis* (see above) females contained many embryos in different stages of development. It would be valuable to monitor the populations of *P. turneri* on a monthly basis throughout the year to discover if there is regularly a time when no embryonic development takes place.

**Range.**—*Poeciliopsis turneri* is known thus far from the basin of Río Purificación in southern Jalisco and from Río Resolana (probably mislabelled Río Maravasco by Turner), a northern tributary to Río Cihuatlán (Tamayo, 1962:423), about 30 airline km northeast of Cihuatlán in Jalisco. Other streams in the basin of the Purificación bear local names, such as Río Apamila for Río Purificación near La Huerta. It is unlikely that the species occurs farther down the coast but it may be found in one or more of the small, independent Pacific tributaries between Río Purificación and Cabo Corrientes.

**Etymology.**—It is particularly fitting that this fish be named in honor of the late Clarence L. Turner who made important, pioneering contributions to the knowledge of reproduction and viviparity in teleost fishes and who first collected this species and recognized it as new.

*Poeciliopsis catemaco*, new species

Figs. 11-12

*Poeciliopsis* sp.—Miller, 1966:790 (Lake Catemaco).

**Types.**—All material is from the basin of Laguna Catemaco, Veracruz. Holotype (UMMZ 176977), a mature male 36.9 mm S.L., was captured alive when immature along a small beach on the west side of Laguna Catemaco, on 24 August 1957 by Andrew and Priscilla Starrett and Thomas M. Uzzell, Jr.; 95° 07' W Long., 18° 25' N Lat., elevation about 340 m; it was preserved on 26 January 1958. The allotype (UMMZ 181806), an adult female 73.6 mm long, was taken in the lake by Percy Clifton and Leroy Kuhn on 13 January 1956; it is the only adult female captured and preserved in the field (all other adult females were purchased in markets or taken alive and reared to maturity). Only one mature male (see below) has been captured and preserved in the field. Taken with the holotype (and also reared to maturity) were three adult male paratypes (UMMZ 176978) preserved between 26 May and 28 June 1958. There are 835 other paratypes: UMMZ 173760 (52, 21-31 mm) and UMMZ 178554 (294, 12-30 mm), Playa Azul, ca. 3 km E of Catemaco; UMMZ 173761 (33, 19-34 mm), ca 1 km S of Catemaco; UMMZ 173765 (35, 25-32 mm, including 3 cleared and stained), pools in overflow channel of Río Bravo at its exit from the lake; UMMZ 181677 (7 females, 62-72 mm) and UMMZ 183908 (9 females, 64-74 mm), purchased in market at San Andrés Tuxtla and said to be from L. Catemaco; UMMZ 184540 (279 juveniles and 1 male, 20-36 mm), about 1 km S of Catemaco; UMMZ 197599 (37 females, 55.5-73.0 mm) purchased in the market at Catemaco; and UF 7340 (88, 16-30 mm) from 1 km by road W of Coyame.

**Diagnosis.**—A slender-bodied, semipelagic species of *Poeciliopsis* in which the female attains a size large enough (90 mm T.L.) to enter the commercial catch, with 8 dorsal rays, 19 to 25 gill rakers, a series of small spots (smaller than pupil) along the midside, short caudal fin, broad head, very long gonopodium (extending almost to base of caudal fin), and with large young 13.5 to 14.3 mm T.L. at birth.

