Miller 1948

MISCELLANEOUS PUBLICATIONS
MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN, NO. 68

THE CYPRINODONT FISHES OF THE DEATH VALLEY SYSTEM OF EASTERN CALIFORNIA AND SOUTHWESTERN NEVADA

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ANN ARBOR
UNIVERSITY OF MICHIGAN PRESS
APRIL 20, 1948

maxillaries protractile. Jaws unequal, the lower one projecting. Borders of oviduct swollen, but not forming a distinct pouch about the anal fin (as in *Fundulus*). Dorsal and anal fins placed far back on the body, the anal inserted directly under or slightly behind the dorsal. Dorsal with 9 to 13 rays; anal with 10 to 15. Pectorals set low, but with 2 vertical bases; with 15 to 20 rays. Pelvic fins absent. Caudal fin truncate or rounded, with 16 to 23 principal rays. Preopercular pores usually 14 (13 to 16), preorbital pores 8 (7 to 9), and mandibular pores 8 (6 to 8) (Tables XXXIV–XXXVI).

The tubercular-shaped molar teeth and the greatly enlarged upper and lower pharyngeal bones (Gilbert, 1893: Pl. 5) are the most distinctive characters of the genus. The lack of pelvic fins is not diagnostic of *Empetrichthys*, for a related genus, *Crenichthys*, as well as other cyprinodonts (*Orestis, Cyprinodon diabolis*, and *Tellia*), has independently lost these fins.

RELATIONSHIPS.—During the course of its classification, this singular genus has been assigned to 3 different families by various authors. In his original description, Gilbert (1893: 233–34) correctly placed *Empetrichthys* in the Cyprinodontidae. Garman (1895: 19, 116) retained *Empetrichthys* in this family, concluding that it is "allied to *Fundulus* through the more compressed species." Jordan and Evermann (1896: 631, 667), following Gill (1894: 115), still put all of the cyprinodonts in 1 family, but used the name Poeciliidae. Later, Jordan (1923: 158), following Eigenmann (1920), regarded *Empetrichthys* and *Orestias* (a superficially similar genus of the High Andes) as the only members of a distinct family, the Orestiidae. Recently, Jordan, Evermann, and Clark (1930: 182) even erected a separate family, the Empetrichthyidae, for the sole reception of *Empetrichthys*. Myers (1931: 10) placed *Empetrichthys* in the subfamily Fundulinae of the family Cyprinodontidae, concluding that *Empetrichthys* ". . . appears to have nothing to do with *Orestias*."

Empetrichthys probably originated from *Fundulus*, as was suggested by Garman. The fossil evidence also supports this view for the Death Valley species, *Fundulus curryi* (Miller, 1945: 316–19, Fig. 1), appears to have been strikingly like *Empetrichthys*.

The nearest living relative of *Empetrichthys* is *Crenichthys* of Railroad Valley (Hubbs, 1932) and the White River basin in eastern Nevada (Hubbs and Miller, 1941). Each of these genera retains primitive features along with specializations. Both probably arose from an ancestral stock which differed from *Fundulus* primarily in the lack of pelvic fins.

HABITAT.—Desert warm springs, frequenting the deeper holes; usually uncommon in shallow spring-fed ditches or marshy areas.

TYPE SPECIMEN.—After my work on this genus was completed I examined the 6 speciments of *Empetrichthys merriami* in the United States

National Museum and found that the type (= holotype) was not so labeled. Jordan and Evermann (1896: 667) incorrectly designated the type as U.S.N.M. No. 46101. This jar contains 3 specimens, 41 to 58 mm. in standard length, none of which is the type; that specimen was figured and so labeled by Gilbert (1893: Pl. 5, Fig. 1). In the jar containing U.S.N.M. No. 46102, however, I found the specimen figured by Gilbert and removed it from the other 2 specimens in this jar. The type may now be correctly designated as U.S.N.M. No. 131151, a large female, 67 mm. in standard length.

Empetrichthys merriami Gilbert

(Pls. X and XI)

This species is present only in Ash Meadows (Map 3) of the Amargosa River drainage, where it is rare. Over the 6-year period (1936–42) during which we collected in this region, only 22 specimens have been taken, although we made special efforts to obtain greater numbers. Myers and Wales collected 3 in 1930. Over the same 6-year period, 3861 specimens of *Cyprinodon nevadensis* and 515 of the cyprinid *Rhinichthys osculus nevadensis* Gilbert were secured in Ash Meadows.

