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Skiffia francesae, a New Species of Goodeid Fish from Western México

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A new species of *Skiffia* from the Río Teuchitlán on the Pacific slope of western México is based on both preserved and live material. It is regarded as most closely related to *Skiffia multipunctata*, as determined by meristic and morphometric data. It differs in shape and form of head and lips, size of orbit and head, diploid number of chromosomes and male coloration.

THE Goodeidae comprise a small family of viviparous cyprinodontoid fishes, restricted to México. The 35 to 40 extant species are generally confined to highlands of the Mesa Central, although the genus *Ilyodon* occurs in lowland habitats on the Pacific slope in Jalisco and Colima (Miller and Fitzsimons, 1971). This family exhibits great diversity in morphology, feeding adaptations, karyotypes, habitats and behavior; the biochemistry of the group (under study by Bruce J. Turner) may be as complex as is courtship behavior. Fitzsimons (1970, 1972) found interspecific and intraspecific differences in fixed action patterns and in their sequences in four goodeid species.

The family has several characters that are related to viviparity. All males have a modified anal fin with 6–8 crowded, shortened anterior anal-fin rays, which as a group are separated slightly from the rest of the fin. During gestation, the young, except for one species, develop rectal processes, called trophotaeniae, presumably used for nutrition and respiration. Trophotaeniae may be retained for up to two days after birth and have been used in past taxonomic studies of goodeids (Hubbs and Turner, 1939). Males, unlike those of poeciliids, lack spermatophores, and females do not store sperm.

Herein is described a new species of *Skiffia*, based on preserved and live specimens in the University of Michigan Museum of Zoology (UMMZ).

MATERIALS AND METHODS

Counts were made as described by Miller (1948) with modifications of Fitzsimons (1970, 1972). The last two rays in both dorsal and anal fins are counted as one because they share a common pterygiophore. In some specimens, one of the caudal vertebrae might have been included in the precaudal count due to the difficulty in determining the transitional vertebrae. All gill rakers and rudiments of the first arch

were counted. Measurements were made to the nearest 0.1 mm using Helios dial calipers.

Thirty specimens (15 ♂♂, 15 ♀♀) were examined to obtain meristic data; measurements were made on 12 (6 ♂♂, 6 ♀♀). Numbers in parentheses represent the number of specimens with the indicated counts. Counts of the holotype are designated by asterisks.

Skiffia ***francesae*** n. sp.
Figs. 1 and 2, Table 1

Types.—Holotype (UMMZ 201177), mature male 29.5 mm SL; coll. by R. R. Miller and J. M. Fitzsimons, 22 Feb. 1970; Río Teuchitlán, below and just E of Teuchitlán, near road between Hwy. 70 (Ameca to Guadalajara) and Etzatlán, Jalisco, México. Allotype (UMMZ 201178), adult female, 30.5 mm SL, and 146 paratopotypes (UMMZ 189588), 22–37 mm SL, taken with holotype; 57 juvenile to adult paratopotypes (UMMZ 172223), 29–43 mm SL, including two cleared and stained (male, female).

Diagnosis.—A small species of *Skiffia* (maximum SL ca. 43 mm), most closely related to *S. multipunctata,* but differing in having a wedge-shaped head and upturned lips; a proportionately larger head and orbit; a tendency toward fewer lateral scales, predorsal scales and vertebrae; a diploid number of 48 chromosomes. Males with a less prominent notch in dorsal fin, no irregular black spots on sides of body, a gray cast superimposed on gold body and gray fins.

Description.—Form and coloration of mature adults as in Fig. 1, pigmentation of embryo as in Fig. 2. Proportional measurements are in Table 1. Fin rays: dorsal 15(4), 16(18), 17*(8); anal 14(16), 15*(14); pectoral (both fins) 12(3), 13*(26), 14(29), 15(2); pelvic (both fins) 5*(2), 6*(58); caudal 17(4), 18*(16), 19(10). Branchiostegal rays (both sides): 4(1), 5*(59). Scales: in lateral series 30(1), 31*(4), 32(8), 33(6), 34(2), 35(2); between dorsal and anal 15(1), 16(7), 17*(14), 18(6), 20(1); predorsal 19(1), 20(3), 21*(9), 22(7), 23(2), 24(2); around caudal peduncle 17*(7), 18(12), 19(6); around body 33(1), 35(3), 36(4), 37(7), 38*(3), 39(5), 40(1), 41(1). Total vertebrae (including hypural complex): 30(1), 31(2), 32*(7), 33(9), 34(4), 35(1); 6 specimens with double neural spine on penultimate vertebra (perhaps indicating fusion of two vertebrae) not included in counts. Precaudal vertebrae: 14(4), 15*(11), 16(8), 17(1); caudal: 16(2), 17*(11), 18(10), 19(1). Gill rakers: 26(1), 27(3), 28(5), 29(5), 30(6), 31*(6), 32(2), 33(1), 34(1). Number of gill rakers not clearly correlated with size.

