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By ROBERT RUSH MILLER AND VLADIMIR WALTERS

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A NEW GENUS OF CYPRINODONTID FISH FROM NUEVO LEON, MEXICO[1]

By ROBERT RUSH MILLER[2] AND VLADIMIR WALTERS[3]

ABSTRACT: *Megupsilon aporus*, a new genus and species of cyprinodontid fish related to *Cyprinodon*, is described from a large series of individuals from an interior basin in Nuevo León, México. It is unique in having a huge Y-chromosome in the male and in the sexually dimorphic chromosome number (male 2n = 47, female 48), as well as in lacking pores in the cephalic sensory canal system, possessing two distinctive behavioral traits (jaw-nudge and opercular rotation) not developed in *Cyprinodon*, and having blackened scales on the side in the nuptial male which also lacks a black terminal band on the caudal fin. *Megupsilon* inhabits shallower water than does the species of *Cyprinodon* with which it is sympatric. It also has a much shorter gut than *Cyprinodon* and is carnivorous, whereas the local *Cyprinodon* is herbivorous. The new genus is a relict, representing an earlier invasion of the basin than does the species of *Cyprinodon*.

INTRODUCTION

Cyprinodontoid fishes comprise nearly one-third of the known freshwater fish fauna of México (approximately 115 of 390 species). Of these, the autochthonous Goodeidae and the Cyprinodontidae together have about as many species as do the Poeciliidae, whereas the fourth family of the group, the Anablepidae, is monotypic. The novelty described here is the third known endemic Mexican genus of the Cyprinodontidae (*Garmanella* Hubbs, 1936 and *Cualac* Miller, 1956 are the other two); its discovery further emphasizes the richness and diversity of the continental fish fauna of México. The new genus is distinguished from all other members of the family karyotyped thus far by the very large Y-chromosome in the male and the sexually dimorphic chromosome number (Uyeno and Miller, 1971). It is confined to a single, spring-fed pond on a high, endorheic plateau in Nuevo León, northeastern México.

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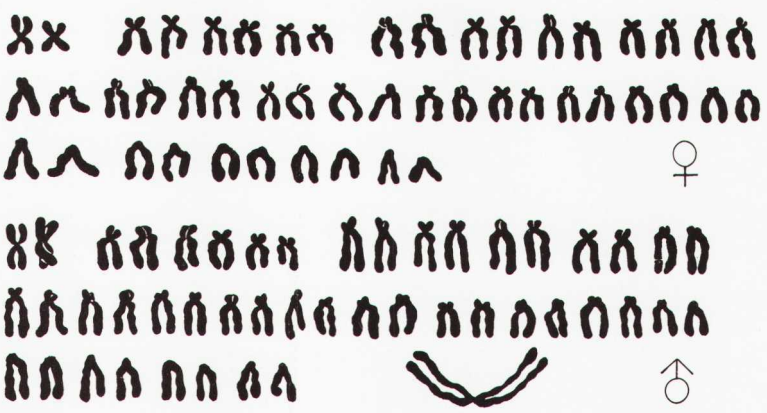

FIGURE 1. Karyotype of *Megupsilon aporus*.

Megupsilon, new genus
Figures 1-4

Type species. *Megupsilon aporus*, new species.

Diagnosis. A *Cyprinodon*-like killifish with uniserial tricuspid jaw teeth from which it is distinguished by having: (1) a huge Y-chromosome in the male (unique for cyprinodontoids) and a sexually dimorphic diploid chromosome

FIGURE 2. Photomicrographs of somatic chromosome complements of *a*, female (2n = 48) and *b*, male (2n = 47), of *Megupsilon aporus* x 1900.

number, 47 in the male and 48 in the female (Figs. 1-2); (2) the cephalic sensory canal system represented by exposed neuromasts only (no trace of canals or pores); (3) two distinctive behavioral traits (see below); (4) blackened scales on the side between dorsal and anal fins in the male (Fig. 3); and (5) nuptial male without black terminal border on caudal fin. In addition, the following combination of characters separates this genus from all others having tricuspid teeth that comprise the North American subfamily Cyprinodontinae (for diagnosis, see Uyeno and Miller, 1962: 528): entire preorbital region scaleless; pelvic fins and girdle lacking; intestine of adult usually shorter than body length; gill rakers few (10-13); anal fin of female about as large as her dorsal fin (Fig. 3). The pelvic fins and girdle are lacking also in *Cyprinodon diabolis* and in the Old World species *Aphanius (Tellia) apodus*, and the development of squamation in the preorbital region is variable in *Cyprinodon* and lacking in *Floridichthys*.