The 22 specimens of *E. merriami* were collected from 5 separated springs in the Meadows, namely Deep Spring, Eagle Spring, Point of Rocks Spring (Kings Spring), Forest Spring, and Hidden Spring (Map 3). According to Shapovalov (1941: 445), the type locality is Kings Spring. The largest number taken from a single spring, 13, came from Deep Spring, where neither *Cyprinodon* nor *Rhinichthys* is particularly common. *E. merriami* prefers the deeper springs, where it dwells near the bottom. A description of the habitat of these springs has been given under the account of *Cyprinodon nevadensis mionectes* (pp. 48–52, 56).

The systematic characters of *merriami* are discussed in detail in connection with the description of the new species, *latos*.

DIAGNOSIS.—A deep-bodied, heavy-set species of *Empetrichthys* with a broadly arched predorsal profile, a large, deep head, a rather narrow mouth, a strong mandible, and 29 or 30 scales in the lateral series. The sides are marked by a rather irregular lateral band (Pls. X and XI). The anal rays usually number 14.

There may be some local differentiation in the populations of the different springs, but the material now available is insufficient to determine whether the observed variations are significant.

Empetrichthys latos, new species

(Pls. X and XI)

To date *Empetrichthys* has been regarded as a monotypic genus. Gilbert (1893: 234) had at his disposal only 6 specimens from Ash Meadows and 1

from Pahrump Valley. It is not surprising that he referred that single specimen to *merriami*. A study of the many specimens of *Empetrichthys* which have been taken in recent years from Pahrump Valley convinces me that this isolated basin contains a species distinct from that of Ash Meadows.

The 3 springs from which we have collected *Empetrichthys* in Pahrump Valley are well isolated although only 7 miles apart, and their remnant populations are regarded as comprising 3 distinct subspecies. Several important characters, shared by all 3, distinguish each of these populations from *merriami*. Subspecific rank is assigned the 3 forms because the differences between them appear to be in the average only.

TYPES.—The holotype of the typical form, *E. latos latos*, is an adult female, 43 mm. long, seined by Robert R. and Frances H. Miller on October 5, 1942, from the main spring pool on Manse Ranch, Pahrump Valley, Nye County, Nevada (U. S. Geological Survey, Las Vegas Quadrangle); U.M.M.Z. No. 141855. The type specimens of each subspecies are designated in the subspecific descriptions.

DIAGNOSIS.—A rather slender species of *Empetrichthys* with a gently sloping to convex predorsal profile, a relatively short and slender head, a comparatively broad mouth, a weak mandible, and usually 31 or 32 scales in the lateral series. The sides are marked by a narrow axial streak (Pls. X and XI), which is faint to obsolescent in *E. l. concavus*. The anal rays usually number 12 or 13.

COMPARISON.—*Empetrichthys latos* differs from *E. merriami*, the only other known species of the genus, principally in mouth structure, body shape, and color pattern (Pls. X and XI). In *merriami* the head constricts abruptly in the preorbital region so that the 2 sides of the snout slope markedly toward the tip of the mandible. As a result of this constriction the mouth is narrower. In *latos* the sides of the head are almost parallel all the way to the tip of the mandible, and the mouth is consequently broader. When the mouth is forced open, as with a pair of forceps, the horizontal gape is definitely evident in *merriami*, but is almost eliminated in *latos*. The bones of the premaxillaries and mandible are much weaker and less firmly connected in *latos*.

In *merriami* the predorsal region is broadly convex. The change in slope of the predorsal profile takes place farther forward so that the head is deeper than it is in *latos*. The body is also thicker in *merriami*. The differences in color pattern between the 2 species are well shown in Plate X. In particular the narrow axial streak of *latos* contrasts with the disrupted lateral band of *merriami*.

The large difference in head depth and opercle length between *merriami* and *latos* can be expressed by a character index in which these measurements, expressed in thousandths of the standard length, are added together (Table XXXII).

TABLE XXXII

CHARACTER INDEX FOR HEAD DEPTH AND OPERCLE LENGTH IN TWO SPECIES OF *Empetrichthys*

The index was derived by adding together the depth of the head and the length of the opercle, expressed in thousandths of the standard length. The sexes are combined.