No mandibular, preopercular or lachrymal pores, but pit-like depressions of neuromasts evident. No sensory-pore canals on top of head, but neuromasts present.

Outer row of teeth in each jaw strongly bifid, ca. 30–35 teeth, total, in upper jaw (both sides), the same in lower jaw. Inner teeth consisting of few small bifid and conical teeth scattered irregularly.

Dimorphism and coloration.—Sexual dimorphism marked in both proportional measurements and coloration. All fins in male larger, especially dorsal and anal fins. Prepelvic length, body depth and head depth greater in males, whereas predorsal length and body width greater in females. First six anal-fin rays of male small, folding into fleshy dermal pocket supported by seventh anal ray. In male only, dorsal fin notched, first 4–5 rays separated slightly from rest.

Male bright gold with superimposed gray cast, especially intense in courting; courting males with gray borders on dorsal, anal and caudal fins and with gray pelvic fins. No black spots on body, but black crescent present at base of caudal peduncle. In non-courting males, gold coloration most evident in dorsal, anal and caudal fins and faintly present along caudal peduncle. Some scattered, small gray spots may occur at base of caudal fin and on dorsal fin. Females and juveniles gray-green with scattered small black flecks along lateral scale row and dorsal surface. Fins transparent. Base of caudal peduncle with small black crescent. Females without color change in courtship.

In ethyl alcohol, gold of males fading to uniform black-brown color. Fins gray-black, with few black spots on dorsal and caudal fins in some specimens. Black crescent at base of caudal peduncle often evident. Females retaining dark spots along sides. Newborn young uniform dull yellow, with very small black pigment spots on body and fin rays, a black crescent at base of caudal peduncle, fins transparent.

Anal fin-rays and supports.—Rudimentary stub in front of first regular anal ray (not included in counts, only seen on cleared and stained specimens). Following based on two cleared and stained specimens (1 ♂, 1 ♀). First four anal-fin rays with pterygiophores lacking medial

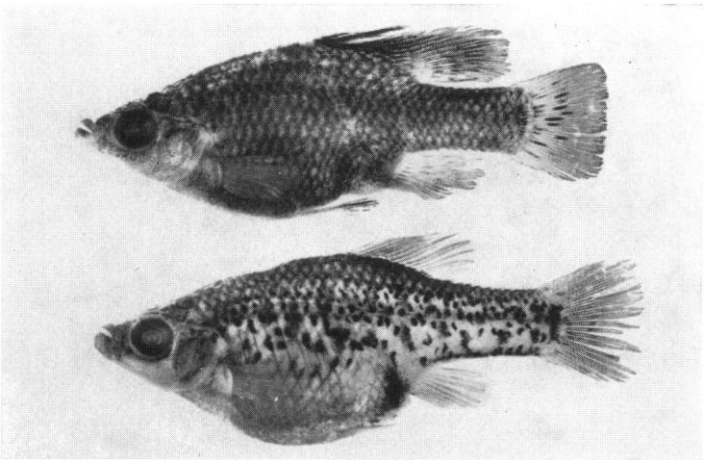

Fig. 1. *Skiffia francesae* n. sp. Above, male holotype, UMMZ 201177, 29.5 mm SL; below, allotype, UMMZ 201178, 30.5 mm SL.

radials. Pterygiophores apparently basals or fused proximal and medial radials (Miller and Fitzsimons, 1971). Next 12 pterygiophores in male and next 11 in female with medial radials. In male, last pterygiophore probably modified basal. Last fin ray apparently broken off, although internal bony supports present. In female, penultimate pterygiophore a basal and last one apparently a much modified basal, as in *Ameca splendens* (Miller and Fitzsimons, 1971). Each pterygiophore with distal radial (except for anteriormost stub of both sexes, and last ray in female) fitting into base between two halves of corresponding ray. First six anal rays of male and vestigial stub small, slender and unbranched. Remaining rays larger and branched. First 3 to 5 rays and vestigial stub unbranched in female; others branched.