Relationships. The new genus is obviously closest to *Cyprinodon* with which it shares many traits, e.g., tricuspid teeth, body shape, size and position of fins, squamation, and osteological characters. It has diverged sufficiently

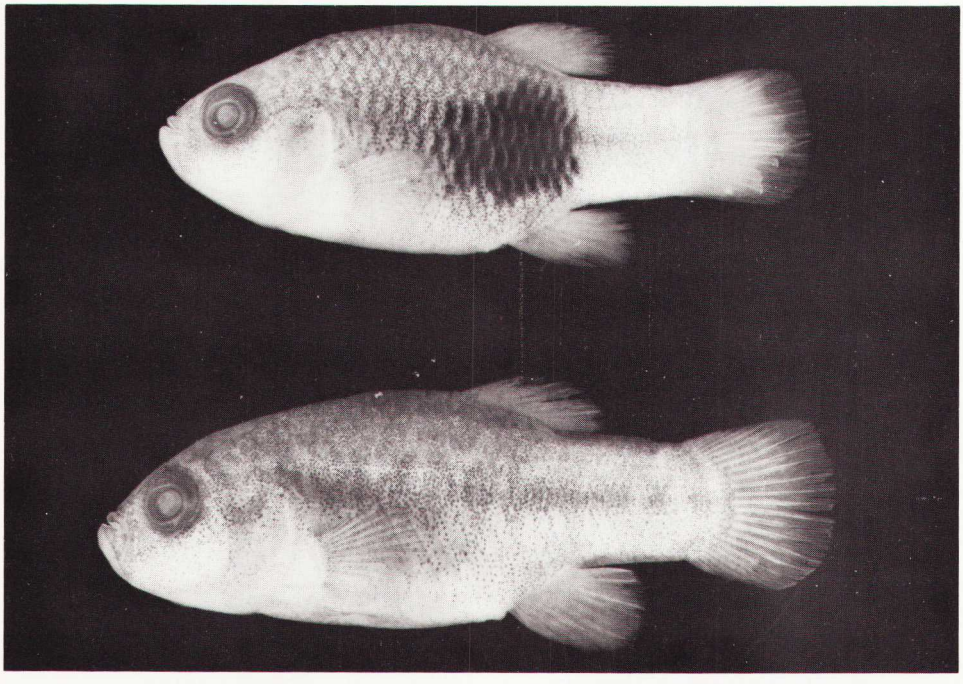

FIGURE 3. Paratypes (UMMZ 189020) of *Megupsilon aporus*. *Above*, male, 24 mm SL.; *below*, female, 27.5 mm SL. Photo by Louis P. Martonyi.