Locality and Form	Character Index	
	Range (Ave.)	No.
Pahrump Valley		
E. l. latos	372–426 (391)	21
E. l. pahrump	382–413 (396)	20
E. l. concavus	383–421 (402)	19
Total	372–426 (398)	60
Ash Meadows		
E. merriami	414–449 (431)	13

SUBSPECIES AND ECOLOGY.—The 3 subspecies of *Empetrichthys latos* are discussed in order from south to north. The main spring pool on Manse Ranch was selected as the type locality because the population of *E. latos* is larger there and the natural conditions of that spring appear least likely to be seriously altered by man. *Empetrichthys* is the only fish native to Pahrump Valley. Its comparative abundance there may be largely due to lack of competition.

ETYMOLOGY.—The name *latos,* from *latus* and *os,* refers to the wide mouth of the new species.

Empetrichthys latos latos, new subspecies

(Pl. XI)

TYPES.—The holotype has been designated in the description of the species. There are 143 paratypes, U.M.M.Z. No. 140489, 15 to 48 mm. long, taken with the holotype at Manse Ranch, and 34 paratypes, U.M.M.Z. No. 132915, 10 to 50 mm. long, collected by R. R. Miller and Alex J. Calhoun on July 16, 1938, from the outlet of the main spring pool.

DIAGNOSIS AND COMPARISONS.—A subspecies of *E. latos* characterized by a relatively short distance between anal origin and caudal base. In this character the males of *E. l. latos* show little or no overlap with the males of either *E. l. pahrump* or *E. l. concavus;* in the females the values show only slight overlap. The comparatively short distance between the anal origin and the caudal base appears to be influenced by the more posterior position and the short basal length of the anal fin. The head depth is less in the males, and the width of the preorbital is broader in both sexes than in those 2 subspecies, and the snout is longer than it is in *concavus.* The basal length of the anal fin is shorter, but overlaps the figures for the other 2 subspecies. The caudal fin of *latos* is much shorter than it is in

concavus (Pl. XI). On the average the mouth is broader and the dorsal fin more posterior in position than in either *pahrump* or *concavus* (Table XXXIII). The darker pigmentation of *latos* may be due, in part at least, to the darker habitat.

HABITAT.—The main spring pool at Manse Ranch is about 50 feet wide at the head, 10 feet wide at the outlet, and 60 feet long. It is 1 to 6 feet deep and has a silt bottom. The water is crystal clear and chalky blue in a deep hole near the center of the spring. On October 5, 1942, vegetation noted was thick water cress, *Chara*, green algae, and a fine-leaved *Potamogeton*. The shore is a low bank, bordered by cottonwood (*Populus Fremonti?*) and willow, which well shade the pool. The current is moderate in the pool and swift in the outlet. About 50 yards above is a much smaller spring which flows into the head of the pool just described; it contained no fish life.

The temperature of the main spring, as recorded by several investigators over a period of 26 years, is very constant, about 24° C. (23.3° C. to 24.0° C.).

Mr. Sawday, owner of the ranch at the time of our visit, kindly allowed us to collect specimens.

Empetrichthys latos pahrump, new subspecies

(Pl. XI)

TYPES.—The holotype, an adult female, 35 mm. long, was seined by R. R. and F. H. Miller from the marshy overflow of a spring-fed ditch on Pahrump Ranch, 6 miles northwest of Manse Ranch, in Pahrump Valley, Nye County, Nevada; U.M.M.Z. No. 141856. One hundred and forty-two paratypes, U.M.M.Z. No. 140490, 14 to 36 mm. long, were taken with the holotype.

DIAGNOSIS AND COMPARISONS.—A subspecies of *Empetrichthys latos* closely resembling *E. l. latos*, differing principally in the longer distance between anal origin and caudal base. From *concavus* it is readily separated by the much shorter and more nearly truncate caudal fin (Pl. XI). In the length of the anal and caudal fins *pahrump* is somewhat intermediate between *latos* and *concavus*. It also appears to be intermediate in color pattern, but the paleness is very probably influenced by the clay and silt bottom over which the sample was collected. The head is only very slightly concave.

HABITAT.—The 2 main springs on Pahrump Ranch, which rise about 200 yards east of the principal ranch houses, are used extensively for irrigation. Until recently the northern spring contained native fish life, but it was greatly altered by dredging in 1941, and only a few carp were observed there in 1942. The southern spring still harbored a few fish in 1942, but in October of that year most of the population of *pahrump* was in a marshy area about 200 yards from the source of the southern spring. As shown

by readings over a 26-year period, the temperature of the spring sources is constantly about 25° C. (24.7° C. to 25.0° C.); that of the outlets varies somewhat and is usually less than 25° C.