Reproductive biology.—In aquarium-reared specimens, four broods of 8 to 15 young were recorded. Trophotaeniae apparently detach quickly after birth as no young retained them. In the laboratory, many young survive in stock tanks and are not cannibalized by adults. Fitzsimons (pers. comm.) obtained hybrids of this species with *S. multipunctata* by forced laboratory matings. The hybrids were fertile, producing successive generations and maintaining a stock until sacrificed a few years later.

Fourteen aquarium-reared broods were recorded from wild fish. Mean number of young per brood was 9, range 5 to 15. Brood size was: 5(2), 6(3), 8(2), 9(1), 12(2), 14(2), 15(2), where numbers in parentheses represent number of broods having indicated number of young. Newborn individuals ranged from 8.5–10.7 mm SL (based on three broods).

Ovary.—As in other goodeids, the single median ovary is formed by union of right and left organs. The fused walls form a thick, prominent septum along midline. The rest of the ovarian wall is thin. The anterior end of ovary is slightly bilobed and attached to dorsal side of body cavity. The ovary is an off-white to yellowish organ in freshly killed females and has a granular appearance in females with eggs but without embryos. It tapers to form a birth canal posteriorly, is highly folded internally and may contain eggs throughout its length, except in the birth canal. In females with

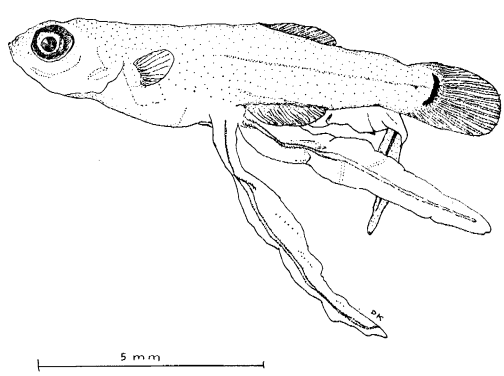

Fig. 2. Near-term young of *Skiffia francesae* (aquarium-reared), with trophotaeniae attached. Dissected from a female near parturition.

TABLE 1. PROPORTIONAL MEASUREMENTS, IN THOUSANDTHS OF STANDARD LENGTH, OF *Skiffia francesae*. (Based on UMMZ 189588, UMMZ 201177 holotype, UMMZ 201178 allotype.) Means in parentheses.

Measurement	Holotype ♂	6 Males	6 Females
Standard length, mm	29.5	24.0–33.2(27.5)	25.5–34.2(30.0)
Predorsal length	525	524–535(529)	553–561(557)
Prepelvic length	546	521–546(538)	517–564(547)
Anal origin to caudal base	373	367–387(377)	360–375(365)
Body, greatest depth	400	379–400(391)	360–420(378)
Width	122	122–139(130)	121–167(143)
Head, length	281	266–283(275)	259–284(273)
Depth	197	187–201(195)	172–193(183)
Width	173	169–184(176)	162–177(171)
Caudal peduncle, length	264	264–275(269)	261–271(268)
Least depth	146	139–146(143)	123–147(134)
Interorbital, least bony width	129	123–135(130)	123–134(127)
Preorbital width	31	23–30(27)	23–29(25)
Postorbital length	108	102–113(107)	98–108(103)
Snout length	88	71–88(81)	78–88(82)
Orbit length	102	96–111(105)	94–102(97)
Mouth width	91	83–93(90)	87–99(93)
Mandible length	75	63–82(75)	61–78(70)
Dorsal fin, basal length	251	225–259(239)	185–204(194)
Depressed length	478	422–478(445)	277–305(291)
Anal fin, basal length	91	90–100(95)	75–97(91)
Depressed length	241	220–241(230)	168–188(178)
Middle caudal rays, length	210	210–217(213)	191–207(198)
Pectoral length	200	187–211(197)	162–196(178)
Pelvic length	186	176–189(183)	140–158(149)
Upper jaw length	68	62–74(68)	58–67(62)
Opercle length	85	85–93(88)	86–95(90)

near-term young, the ovary is much enlarged, accommodating the growing young; the ovarian wall is thin (folds may be absent) and young can clearly be seen through it. A few small eggs may be present in anterior third of ovary. Young are arranged parallel to the length of the ovary, some headfirst, some tailfirst with respect to the birth canal. The trophotaeniae are aligned closely with the ovarian walls in posterior half of ovary, where nutrient and gas exchanges presumably occur.