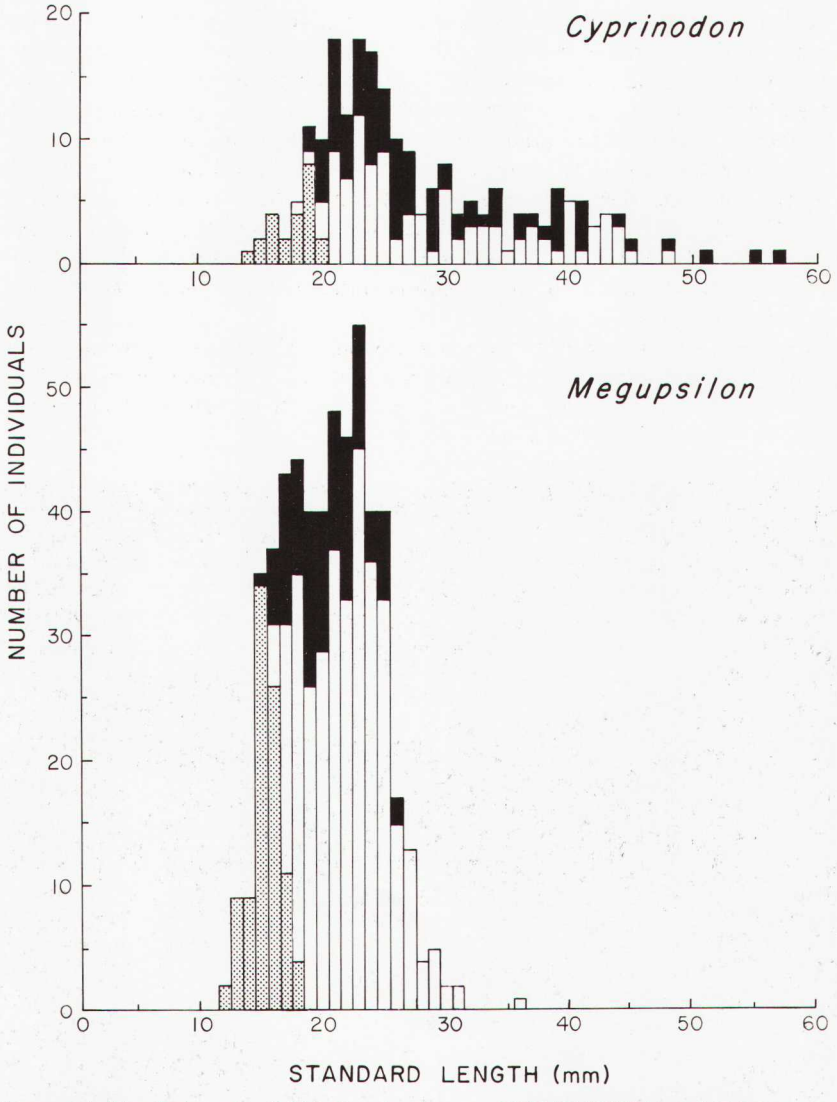

FIGURE 4. Size frequency of 216 *Cyprinodon* sp., UMMZ 189021, and 533 *Megupsilon aporus*, UMMZ 189020, from El Potosí, all collected 25 March 1968. Stipple, immatures; black, males; clear, females.

that it is behaviorally and reproductively incompatible with *Cyprinodon* and both premating and postmating isolating mechanisms prevent its hybridization with that genus. Robert K. Liu (personal communication, 1970) has observed two traits, jaw-nudge and opercular rotation, found in no species of *Cyprinodon* tested and has failed to obtain hybrids in forced matings between the two genera.

Etymology. The generic name is from the Greek prefix μεγα (mega-), from μεγασ (megas) meaning big, great, and υψιλον (upsilon), name of the Greek letter Υ (υ), in reference to the huge Y-chromosome; gender is neuter. The specific trivial, *aporus,* is from the Latin, meaning without pores, in reference to the lack of pores in the sensory cephalic canal system. We are indebted to Carl L. Hubbs for proposing the generic name.

The material used in the following description is deposited in The University of Michigan Museum of Zoology (UMMZ), University of California, Los Angeles (UCLA), and the Natural History Museum of Los Angeles County (LACM).

Megupsilon aporus, new species
Figures 1-3

Types. Holotype, a breeding male, UMMZ 189018, 21.4 mm SL, collected by R. R. Miller and H. L. Huddle at El Potosí, Nuevo León, México, 25 March 1968. Allotype, an adult female, UMMZ 189019, 26.6 mm SL, taken with the holotype. Paratopotypes: UMMZ 189017, an adult male, 19 mm SL, collected by Miller and Huddle at the type locality, 23 February 1961; UMMZ 189020, 510 juvenile to adult (including a male and female cleared and stained), 12-36 mm SL, taken with the holotype; LACM 32147-1, 25 juvenile to adult, 11-28 mm SL, (ex UMMZ 189020); UCLA, W68-21, 124 juvenile to adult, 13-28 mm SL, collected by Vladimir Walters and John Bleck at the type locality, 15 February 1968.

Additional Material (not designated as paratypes). UCLA, W68-74, 151 juvenile to adult, 7-31 mm SL, collected by Vladimir Walters and Bruce J. Turner at the type locality, 29 June 1968. Food studies were performed on 60 of these specimens.

Diagnosis. See generic diagnosis (genus is monotypic).

Description. The generic diagnosis of this species includes most of the important specific characters. Form and pigmentation are portrayed in Figure 3 and other diagnostic features appear in Figures 1 and 2. Proportional measurements are given in Table 1. Methods of counting and measuring are those used by Miller (1948: 9-13). The last two closely approximated rays in both dorsal and anal fins are counted as a single ray.