**Description.**—Body shape, sexual dimorphism, coloration, and the gonopodial suspensorium are shown in Figures 11 and 12. and proportional measurements are given in Table 5. Meristic data follow. Fin rays: dorsal, 8 (31), the first ray unbranched;

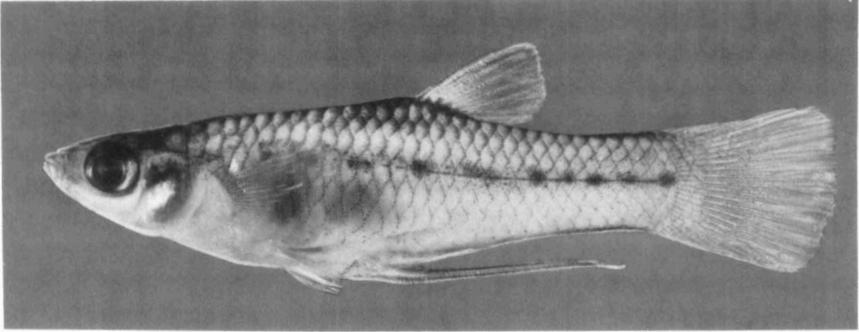


FIG. 11. Holotype (UMMZ 176977, 36.9 mm) of *Poeciliopsis catemaco* from Laguna Catemaco. Photo by The University of Michigan Photographic Services (retouched).

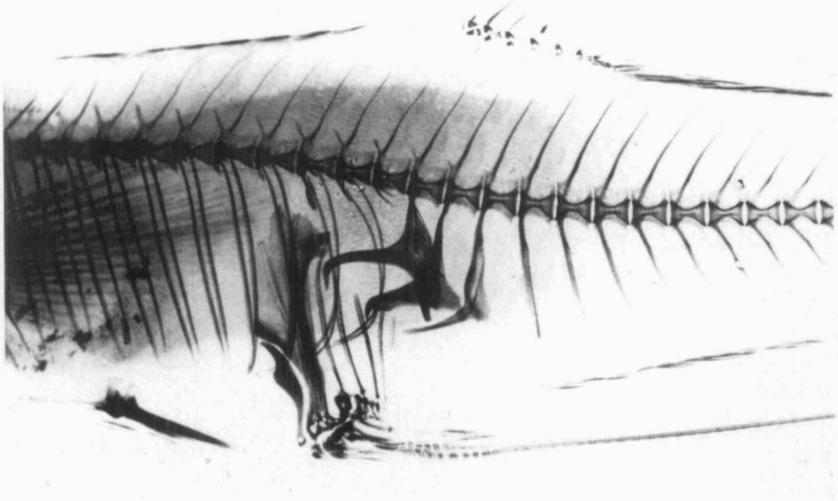


FIG. 12. Enlargement of radiograph of trunk region of *Poeciliopsis catemaco* (UMMZ 176978, 35.0 mm) to show gonopodial suspensorium. Prepared by J. F. McKinney.

anal, 9 (31); pectoral, 13 (4), 14 (49), 15 (7), mean 14.05; pelvic, 6 (62); caudal, 18 (15), 19 (9), 20 (4), mean 18.61, more numerous in the larger fish (adult females). Scales: lateral series, 29 (5), 30 (25), mean 29.83; predorsal, 14 (6), 15 (21), 16 (2), mean 14.86; around caudal peduncle, 16 (29); around body, 20 (6), 21 (5), 22 (7), mean 21.05. Head pores; preopercular, 13 (1), 14 (24), 15 (3), 16 (2), 19 (1), mean 14.35; lacrimal, 0 (3), 2 (2), 4 (7), 5 (3), 6 (12), 7 (2), 8 (2), mean 4.81;

mandibular, 0 (2), 2 (3), 3 (1), 4 (24), 5 (1), mean 3.55—pore development correlated with size, the smaller fish (28-37 mm) having fewer pores. In the development of the cephalic pores on top of the head, *P. catemaco* typically has only pores 6b and 7 present (31 specimens examined) although 1, 2a, 2b, and 3 also occurred on both sides in one individual, 1, 2a in two, and 3, 4 (left side) and 1, 2a, 3, 4 (right side) in one specimen. Gill rakers, 19 (1), 20 (3), 21 (4), 22 (5), 23 (9), 24 (7), 25 (2), mean 22.52. Vertebrae, 30 (1), 31 (46), 32 (2), mean 31.02, the formula usually 13 + 18 (13 + 17 in 1, 13 + 19 in 2).