ETYMOLOGY.—This subspecies is named *pahrump* after the valley in which it is found, and more particularly for Pahrump Ranch, which is the more precise type locality.

Empetrichthys latos concavus, new subspecies

(Pl. XI)

TYPES.—The holotype is an adult female, U.M.M.Z. No. 141857, 39 mm. long. It was collected by R. R. and F. H. Miller on October 5, 1942, in a spring on the Raycraft Ranch, about one-half mile north of Pahrump Ranch, Pahrump Valley, Nye County, Nevada. This spring is named on a map (Pl. VIII) in Waring's report (1920). Twenty-six paratypes, U.M.M.Z. No. 140491, 17 to 40 mm. long, were collected with the holotype.

DIAGNOSIS AND COMPARISONS.—A subspecies of *Empetrichthys latos* most closely resembling *E. l. pahrump,* from which it differs chiefly in the much longer and more nearly rounded caudal fin. The rays along the upper and lower borders of this fin are definitely shorter than they are in either *pahrump* or *latos* (Pl. XI). The profile between snout and occiput is most strongly concave in this subspecies. The anal fin of *concavus* is longer than it is in *pahrump,* especially in the female, and much longer than the anal fin of *latos.* In the males the snout is shorter and the body is deeper than in the 2 other subspecies (Table XXXIII). The cheek is deeper than it is in either *pahrump* or *latos.* The axial streak is generally finer and much less conspicuous than it is in the other 2 subspecies, and in some specimens of *concavus* it is obsolescent.

HABITAT.—*E. latos concavus* was collected on Raycraft Ranch from the spring-fed pond, 5 to 25 feet wide and about 40 feet long, and its outlet ditch, 1 to 4 feet wide. The temperature of the spring on October 5, 1942, was 25.3° C., slightly warmer than were the springs on either Manse or Pahrump ranches. The water in the spring pond and outlet was clear but easily roiled because of a bottom of silt and trash. Vegetation noted in 1942 was water cress, *Typha,* and grass. The current in the spring was slight, but rather swift in the outlet. The depth of water was not over 1½ feet. The shore consisted of low banks, willows, and meadowland. According to Waring (1920: 76) this spring has a flow of about 10 gallons a minute. *Empetrichthys* was not common, perhaps because introduced carp were also present.

ETYMOLOGY.—The new subspecies is named *concavus* in reference to the marked concavity of the top of the head.

TABLE XXXIII

PROPORTIONAL MEASUREMENTS OF ADULTS OF TWO SPECIES OF *Empetrichthys*, EXPRESSED IN THOUSANDTHS OF THE STANDARD LENGTH

Locality and Form	Standard Length	Predorsal		Anal Origin to Caudal Base				Body, Greatest Depth	
				Males		Females			
	Range (Ave.)	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.
Pahrump Valley									
l. latos	26–47 (35)	669–693 (681)	20	332–356 (346)	10	310–344 (328)	10	274–332 (306)	20
l. pahrump	28–42 (33)	658–687 (673)	20	355–382 (367)	10	338–358 (348)	10	281–333 (309)	20
l. concavus	25–39 (32)	645–688 (663)	19	359–377 (366)	9	335–359 (350)	10	271–328 (293)	19
Total	25–47 (33)	645–693 (672)	59	332–382 (359)	29	310–359 (342)	30	271–333 (303)	59
Ash Meadows *merriami*	20–59 (35)	650–694 (675)	13	351–376 (362)	5	334–359 (342)	5	288–348 (314)	13

Locality and Form	Body, Greatest Width		Head, Length		Head, Depth			
					Males		Females	
	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.
Pahrump Valley								
l. latos	185–225 (207)	20	306–337 (316)	20	252–277 (267)	10	271–302 (281)	10
l. pahrump	194–219 (209)	16	294–326 (312)	20	269–290 (280)	10	272–287 (277)	10
l. concavus	191–230 (205)	19	298–320 (310)	19	273–293 (284)	9	265–296 (276)	10
Total	185–230 (207)	55	294–337 (313)	59	252–293 (277)	29	265–302 (278)	30
Ash Meadows *merriami*	184–237 (204)	13	307–353 (329)	13	286–308 (298)	8	285–309 (299)	5

