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STUDIES OF THE FISHES OF THE ORDER  
CYPRINODONTES. XVIII. *CYPRINODON*  
*LACINIATUS*, NEW SPECIES, FROM  
THE BAHAMAS

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RECENT discoveries have materially increased the number of species of *Cyprinodon* recognized from the salt, brackish, and fresh waters along the shores of the western North Atlantic. Since the revisions of Garman (1895: 19-29, Pl. 1, Figs. 1-4) and of Jordan and Evermann (1896-1900: 670-76, 2832, 3256, Pl. 111, Fig. 296, Pl. 112, Figs. 296a-297) there have been described:

*Cyprinodon dearborni* Meek (1909: 208) from the Dutch West Indies (and Venezuela).

*Cyprinodon baconi* Breder (1932: 1-2, Fig. 1), from Andros Island, Bahamas.

*Cyprinodon bondi* Myers (1935: 302-4), from Étang Saumâtre, Haiti.

*Cyprinodon variegatus artifrons* Hubbs (1936: 223-25, Pl. 6, Figs. 1-5), from Yucatán (*C. v. ovinus* also recognized, from the North Atlantic states).

*Cyprinodon hubbsi* Carr (1936: 160-63, Fig. 1), from Lake Eustis, Florida.

*Cyprinodon jamaicensis* Fowler (1939: 1-4, Figs. 1-2), from Jamaica.

These new forms are all very similar to *Cyprinodon variegatus*, and most or all may eventually be treated as subspecies of *variegatus*. We now describe a species concerning which the question as to generic separation might even be raised. Pending the completion of our revision of *Cyprinodon*, and the examination of additional material which we anticipate receiving from the Bahamas, however, we retain the novelty in the genus *Cyprinodon*.

This new species, which we name *Cyprinodon laciniatus* because of its strongly and diagnostically lacinate scale margins, appears to bear no particular relationship with the genus *Floridichthys*, which has recently been segregated from *Cyprinodon* (Hubbs, 1926: 15-17; Myers, 1935: 302-3; Hubbs, 1936: 212-18). Following the rather unsatisfactory characters originally proposed, and the more precise criteria advanced by Myers, in the order in which they were stated, we find that the new species agrees with *Cyprinodon* and contrasts with *Floridichthys* in the following respects: The humeral process, though (as in some other species of *Cyprinodon*) little larger in area than adjacent scales, is very thick and hard; its outermost layer (see Hubbs, 1936: 217-18) is a scale with obsolescent radii and ridges; its middle layer, a strong expansion of the shoulder girdle, underlies almost the entire scale, and is not hooked around the pectoral base. The branchial aperture ends nearer the pectoral base than the bound-down tip of the opercle (this feature is of less significance than it was first thought to be). (In the minor character of the essential similarity of the body contours in the adult males and females, *C. laciniatus* resembles *Floridichthys carpio* more closely than it does most species of *Cyprinodon*.) The scales on the sides of the head and on the nape of mature males are ciliate (that is, they bear suberect, marginal, hairlike contact organs). The scales below the orbit are imbricate forward, and scales with the free margin anterior and dorsal extend on the lachrymal in front of the lower part of the eye, rather than ending in an even line running from the orbit to the lower part of the maxillary (this particularly diagnostic feature, like the

following characters, was first pointed out by Myers). The anterior edge of the squamation on the top of the snout is formed by one rather large scale flanked on either side by a smaller scale; or by two lateral scales, somewhat enlarged and in contact medially; these scales are separated by a narrow scaleless strip from the rostral fold. The broad flap separating the pelvic fins is bound down at the sides and is composed of one or two distal scales and several basal scales. The inner border of the iris (as in most but not all forms of *Cyprinodon*) is smoothly oval, not broken by a lappet-like projection into the dorsal part of the pupil. The posteriormost dorsal rays are much shorter than the longest ones. The relatively rather slender caudal peduncle is constricted toward the caudal fin. The scales are rather thin and are irregularly arranged. (The character of the position of the dorsal origin does not hold.) The dorsal fin has an ocellated black spot in the young and female (as in almost all forms of *Cyprinodon*).