The rather weakly implanted jaw teeth are biserial, the outline of the outer series of teeth weakly indented medially, the inner teeth regularly arranged and nearly as numerous as the outer.

The structure of the gonopodium of the new species is essentially like that of *P. gracilis* (see Rosen and Gordon, 1953: Fig. 36B), with the exception that the paired serrae on the posterior margin of ray 4 are weaker than in that species. It lacks a retrorse hook at the tip but has a weakly recurved membranous protrusion. The suspensorium (Fig. 12) is also like that of *P. gracilis* (see Rosen and Bailey, 1963: Fig. 56B) except that the horizontal arms of the two anterior gonapophyses are more elongate.

Proportional measurements (Table 5) reveal sharp sexual dimorphism (in addition to the position and shape of the anal fin) as follows: males have a more anterior dorsal fin, the caudal peduncle longer, shorter pelvic fins, and a longer caudal fin. Other differences shown in the table are attributed either to the insufficient number (5) of mature males available for measurement or to allometric growth (orbit length).

Little was noted in the field of the life colors of this species, perhaps because it is rather plain. The body had a purplish iridescence with inconspicuous lateral markings; this refers almost exclusively to immature fish since we only caught one mature male and no mature females. The color pattern consists of 8 to 17 (typically 11-13) roundish, black dots along midside, smaller than pupil, extending from just above and behind pectoral-fin base to base of caudal fin. These marks overlie a fine axial streak that extends from rear of head to caudal base. Some are doubled (as many as 4 pairs), on occasion some may be fused into a dash, and in one female (market fish, UMMZ 197599, tag V) about four spots are fused into a continuous stripe on the left side of the caudal peduncle and on the right side of this fish most of the spots are so fused. The holotype

TABLE 5

PROPORTIONAL MEASUREMENTS OF *POECILIOPSIS CATEMACO* AND  
*POECILIOPSIS GRACILIS* IN PERMILLAGE OF STANDARD LENGTH

Measurement	<i>Poeciliopsis catemaco</i>			<i>Poeciliopsis gracilis</i>	
	Holotype	5 males <sup>1</sup>	10 females <sup>2</sup>	10 males <sup>3</sup>	10 females <sup>3</sup>
Standard length	36.9	32.4-36.9 (35.0)	58.1-73.6 (66.0)	20.4-26.5 (25.1)	25.3-32.7 (29.2)
Predorsal length	591	575-599 (588)	602-640 (622)	589-632 (604)	617-661 (639)
Dorsal origin to caudal base	434	432-445 (438)	386-426 (408)	408-436 (421)	361-405 (385)
Anal origin to caudal base	547	546-559 (552)	388-437 (418)	538-574 (555)	374-419 (404)
Body depth	268	262-275 (268)	257-299 (283)	270-298 (282)	297-336 (317)
Head, length	271	267-281 (272)	255-271 (264)	260-271 (268)	261-283 (273)
Width	163	157-176 (167)	149-170 (160)	152-161 (157)	170-180 (173)
Caudal peduncle, length	466	466-489 (476)	315-350 (334)	468-485 (478)	294-329 (315)
Least depth	152	151-169 (158)	149-166 (157)	162-184 (171)	159-173 (166)
Interorbital, least bony width	92	90-98 (94)	95-103 (98)	93-106 (101)	107-115 (112)
Mouth width	76	64-83 (76)	60-71 (66)	63-72 (68)	70-84 (75)
Snout length	76	70-80 (75)	67-84 (75)	69-81 (74)	70-79 (75)
Orbit length	92	89-105 (95)	78-86 (82)	90-98 (94)	88-98 (93)
Dorsal, depressed length	214	203-224 (213)	197-218 (210)	221-255 (239)	208-228 (217)
Basal length	100	100-106 (103)	94-110 (104)	100-115 (106)	91-103 (97)
Anal, depressed length or gonopodium	453	453-481 (466)	186-207 (199)	419-451 (436)	188-213 (203)
Basal length			77-89 (84)		76-90 (83)
Pectoral length	203	201-211 (204)	194-216 (205)	192-226 (209)	198-216 (208)
Pelvic length	119	113-123 (118)	126-139 (130)	112-126 (117)	122-136 (128)
Caudal, length middle rays	268	251-268 (259)	225-242 (234)	281-308 (293)	264-289 (278)