Trophotaeniae.—Near-term young were removed from three females. All young with intact trophotaeniae had three thin, almost transparent, fragile lobes extending from perianal lip (Fig. 2) to slightly beyond caudal fin. Each lobe contained a large central blood vessel running along its length. Several large vessels branched off the central one. Although branching is seen in other goodeids (Miller and Fitzsimons, 1971), the lobes are unbranched in broods examined. In four newborn broods preserved, the trophotaeniae are lost. I have often observed in other goodeids that trophotaeniae may be variably present or absent in newborn young. The degree of development of trophotaeniae in newborn young does not appear to be associated with survival. Hubbs and Turner (1939) used the three-lobed trophotaeniae as a generic character in *Skiffia*.

Karyology.—T. Uyeno (pers. comm.) found a diploid number of 48 for *Skiffia francesae* consisting of 2 small metacentrics, 2 submetacentrics, and 44 subtelocentrics and telocentrics. The diploid number for *S. multipunctata* is 46, for *S. bilineata* 48 and for *S. lermae* 26 (Teruya Uyeno, pers. comm.).

Comparisons.—Four species are now recognized in the genus *Skiffia*. The new species is readily distinguished from *S. bilineata* (Bean) by coloration. *Skiffia bilineata* males have black dorsal and anal fins and a variable number of thin black bars on the sides of the body; females have

two horizontal black stripes along the body. *Skiffia bilineata* may retain a variable number of head pores; males of this species lack the fleshy anal-fin pouch and notched dorsal fin of the other species of *Skiffia*.

The new species differs from *Skiffia lermae* Meek in having fewer lateral scales (30–35 in *S. francesae*, 35–40 in *S. lermae*), more dorsal fin-rays (14–18 in *S. francesae*, 11–14 in *S. lermae*) and a tendency toward more gill rakers. *Skiffia lermae* males have bright orange caudal peduncles and caudal fins and blue-black heads. Females of both species are similarly colored.

Skiffia francesae is most closely allied to *S. multipunctata* (Pellegrin) and in proportional measurements and coloration appears to be a dwarf relative of that species. The new species has a proportionately larger head and lower ranges and modes for predorsal-scale, lateral-scale and vertebral counts. The two species are alike in all fin-ray and in most scale counts. Adult males of *S. francesae* resemble juvenile males of *S. multipunctata* in coloration, but lack black spots on the body. The notch in the dorsal fin of the new species is not as deep as in *S. multipunctata*. Female coloration is similar in both species. The new species has $2n = 48$ chromosomes as compared to $2n = 46$ in *S. multipunctata* (Teruya Uyeno, pers. comm.).

Feeding adaptations and habits.—The wedge-shaped head of *Skiffia francesae* has upturned lips. It occurs in water no more than 0.5 m deep. Stomach contents of a wild caught male indicate benthic feeding. Its gut contained mostly pennate diatoms (5 or more genera represented), some filamentous algae (probably Ulotrichales and others, Miller and Fitzsimons, 1971), one small snail and a few pollen grains. Silt and a few sand grains were also present. Pennate diatoms (largely benthic) and the other gut contents indicate that this species grazes rocks and plant surfaces along or near the bottom. The intestine is about 2 to 3 times the length of the fish; in a male, 30.3 mm SL, it exceeded 63 mm, and in a female, 30.6 mm SL, it was 95 mm. No discernible stomach is evident by gross examination. In the three specimens examined, the gut ran from the head into a J-loop and then into three counter-clockwise coils (on the right side) terminating in a relatively straight section leading from the center of the innermost coil to the anus. Aquarium stocks eat "trout chow," *Daphnia* and newly hatched brine shrimp, and can be conditioned to feed at the surface. Wild fish probably eat a wide range of food items.