Except in the very young almost all the body scales in both sexes of *C. laciniatus* are coarsely lacinate (Fig. 1E). In some other forms of the genus, as *C. v. variegatus*, the lateral scales, especially in adult males, may be slightly lacinate, and those on the upper and lower margins of the caudal peduncle may be even more deeply cleft than in *laciniatus*. In no other species, however, are the scales so uniformly lacinate.

*C. laciniatus* has other outstanding features. One of these is the great length of the cheek: the distance from the posterior end of the suborbital margin to the preopercular angle is more than twice as great as the length of the opercle, instead of being of subequal length. The mouth is exceptionally wide, and strongly oblique in an even arch (not subhorizontal anteriorly and subvertical posteriorly). The whole muzzle is more ponderous than in other forms. The teeth (Fig. 1A and C) are unusually long and slender; the cusps are less incisor-like than usual; the median one is definitely longer than the outer ones; the outer face of the tooth bears a rounded median keel, but the concave inner surface is not keeled. In *C. v. variegatus* the outer face is smooth, the inner surface keeled.

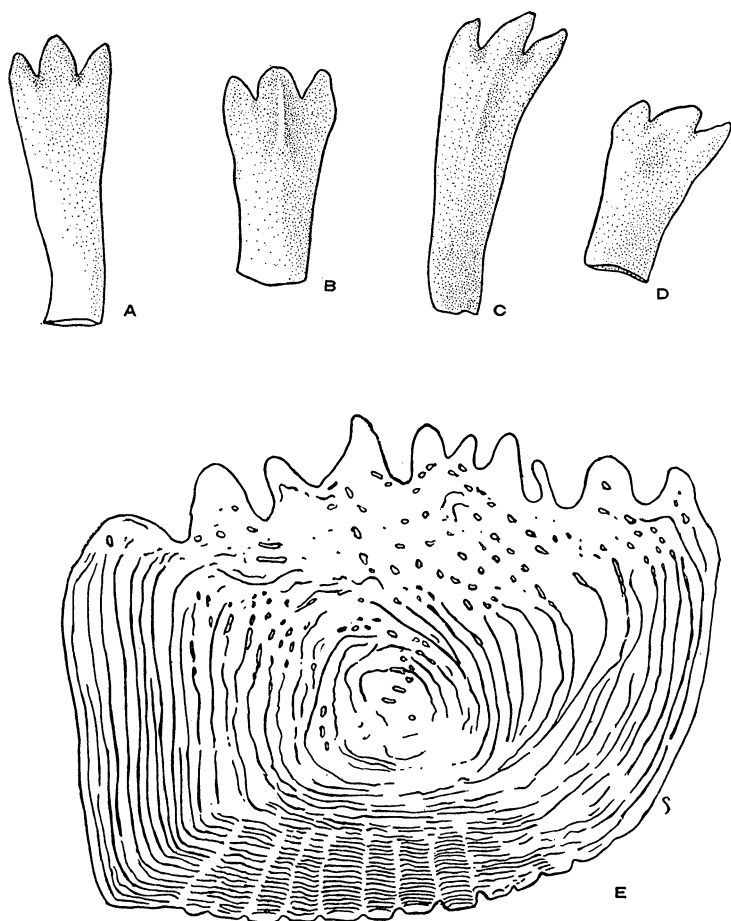


FIG. 1. Teeth and scale of *Cyprinodon*.

A. Inner face of an anterior mandibular tooth from an adult paratype of *Cyprinodon laciniatus*. All the tooth drawings were made with the aid of a camera lucida.

B. The same, for an adult of *Cyprinodon v. variegatus* from Tampa, Florida.

C. Outer face of the tooth shown in Fig. 1A.

D. Outer face of the tooth shown in Fig. 1B.

E. Sketch of a scale from the middle of the right side of an adult female paratype, 43 mm. in standard length, of *Cyprinodon laciniatus*. Drawn with the aid of a scale-reading machine.