Locality and Form	Head, Width				Caudal Peduncle, Length				Caudal Peduncle, Depth	
	Males		Females		Males		Females			
	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.
Pahrump Valley										
l. latos	210–218 (215)	10	219–239 (225)	10	188–212 (199)	10	187–218 (206)	10	143–164 (155)	20
l. pahrump	212–223 (217)	10	196–230 (214)	9	195–211 (206)	10	205–228 (217)	10	147–171 (157)	19
l. concavus	212–231 (219)	9	214–238 (222)	10	196–220 (209)	9	204–225 (214)	10	143–160 (153)	19
Total	210–231 (217)	29	196–239 (221)	29	188–220 (205)	29	187–228 (212)	30	143–171 (155)	58
Ash Meadows *merriami*	194–233 (212)	8	209–249 (227)	5	187–209 (196)	8	194–218 (207)	5	138–162 (149)	11

TABLE XXXIII (Cont'd)

Locality and Form	Interorbital, Least Bony Width		Preorbital, Least Width		Preorbital Margin to Preopercular Angle		Eye Margin to Preopercular Angle			
							Males		Females	
	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.
Pahrump Valley										
l. latos	100–118 (107)	20	24– 33 (29)	20	147–167 (155)	20	80– 92 (86)	10	84–110 (94)	10
l. pahrump	103–116 (109)	20	20– 28 (24)	20	144–156 (147)	19	80– 91 (85)	10	76– 97 (88)	10
l. concavus	102–115 (107)	19	19– 28 (24)	19	143–158 (151)	19	78– 90 (84)	9	81– 90 (85)	10
Total	100–118 (108)	59	19– 33 (26)	59	143–167 (151)	58	78– 92 (85)	29	76–110 (89)	30
Ash Meadows *merriami*	98–125 (114)	13	24– 36 (28)	13	130–159 (147)	13	81–101 (87)	8	85– 99 (92)	5

Locality and Form	Greatest Length Opercle,		Snout, Length		Orbit, Length				Mouth, Width	
					Males		Females			
	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.
Pahrump Valley										
l. latos	107–128 (117)	20	78– 89 (83)	20	69– 95 (81)	10	70– 89 (76)	10	104–125 (113)	20
l. pahrump	108–124 (118)	20	71– 87 (79)	20	75– 84 (80)	10	69– 83 (77)	10	102–113 (105)	19
l. concavus	115–129 (122)	19	66– 79 (73)	19	77– 93 (86)	9	70– 84 (76)	10	102–114 (106)	19
Total	107–129 (119)	59	66– 89 (78)	59	69– 95 (82)	29	69– 89 (76)	30	102–125 (108)	58
Ash Meadows *merriami*	123–140 (132)	13	73– 88 (80)	13	65–104 (84)	8	61– 91 (74)	5	82–107 (97)	13

Locality and Form	Upper Jaw, Length		Mandible, Length				Dorsal Fin, Basal Length			
			Males		Females		Males		Females	
	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.
Pahrump Valley										
l. latos	96–112 (103)	20	95–104 (99)	10	93–110 (101)	10	147–171 (159)	10	136–152 (145)	10
l. pahrump	95–105 (101)	20	94–108 (97)	10	89–102 (95)	10	148–165 (158)	10	127–152 (142)	10
l. concavus	92–106 (100)	19	78– 93 (87)	9	93–103 (98)	10	146–165 (157)	9	132–146 (139)	10
Total	92–112 (101)	59	78–108 (95)	29	89–110 (98)	30	146–171 (158)	29	127–152 (142)	30
Ash Meadows *merriami*	89–107 (98)	13	88–105 (97)	8	93–110 (100)	5	138–173 (150)	8	120–145 (136)	5

TABLE XXXIII (*Cont.*)

Locality and Form	Dorsal Fin, Length				Anal Fin, Basal Length			
	Males		Females		Males		Females	
	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.
Pahrump Valley								
l. latos	220–257 (242)	10	216–247 (227)	10	130–153 (139)	10	112–131 (123)	10
l. pahrump	229–259 (244)	10	203–236 (224)	10	151–167 (158)	10	123–143 (133)	10
l. concavus	241–257 (251)	9	217–233 (227)	10	142–165 (155)	9	127–142 (134)	10
Total	220–259 (245)	29	203–247 (226)	30	130–167 (151)	29	112–143 (130)	30
Ash Meadows								
merriami	208–233 (222)	8	195–218 (209)	5	151–179 (160)	8	124–147 (134)	5