Dorsal rays: 9(10), 10(29), 11(11), $\bar{x}$ 10.02, all rays branched in 4 fish, the first one unbranched in 44, and the first two rays unbranched in 2; anal rays: 9(4), 10(39), 11(7), $\bar{x}$ 10.06, all rays branched in 35, the first ray unbranched in 15; pectoral rays (both fins): 13(15), 14(60), 15(25), $\bar{x}$ 14.10;

TABLE 1
Proportional measurements, in thousandths of standard length, of *Megupsilon aporus*.
Data for the holotype and allotype are included with the 20 adults.

			10 Males		10 Females	
Measurement	Holotype ♂	Allotype ♀	Range	Average	Range	Average
Standard length, mm	21.4	26.6	21.1-27.1	24.0	23.0-31.8	25.7
Predorsal length	626	616	598-628	616	598-616	610
Anal origin to caudal base	397	380	391-419	404	366-393	378
Body, greatest depth	421	410	415-459	434	388-428	408
Greatest width	210	218	210-234	221	211-234	225
Head length	369	357	346-369	358	343-370	358
Depth	350	320	327-350	340	311-336	325
Width	234	241	234-253	245	232-263	248
Caudal peduncle length	257	248	257-289	272	244-263	252
Least depth	206	199	194-222	208	180-199	191
Interorbital, least bony width	93	86	93-103	98	82-95	89
Preorbital width	33	34	30-37	34	29-38	33
Opercle length	117	120	103-119	113	111-126	118
Snout length	84	83	81-96	87	76-87	82
Orbit length	107	105	106-114	110	97-114	107
Mouth width	112	120	107-122	116	109-135	123
Upper jaw length	126	128	118-134	128	120-138	130
Mandible length	126	124	114-131	124	117-134	126
Dorsal fin, basal length	178	177	175-203	186	148-181	168
Depressed length	285	278	268-303	284	236-278	260
Anal fin, basal length	140	132	122-144	133	118-138	129
Depressed length	271	244	244-271	254	239-268	250
Middle caudal rays, length	233	229	214-236	227	214-244	225
Pectoral fin length	215	192	188-215	199	182-210	193

caudal rays: 16(1), 17(5), 18(31), 19(10), 20(3), $\bar{x}$ 18.18. The holotype has dorsal i,9, anal 0,10, pectorals 15-15, and caudal 18.

Scales in lateral series: 24(8), 25(41), 26(1), $\bar{x}$ 24.86; scales between dorsal and anal fins: 10(25), 11(24), 12(1), $\bar{x}$ 10.52; scales around caudal peduncle: 14?(1), 15(4), 16(44), $\bar{x}$ 15.88; scales around body: 26(2), 27(3), 28(28), 29(3), 30(12), 31(0), 32(2), $\bar{x}$ 28.56; predorsal scales: 18(4), 19(14), 20(14), 21(12), 22(6), $\bar{x}$ 20.04. The holotype has 25 lateral scales, 10 between dorsal and anal, 16 around peduncle, 28 around body, and 22 predorsal.

Vertebral counts (including hypural complex), taken from radiographs,

are: 25(8), 26(50), 27(3), $\bar{x}$ 25.92; of these the precaudal vertebrae number 11(42), 12(15) and the caudal vertebrae 13(1), 14(20), 15(33), 16(3). Holotype 11 + 15 = 26.

Gill rakers: 10(8), 11(24), 12(14), 13(4), $\bar{x}$ 11.28. Holotype, 11. All gill rakers on the outer part of the first arch were counted, without distinction between upper and lower limbs.

The branchiostegals numbered 4 in 6 specimens and 5 in 34; only one fish had the formula 4-4. In the typical count, 4 branchiostegals insert on the ceratohyal and 1 on the epihyal.