<sup>1</sup> Based on UMMZ 176977-78, 184540.<sup>2</sup> Based on UMMZ 181677, 181806, 183908, 197599.<sup>3</sup> The 20 adults, UMMZ 92117, are from Arroyo Hueyapan, trib. to outlet of Laguna Catemaco.

(Fig. 11) has 12 spots on the left side, of which the first two are partly covered by the pectoral fin, the third and fourth are doubled, the fifth lies directly below the origin of the dorsal fin, the sixth and seventh are doubled, and the eighth to twelfth lie wholly on the caudal peduncle (on the right side are 13 spots, of which 5 and 6 are doubled); the allotype has 13 spots. There is a fine streak on both the midventral and middorsal surfaces of the caudal peduncle, weaker to obsolete on the dorsal surface, but there is no clearcut evidence of a predorsal streak. The pigment about the vent of adult females is weakly developed or lacking, only 10 of 54 fish showing slight to marked darkening. This consisted of melanophores between anal origin and opening of anus with arms extending dorsolaterally onto two adjacent scales so that a black mark is visible on either side when the fish is in a vertical position (the pattern is similar but much more pronounced and extensive in *P. gracilis*). There is no obvious genital papilla.

The caudal fin is dusky basally to blackened distally in adult females and all the fins except the pelvics are moderately to strongly peppered with small melanophores along the rays. In the adult male, the rays of the pelvic fins are also pigmented.

**Habitat and Associates.**—Laguna Catemaco has been described above (see *Poecilia catemacensis*). Although we seined to as deep as 1.5 m with a 4.6-m seine of 6.35-mm mesh in attempts to catch adults, only one mature male was obtained and no adult females. Nocturnal seining was not attempted, however. Commercial fishermen capture only females, presumably because the mesh used is too large to retain the smaller-sized males. Associated species are listed under the account of *Poecilia catemacensis*.

**Comparisons.**—In general appearance, morphology, meristics, pigmentation, and details of the gonopodium (which has no retrorse hook at its tip) this species most closely resembles *Poeciliopsis gracilis*, one of the most widespread species in the genus (both slopes of Middle America, from southern México to Nicaragua). I regard *P. catemaco* to be a lacustrine derivative of that species, the only other member of the genus known from the lowland parts of this region of México.

*Poeciliopsis catemaco* differs from *P. gracilis* in the following features: (1) greater size—*catemaco* is probably the second largest known species of *Poeciliopsis* exceeded only by *P. (Aulophallus) elongata*, which attains at least 110 mm S.L. and

150 mm T.L., although it is probably matched in size by *P. (Aulophallus) retropinna*; (2) 8 rather than 7 (or rarely 8) dorsal rays; (3) mandible longer and lower jaw more oblique; (4) gill rakers more numerous, 19 to 25 vs. 15 to 19; (5) body not so deep, head broader, gonopodium longer, and caudal fin shorter (Table 5); and (6) reproductive biology—see next paragraph. Adult males of *P. catemaco* have the caudal peduncle less deep and the dorsal fin (when depressed) shorter, and adult females have the caudal peduncle longer, and the interorbital region and mouth narrower, than in *P. gracilis* (Table 5). The nearest population of *P. gracilis* occurs in Río Bravo (outlet of Laguna Catemaco) below the last and highest barrier falls, Salto de Eyipantla.