Locality and Form	Anal Fin, Length				Middle Caudal Rays, Length			
	Males		Females		Males		Females	
	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.	Range (Ave.)	No.
Pahrump Valley								
l. latos	214–239 (223)	10	181–210 (199)	10	199–221 (211)	10	194–227 (210)	10
l. pahrump	225–251 (239)	10	195–218 (207)	10	215–228 (221)	10	205–224 (214)	8
l. concavus	236–263 (247)	9	213–226 (221)	10	221–246 (232)	9	220–241 (228)	10
Total	214–263 (236)	29	181–226 (209)	30	199–246 (221)	29	194–241 (218)	28
Ash Meadows								
merriami	216–240 (230)	8	191–213 (204)	5	181–215 (197)	6	179–191 (184)	4

Locality and Form	Pectoral, Length Longest Ray			
	Males		Females	
	Range (Ave.)	No.	Range (Ave.)	No.
Pahrump Valley				
l. latos	165–182 (173)	10	163–187 (171)	10
l. pahrump	165–178 (170)	10	154–168 (162)	9
l. concavus	170–186 (179)	9	165–186 (173)	10
Total	165–186 (174)	29	154–187 (169)	29
Ash Meadows				
merriami	156–189 (174)	7	153–174 (162)	5

TABLE XXXIV

FIN-RAY COUNTS IN *Empetrichthys latos* AND *E. merriami*

Locality and Form	Dorsal Rays					No.	$M \pm \sigma_M$
	9	10	11	12	13		
Pahrump Valley							
l. latos	.....	6	60	44	3	113	11.39 ± .06
l. pahrump	.....	7	46	19	4	76	11.26 ± .08
l. concavus	.....	1	18	7	.....	26	11.23 ± .10
Total	.....	14	124	70	7	215	11.33 ± .04
Ash Meadows							
merriami	1	4	15	6	.....	26	11.00 ± .14

Locality and Form	Anal Rays						No.	$M \pm \sigma_M$
	10	11	12	13	14	15		
Pahrump Valley								
l. latos	1	10	61	38	3	.....	113	12.28 ± .07
l. pahrump	.....	8	37	29	2	.....	76	12.33 ± .08
l. concavus	.....	.....	5	20	1	.....	26	12.85 ± .09
Total	1	18	103	87	6	.....	215	12.37 ± .05
Ash Meadows								
merriami	.....	.....	2	7	15	6	30	13.83 ± .15

Locality and Form	Pectoral Rays						No.	$M \pm \sigma_M$
	15	16	17	18	19	20		
Pahrump Valley								
l. latos	.....	17	106	70	7	1	201	17.35 ± .05
l. pahrump	1	32	88	16	.....	.....	137	16.87 ± .05
l. concavus	.....	28	22	2	.....	.....	52	16.50 ± .08
Total	1	77	216	88	7	1	390	17.07 ± .04
Ash Meadows								
merriami	1	10	15	12	.....	.....	38	17.00 ± .13

Locality and Form	Caudal Rays								No.	$M \pm \sigma_M$
	16	17	18	19	20	21	22	23		
Pahrump Valley										
l. latos	.....	4	24	30	31	9	2	.....	100	19.23 ± .11
l. pahrump	1	1	14	16	25	5	1	1	64	19.36 ± .15
l. concavus	.....	1	5	7	11	.....	.....	.....	24	19.17 ± .18
Total	1	6	43	53	67	14	3	1	188	19.27 ± .08
Ash Meadows										
merriami	.....	1	3	6	7	.....	.....	.....	17	19.12 ± .22

TABLE XXXV

SCALE COUNTS IN *Empetrichthys latos* AND *E. merriami*

Locality and Form	Lateral Series Scales					No.	$M \pm \sigma_M$
	29	30	31	32	33		
Pahrump Valley							
l. latos	....	5	45	41	5	96	31.48 ± .07
l. pahrump	1	14	41	15	2	73	31.04 ± .09
l. concavus	....	4	13	7	....	24	31.13 ± .14
Total	1	23	99	63	7	193	31.27 ± .05
Ash Meadows							
merriami	10	9	....	....	....	19	29.47 ± .11