Coloration and Dimorphism. The life colors of the new genus were noted in both field and laboratory; the sexes show marked dichromatism (typical also of *Cyprinodon*): nuptial males have steel blue iridescence on the back and sides anterior to the blackened area that lies between the dorsal and anal fins; the caudal peduncle, however, has a golden bronze sheen, seen also on top of the head, and the caudal fin is watery orange, with no trace of the terminal black border typical of *Cyprinodon;* the dorsal and anal fins are chalky bluish white, the base of the dorsal orange. There is a conspicuous, vertical black bar on the eye above and below the pupil that disappears on preservation. There is also an orange spot on the posterior part of the opercle, noted only in the male. Adult females are golden olivaceous over the entire body and have a weak and often interrupted midlateral stripe, from the upper angle of the gill opening to the base of the caudal fin, that is no wider than three-fourths the diameter of the eye; rarely there is a tendency to develop several teardrop-shaped extensions from this stripe toward the anal fin.

The male differs most notably from the female in having the side of the body heavily blackened between the tip of the extended pectoral fin and the bases of the dorsal and anal fins (Fig. 3); this mark varies in development, apparently being most intense and expansive in alpha males. Neither young nor adult possess a dorsal ocellus, found in most species of *Cyprinodon*. The anal fin of the female is as large as or larger than her dorsal fin, whereas in the male the dorsal fin is larger than the anal fin (as typical for both sexes of *Cyprinodon*).

As shown in Table 1, there is marked sexual dimorphism in the measurement of anal origin to caudal base, head depth, caudal peduncle length, least depth of caudal peduncle, least bony width of interorbital, basal length of dorsal fin, and depressed length of dorsal fin. Except for the interorbital measurement, sexual dimorphism is similar in *Cyprinodon*. In addition, males of *Cyprinodon* have notably longer anal fins than do females, whereas these fins are virtually the same length in both sexes of *Megupsilon*. The functional significance of this difference may be related to breeding behavior.

Individuals of the new genus are small, attaining a maximum standard length of only 36 mm (1 female); males are smaller than females and may mature at 15 mm SL (Fig. 4). The smaller male size may be correlated with the absence of territorial behavior in this genus (see below). The sympatric species

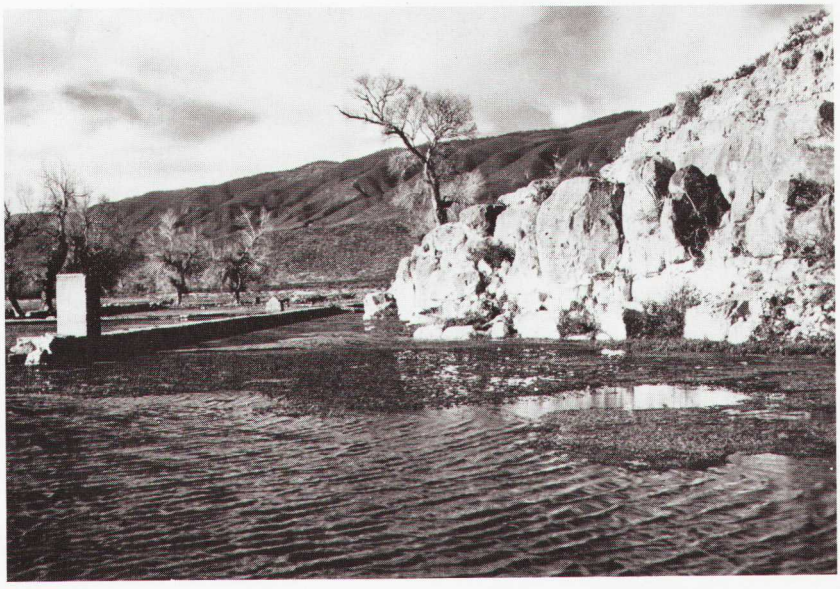

FIGURE 5. Spring-fed pond at El Potosí, type locality of *Megupsilon aporus*. View northeast, 23 February 1961 (from Kodachrome by R. R. Miller).

of *Cyprinodon* at El Potosí reaches a larger size and the two sexes are not significantly different in their maximum lengths.

Discussion. Megupsilon is known only from a spring-fed pond (Fig. 5) near the northern edge of the small settlement of El Potosí, 95 airline km due south of Monterrey, on the west side (rain shadow) of the Sierra Madre Oriental, in Nuevo León. The elevation is about 1,880 m, and the highest adjacent mountains (Cerro Potosí) are about 3,640 m. The pond lies in the endorheic basin named La Hediondilla, which is a high, arid plateau extending northward for about 65 km and southward some 50 km from Potosí. We were told that the pond is the only permanent water in the entire basin, which is lowest toward the southeast. At high level, the pond covers somewhat more than 1 hectare and, in places along its eastern side, is 3.5 to 4 m deep. Its water is very clear though easily roiled because of the firm clay that overlies a limestone base. Vegetation is abundant, particularly *Ceratophyllum* which forms dense masses in the southeastern sector; *Potamogeton* is restricted to water deeper than about 1 m, and unidentified "grasses" are restricted to water shallower than about 1 m; floating masses of green and blue-green algae (unidentified) occur among the "grasses" and *Ceratophyllum; Nasturtium* is also present.