**Superfotation and Development.**—Twenty adult females (UMMZ 197599, taken 31 May 1973) examined by Roger Thibault showed embryos in two developmental stages, and within each stage all of the embryos were in one stage of development. The later stage had absorbed most of the yolk and some of the young had commenced to extend; the earlier stage was late-eyed and had not yet begun to pull away from the yolk. The consistency of these two developmental stages is unusual; most species of *Poeciliopsis* examined possess embryos in different stages of development whenever a large sample is studied. Advanced young were 13.5 to 14.3 mm T.L. No placental arrangements were noted, the embryos being enveloped in thin membrane, comparable to the situation in *Poeciliopsis lucida* Miller. It would appear as if the embryonic contents were adapted to create a streamlined female; such a form would enable the fish to cope better with a lacustrine existence. Embryos extended nearly to the gill region; the ovary was ellipsoidal rather than spherical as in *P. monacha* Miller.

Eyed-embryo yolk measured 3.0 to 4.0 mm in diameter. Unfertilized ova were 2.0 to 2.5 mm in diameter, which implies either a complete absence of mature ova in the population at this time (31 May) or that there is some maternal deposition of yolk material after fertilization. Examination of a single degenerate ovum, 2.2 mm in diameter, supports this contention. Thibault feels that the gestation period is longer than 21 days; other Mexican species of *Poeciliopsis* have a shorter gestation period.

**Evolutionary Adaptations.**—This, the only known lacustrine-adapted species of *Poeciliopsis*, shows a number of features that

fit it for life in the open waters of Laguna Catemaco. Its body is elongate and streamlined and the species attains a large size. The numerous gill rakers presumably are correlated with feeding on microcrustaceans in the pelagic zone, although gut contents have not been examined to confirm or refute this idea. The very elongate gonopodium may increase the effectiveness of orientation and physical contact between the sexes in the open waters of the lake, where mating presumably occurs. The increased size of the newborn young (relative to that in other Mexican species of *Poeciliopsis*, except *P. turneri*—see Schultz and Thibault, MS) may increase their survival rate in the lacustrine environment. The large size of mature ova may be correlated with the larger young and/or with the hypothesized longer gestation period. Too little is yet known of the life history of *P. catemaco* to form a sound basis for some of the above conclusions which must, therefore, be considered tentative.

**Range.**—I have named this fish for the lake to which it is essentially confined, Laguna Catemaco. The species occurs in sheltered areas of the outlet near the lake (though probably only as immatures), but it is unknown thus far from inlet streams, of which a small, well-worked one (the type locality of *Xiphophorus milleri* Rosen) occurs about 2 km south of the town of Catemaco on the west side of the lake.

#### SUMMARY

Five new species of poeciliid fishes of the genera *Poecilia*, *Gambusia*, and *Poeciliopsis* are described from fresh waters on the Pacific and Atlantic coasts of México. It is recommended that *Mollienesia* be recognized as a valid subgenus. *Poecilia chica*, a small species with small fins and a jet-black breeding male, occurs inland in three small drainages in southern Jalisco. *Poecilia catemaconis*, a large, semipelagic lake species, with slender body, small dorsal and caudal fins, and numerous gill rakers, is restricted to Laguna Catemaco southeast of Veracruz City. It is recommended that use of species groups in *Gambusia* be employed with caution until phyletic analyses are completed. *Gambusia eurystoma*, with a very broad mouth and the caudal fin boldly spotted in black, is described from a sulphur spring and outflow near Teapa, Tabasco. *Poeciliopsis turneri*, a boldly-marked species producing only a few large young at each birth,

with uniserial jaw teeth and a placenta (developing embryos entirely dependent upon the mother), occurs in the same area as *Poecilia chica* but is not quite as widespread. *Poeciliopsis catemaco*, restricted to the elevated lake of the same name, is a large, semipelagic species (females enter commercial catch) with numerous gill rakers and large young. All five species are illustrated.

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*Accepted for publication April 19, 1975.*