Habitat.—The Río Teuchitlán, tributary to the Río Ameca, is the type locality of *Skiffia francesae*. The water is murky to muddy, with visibility of about 10 cm. The bottom is deep mud, sand, silt and rocks, with only a slight current in the area inhabited by *Skiffia*. The salinity was 0.1‰ (umhos/cm = 240), water temperature 24 C and air 25 C, at 1600 h, 23 Feb. 1976. The shore is heavily developed by man. The polluted water is used for irrigation, washing, drinking and watering livestock. Shore vegetation consisted mostly of *Acacia* and willows. Aquatic vegetation included a few *Pistia*, many rooted *Ceratophyllum* and *Potamogeton* and floating water hyacinth. Some clear-water springs feed into the river across the road from the area collected. The elevation is 1,311 m by my altimeter.

Associates.—Eleven genera or species representing five families have been taken with the new species (Miller and Fitzsimons, 1971)—Cyprinidae: *Algansea tincella, Yuriria* and *Notropis*; Ictaluridae: *Ictalurus dugesi*; Goodeidae: *Ameca splendens, Zoogoneticus quitzeoensis, Xenotoca melanosoma, Chapalichthys* and *Goodea*; Poeciliidae: *Poeciliopsis infans*; and Atherinidae: *Chirostoma jordani*. In Feb. 1976, two additional species, both exotic, were collected—*Cyprinus carpio* (one dead on shore) and the red aquarium variety of *Xiphophorus maculatus*. This platyfish was very numerous, outnumbering *Skiffia francesae* by a factor of 50. In May 1977, the numbers of *S. francesae* were reduced drastically (M. L. Smith, pers. comm.), probably from competition with *X. maculatus*.

Etymology.—This species is named for Frances H. Miller, in recognition of her help in furthering our understanding of Mexican fishes.

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A New Cyprinid of the Genus *Phoxinus* Endemic to the Upper Cumberland River Drainage

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A distinctive new cyprinid, *Phoxinus cumberlandensis*, has been discovered recently in the upper Cumberland River drainage of Kentucky and Tennessee; it is described herein. The new dace apparently is related most closely to *P. oreas*, though it is well differentiated from its congeners. The new species is endemic to the upper Cumberland, mostly above Cumberland Falls where it may have evolved after dispersal of ancestral stock from the preglacial Teays River drainage. The new *Phoxinus*, an inhabitant of small upland streams, is considered threatened due to degradation by strip mining of many such habitats in the upper Cumberland and has thus been proposed for the Federal Threatened Species List.

RECENTLY, a new cyprinid of the genus *Phoxinus* has become known from the upper Cumberland River drainage of Kentucky and Tennessee (Fig. 1). First discovered in a small tributary in Daniel Boone National Forest, Whitley County, Kentucky, by N. H. Crisp and B. A. Branson, Eastern Kentucky University, the new dace was recognized by them as a form possibly different from *P. erythrogaster* (Rafinesque). A second specimen, the holotype, was collected by J. Lowe and G. W. Wolfe, University of Tennessee, from Bell County, Kentucky. We, along with D. A. Etnier, recognized this specimen as representing a new taxon. Extensive field surveys and examination of older material revealed several additional populations of the new dace, some of which had been extirpated or severely reduced due to destruction of habitats by strip mining activities. Survey of the literature revealed that the new dace was probably first noticed (from Clear Fork tributaries, Whitley Co., Ky.) by Jordan and Swain (1883, based on color description), though they regarded it as "a color variation of *Chrosomus erythrogaster*." Their specimens apparently are not extant and may have been lost in the Indiana University fire of 1883 that ravaged Jordan's collection (pers. comm. E. Baker).

Jenkins, et al. (1972) and Kuehne and Bailey (1961) discussed the depauperate nature of the fish fauna of the upper Cumberland drainage and noted the absence of any endemic forms. The new *Phoxinus* is the first endemic form discovered in the upper Cumberland with the possible exception of a subspecies of Johnny

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Ameca splendens, a New Genus and Species of Goodeid Fish from Western México, with Remarks on the Classification of the Goodeidae

Robert Rush Miller; John Michael Fitzsimons

Copeia, Vol. 1971, No. 1. (Mar. 8, 1971), pp. 1-13.

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