An abrupt limestone cliff (Fig. 5) is at the northeastern edge of the pond. The water is moderately alkaline (pH 7.2-7.4, indicator strips) and moderately

TABLE 2
Temperature Measurements[a]

Date	Time	Temperature (° C)
23 Feb. 1961	1630	20.6 air, 19.4 water
14 Feb. 1968	2230	18.9 water
15 Feb. 1968	1000	20.0 water
25 Mar. 1968	1100	17.8 air, 18.0 water
28 June 1968	1545	26.0 water
28 June 1968	2235	16.5 air, 17.0 water

[a]Water temperatures taken 5 cm below the surface, at the south end of the pond.

hard (DH 11-15, approximately 197-269 ppm as CaO). Air and water temperatures are summarized in Table 2.

Each year, starting in July, the pond level is lowered about 1 m as water is pumped out to irrigate the corn fields, according to the residents. This considerably reduces the surface area of the pond. The pond slowly refills, and by October covers the area shown in the photograph; water level then remains stable until the following summer. The commemorative plaque on the wall of the pumphouse states that this structure was dedicated in 1955 and, according to the residents, the partial dam which parallels the limestone cliff and serves to delimit the deeper portion of the pond from the shallower areas was built in 1960. The annual man-caused changes in the level of the pond may have enabled "grasses" to colonize those pond areas which become dry land in summer.

On 23 February 1961 Miller and Huddle collected a single *Megupsilon* and 315 *Cyprinodon* whereas subsequent collections made in Feburary, March and June, 1968, revealed that *Megupsilon* was 2 or 3 times more abundant than *Cyprinodon*. The 1968 collections indicate that *Megupsilon* predominates in the grassy areas of the pond and in the *Ceratophyllum* whereas the *Cyprinodon,* especially the adults, inhabits water deeper than 1 m. It appears to us that yearly pumping of the pond has resulted in an increase in *Megupsilon* habitat and a decrease in *Cyprinodon* habitat. During pluvial times (Wisconsin glaciation), when the now restricted pond probably formed a sizable marsh and lake, the habitat suitable for *Megupsilon* would have been extensive.

One other species of fish, the goldfish *(Carassius auratus),* is present in the pond. Most were greenish bronze but one bright golden one was noted in 1961 and a number of golden individuals were seen in 1968; the brightly-colored goldfish were confined to the deepest part of the pond and were large, perhaps the original propagules. A dwarf species of crayfish, *Cambarellus alvarezi* Villalobos (1952), is endemic to this pond.

Mr. Robert J. Naiman, while a graduate student at UCLA, measured gut length and studied dietary preferences of the 2 cyprinodontids of El Potosí (Tables 3-4). *Megupsilon* has a much shorter digestive tract than does *Cyprinodon:*

Species	$\bar{x}$ Gut Length (as % SL)	Range	N	Size Range
Megupsilon adults	88%	53-130%	55,	16-33 mm SL
Cyprinodon adults	211%	137-348%	36,	27-54 mm SL
Megupsilon juveniles	78%	53-100%	5,	13-15 mm SL
Cyprinodon juveniles	112%	90-133%	14,	10-16 mm SL

Mr. Naiman's data indicate that *Megupsilon* is carnivorous and feeds mainly on larval chironomids whereas *Cyprinodon* is herbivorous and feeds mainly on filamentous algae. The average adult *Megupsilon* contains 3.96 times more animals than does the average adult *Cyprinodon*, and *Megupsilon* juveniles, on the average, contain 4.32 times more animals than do *Cyprinodon* juveniles. On the other hand *Cyprinodon* adults ingest considerably more plant matter than does *Megupsilon;* the mean fullness value (filamentous algae plus vascular plants) for *Cyprinodon* is 22.07 times that for *Megupsilon* and since an adult *Cyprinodon* gut is 4.3 times the length of an adult *Megupsilon* gut ($\bar{x}$ gut length in adults is 86.5 mm vs. 20.3 mm, respectively) *Cyprinodon* must ingest about 100 times more plant matter than does *Megupsilon*. Both species were found to contain appreciable amounts of unicellular algae such as diatoms and desmids but no attempt was made to estimate quantities.