Locality and Form	Dorsal to Anal Scales					No.	$M \pm \sigma_M$
	12	13	14	15	16		
Pahrump Valley							
l. latos	25	30	19	16	3	93	13.38 ± .12
l. pahrump	2	18	32	12	1	65	13.88 ± .10
l. concavus	1	13	9	2	....	25	13.48 ± .14
Total	28	61	60	30	4	183	13.57 ± .07
Ash Meadows							
merriami	....	7	9	3	....	19	13.79 ± .16

Locality and Form	Predorsal Scales									No.	$M \pm \sigma_M$
	23	24	25	26	27	28	29	30	31		
Pahrump Valley											
l. latos	....	9	17	29	26	9	1	....	....	91	26.13 ± .12
l. pahrump	4	9	15	17	12	3	1	....	1	62	25.69 ± .19
l. concavus	....	3	3	9	5	3	....	1	....	24	26.25 ± .28
Total	4	21	35	55	43	15	2	1	1	177	25.99 ± .10
Ash Meadows											
merriami	....	2	3	5	6	1	....	2	....	19	26.63 ± .36

Locality and Form	Circumference of Peduncle Scales									No.	$M \pm \sigma_M$
	16	17	18	19	20	21	22	23	24		
Pahrump Valley											
l. latos	9	14	19	5	37	3	6	....	....	93	18.86
l. pahrump	2	....	11	7	44	....	1	....	....	65	19.46
l. concavus	....	....	3	....	18	1	2	....	1	25	20.12
Total	11	14	33	12	99	4	9	....	1	183	19.25
Ash Meadows											
merriami	1	....	6	4	7	1	....	....	....	19	19.00

Locality and Form	Circumference of Body Scales												No.	$M \pm \sigma_M$
	27	28	29	30	31	32	33	34	35	36	37	38		
Pahrump Valley														
l. latos	1	2	8	15	12	13	12	7	8	6	5	4	93	32.47 ± .28
l. pahrump	....	1	2	2	4	9	13	12	11	7	1	1	63	33.44 ± .25
l. concavus	....	....	2	5	7	4	3	2	....	1	....	....	24	31.50 ± .34
Total	1	3	12	22	23	26	28	21	19	14	6	5	180	32.68 ± .18
Ash Meadows														
merriami	....	....	1	2	2	4	4	5	1	....	....	....	19	32.42 ± .36

TABLE XXXVI

HEAD-PORE COUNTS IN *Empetrichthys latos* AND *E. merriami*

Locality and Form	Preopercular Pores				No.	$M \pm \sigma_M$
	13	14	15	16		
Pahrump Valley						
l. latos	1	86	9	3	99	14.14 ± .05
l. pahrump	6	59	1	1	67	13.95 ± .05
l. concavus	1	25	.....	.....	26	13.96 ± .04
Total	8	170	10	4	192	14.05 ± .03
Ash Meadows						
merriami	1	9	2	.....	12	14.08 ± .14
	Preorbital Pores					
	7	8	9			
Pahrump Valley						
l. latos	5	91	3		99	7.98 ± .03
l. pahrump	1	66	.....		67	7.99 ± .01
l. concavus	.....	26	.....		26	8.00
Total	6	183	3		192	7.98 ± .01
Ash Meadows						
merriami	.....	13	.....		13	8.00
	Mandibular Pores					
	6	7	8			
Pahrump Valley						
l. latos	.....	4	95		99	7.96 ± .02
l. pahrump	2	3	62		67	7.89 ± .04
l. concavus	.....	1	25		26	7.96 ± .04
Total	2	8	182		192	7.94 ± .02
Ash Meadows						
merriami	.....	1	11		12	7.92 ± .08

EXPERIMENTAL WORK ON *CYPRINODON*

The experimental work on the genus *Cyprinodon* was begun by myself and my father, Ralph G. Miller, in August, 1940, and with my supervision has been carried on by him since that time. During the field work in 1942, I checked the progress of the experiments. The results for the 3-year period ending in the fall of 1943 clearly indicate that we have only scratched the surface of several fields of investigation. At this time, therefore, only the broad outlines and general indications of the work can be briefly presented.

The main purpose of this work is to determine whether differences which have been used to distinguish certain races, subspecies, and species of *Cyprinodon* are genetic or environmental, or both. Thus far no complete answer can be given to this important question, but a preliminary analysis of the data obtained strongly indicates that many of the characters are