When Walters and Bleck arrived at the pond on 14 February 1968, *Megupsilon* was observed to be actively swimming about at 2230 hrs. No

TABLE 3
Feeding Preferences of the El Potosí Cyprinodontids[a]

Food Category	*Megupsilon aporus*, juveniles[b] Mdn No./Fish	$\bar{x}$ No./Fish	*Cyprinodon* sp., juveniles[c] Mdn No./Fish	$\bar{x}$ No./Fish
Chironomid larvae	11.0	11.8	0.50	1.21
Other insects plus arachnids	0.3	1.2	0.14	0.50
Copepods *(Cyclops)*	0.3	4.6	0.14	2.50
Larger crustaceans	0.1	0.2	0.00	0.00
Eggs (cyprinodont?)	0.1	0.4	0.00	0.00
Insect eggs	0.1	not counted	0.00	0.00
Filamentous algae	0.1[d]	0.5[d]	9.0[d]	7.4[d]
Vascular plants	0.0[d]	0.0[d]	0.04[d]	0.29[d]

[a]Fishes collected by seining at 0900-1000, 29 June 1968.

[b]N = 5, 13-15 mm SL; 100% with food in gut; no helminth parasites found.

[c]N = 14, 10-16 mm SL; 92.9% with food in gut; no helminth parasites found.

[d]Fullness values. For plant matter, the fullness of the gut was estimated on an arbitrary scale of 0 (gut devoid of algae/vascular plants) to 10 (gut stuffed with algae/vascular plants).

TABLE 4
Feeding Preferences of the El Potosí Cyprinodontids[a]

Food Category	*Megupsilon aporus*, adults[b] Mdn No./Fish	$\bar{x}$ No./Fish	*Cyprinodon* sp., adults[c] Mdn No./Fish	$\bar{x}$ No./Fish
Chironomid larvae	9.00	15.71	0.93	4.47
Other insects plus arachnids	2.45	2.25	0.40	1.28
Copepods *(Cyclops)*	0.58	4.58	0.01	0.03
Larger crustaceans	1.13	2.87	0.08	0.56
Eggs (cyprinodont?)	0.22	1.20	0.10	0.39
Gastropods	0.03	0.07	0.00	0.00
Filamentous algae	0.15[d]	0.40[d]	9.64[d]	8.90[d]
Vascular plants	0.02[d]	0.04[d]	0.19[d]	0.81[d]

[a] Fishes collected by seining between 0900-1000, 29 June 1968.

[b] N = 55; 20 males, 35 females, 16-33 mm SL; 100% with food in gut; 60.0% with helminth parasites.

[c] N = 36; 12 males, 24 females, 27-54 mm SL; 100% with food in gut; 63.9% with helminth parasites.

[d] Fullness values. For plant matter, the fullness of the gut was estimated on an arbitrary scale of 0 (gut devoid of algae/vascular plants) to 10 (gut stuffed with algae/vascular plants).

reproductive activity was noted then or the following morning, which was marked by light rain and overcast sky. Walters and Turner noted that *Cyprinodon* males were maintaining territories in deep water on June 28-29, but such behavior was not observed for *Megupsilon*.

The two killifishes are endemic to the El Potosí pond today. The pond undoubtedly represents the last remnant of a larger body of water which may have filled much of La Hediondilla during Pleistocene pluvial periods. At some past Pleistocene time, the hypothetical lake must have had a drainage connection to the north or northwest to permit entry by the ancestor of the El Potosí *Cyprinodon*. Although this form has not been studied, it appears to belong to the group of species allied to *Cyprinodon eximius* Girard, which today occurs in isolated drainages and in the Rio Conchos basin, of northern México, as well as in certain Rio Grande tributaries in Texas.

The population of *Megupsilon aporus* can only be regarded as relict and representative of a much earlier cyprinodontine invasion of the Mexican Plateau. That it is most closely related to *Cyprinodon* is indicated by the many shared morphological characters. Another relict cyprinodontine, *Cualac tessellatus* Miller, inhabits a warm spring area (La Media Luna) near Rio Verde in San Luis Potosí.

On the morning of 6 July 1972 Walters revisited the spring pond, accompanied by Robert E. Brown, Jr., Richard Haas, Robert K. Liu, and Sylvia H. Walters. Conditions had changed since the last visit. The pump has been inoperable for several years and the spring's flow is now tapped year-round by sluices. Since pond area is now fairly constant there has been a change in the aquatic vegetation. *Ceratophyllum demersum,* restricted to the area of the pump house in 1968, now covers most of the pond with a thick mat; in shallower areas this vegetation was moribund but in fruit, possibly reflecting elevated summer water temperatures. Wide-angle Infrared Ektachrome photographs, taken with a Wratten 12 filter from the hillside about 25 feet above the spring, show the moribund areas as white to pale pink vs. red for healthy areas. In cooler areas the *Ceratophyllum* is partially overlain by *Ranunculus* sp. Grasses are diminished.

Water temperatures, measured between 9 AM and 12 noon with a YSI telethermometer at several scattered locations, were 22-23°C (surface), 16-19°C (shallow depths), and 18°C at the deepest point. Oxygen content, measured at the same times with a Hach Kit, ranged from 4.5-7.5 ± /0.5 mg/1 = 2.8-5.2 ml/1; the lower readings were taken in shade, near *Ceratophyllum.* Four minnow traps, baited with chicken liver and placed in deep water below the *Ceratophyllum* mat for 90 minutes and then in shallow water in the *Ceratophyllum* mat for 90 minutes yielded several hundred *Cyprinodon* sp., 8 *Megupsilon aporus,* and 2 dwarf crayfish. The trapping results were surprising, in view of the dietary differences between the two fishes as indicated by earlier gut analyses.

Megupsilon aporus was seen to be abundant immediately below and in the *Ceratophyllum* mat. *Cyprinodon* sp. abounded in open water, from the surface to the deepest part of the spring; territorial males were tightly packed in shallow water along the western side of the pond. Crayfish abounded in the *Ceratophyllum.* The goldfish population seemed unchanged. No specimens were preserved; all trapped fish were released.

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RESUMEN

Megupsilon aporus, un nuevo genero y especie de la familia Cyprinodontidae mas cercamente relacionado a *Cyprinodon,* se describe de un estanque aislado en Nuevo León México. Solamente otro pez, una especie de *Cyprinodon,* es indigeno del mismo manantial. Este nuevo genero se distingue por medio de su dimorfismo sexual en numero de cromosomas, $2n = 47$ en el macho y $2n = 48$ en la hembra, y el macho tambien con una enorme cromosoma Y. Ademas *Megupsilon* solamente tiene neuromastos expuestos (carece canales o poros) en el sistema canal sensorio cefalico, sin aletas o ceñidor pelviano, el intestino del adulto mas corto que el largo del cuerpo, pocos rastrillos branquiales (10-13), el macho nupcial sin margen negra terminal en la aleta caudal pero con una region enegredida en el lado entre las aletas dorsal y anal, y la aleta anal de la hembra aproximadamenta tan grande como su aleta dorsal. Enseña dos caracteristicas de comportamiento que no se encuentran en *Cyprinodon* y no es territorial. Es carnivoro y prefiere agua mas o menos poco profunda. El nuevo genero es una reliquia representando una invasion mas temprana que la del especie simpatrica de *Cyprinodon.*

LITERATURE CITED

MILLER, R. R. 1948. The cyprinodont fishes of the Death Valley system of eastern California and southwestern Nevada. Univ. Mich. Mus. Zool., Misc. Publ. 68: 1-155.

UYENO, T., AND R. R. MILLER. 1962. *Empetrichthys erdisi,* a Pliocene cyprinodontid fish from California, with remarks on the Fundulinae and Cyprinodontinae. Copeia 1962 (3): 519-531.

_____. 1971. Multiple sex chromosomes in a Mexican cyprinodontid fish. Nature 231: 452-453.

VILLALOBOS, A. 1952. Estudios de los cambarinos Mexicanos. X. Una nueva especie del genero *Cambarellus* del estado de Nuevo León. Anal. Inst. Biol. 22 (2): 525-532.

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