Unlike other coastal species of *Cyprinodon*, but like several of the desert forms, the pelvic fins tend toward atrophy. These fins are totally lacking on both sides in 5 specimens (3 young

and 2 adults), and are undeveloped on one side of another, out of 41 specimens examined for this character. In others the fins are variously reduced. The longest pelvics extend only to the middle of the anus (in *C. v. variegatus* and many other forms the pelvics of adult males extend to or beyond the origin of the anal fin, and those of the females reach beyond the anus). The number of pelvic rays (Table I) varies from 0 to 7, averaging 4.44 (in *C. v. variegatus* the usual number is 7).

TABLE I  
NUMBER OF RAYS IN BOTH PELVIC FINS OF 41 TYPES OF  
*Cyprinodon laciniatus*

Number of rays .....	0	1	2	3	4	5	6	7
Number of specimens	11	.....	2	4	12	21	29	3

In most if not all these respects the new species differs from the one form, *C. baconi*, previously known from the Bahamas. Specimens from Long Island and Caicos Islands, corresponding in most respects with Breder's description of *C. baconi*, contrast with *C. laciniatus* in all the features just described.

*Cyprinodon laciniatus*, new species

(Fig. 1A, C, and E, and Pl. I)

TYPES.—The holotype, a mature male 46 mm. long to caudal base, was collected in a fish trap by A. Deans Peggs in Lake Cunningham, New Providence Island, Bahamas, in April, 1941; Cat. No. 134565, University of Michigan Museum of Zoology. Twenty-four paratypes, 22 to 52 mm. long, were collected with the holotype, and 17 others, 21 to 43 mm. long, were collected in the same lake by Mr. Peggs in May, 1941. Four other paratypes (U.M.M.Z., No. 72185), 18 to 26 mm. long, were obtained in a "fresh-water lake" on New Providence by Stephen Haws on March 18, 1927. The specimens last named were presented to the Museum of Zoology by Dr. William M. Mann, with 2 other specimens which were sent to the American Museum of Natural History.

We are greatly indebted to Mr. A. Deans Peggs, of Queens

College, Nassau, and to Dr. William M. Mann, for the gift of the type specimens of this very interesting species.

HABITAT AND ASSOCIATES.—Mr. Peggs, who is conducting an intensive limnological survey of Lake Cunningham, reports that the water is brackish, with much algae, that the bottom is marl, on limestone, and that the shore is limestone. Analyses reported on the field data sheet for the collection containing the holotype are :

Salinity .....	10,000 to	Sulfates .....	850 p.p.m.
	13,000 p.p.m.	Chlorides .....	7,000 p.p.m. (Cl)
pH .....	8.5	NO <sub>3</sub> .....	2 p.p.m.
Dissolved oxygen .....	5.6 cc/l	P <sub>2</sub> O <sub>5</sub> .....	0.003 p.p.m.
Free CO <sub>2</sub> .....	2.8 p.p.m.	SiO <sub>2</sub> .....	3 p.p.m.
Half-bound CO <sub>2</sub> .....	48.3 p.p.m.	Ca .....	170 p.p.m.
Bound CO <sub>2</sub> .....	62.9 p.p.m.	Mg .....	400 p.p.m.
Free ammonia .....	0.1 p.p.m.	Na/K .....	37,000 p.p.m.
Albuminoid ammonia .....	0.6 p.p.m.		

The adults were taken in 5 feet of water, the young at 1 to 3 feet. Young and adults of *Gambusia manni* Hubbs (1927) were taken in abundance with the young of *Cyprinodon laciniatus* in depths less than 3 feet. No other fish were taken in the lake. The same 2 species, and these only, were collected by Stephen Haweis in the "fresh-water lake" on New Providence.

Associated invertebrates listed by Mr. Peggs are insect larvae (*Dasyhelia* and *Aeschna*), and crustaceans (*Elastomopus*). Plankton forms mentioned are copepods (*Acartia tonsa*), diatoms (*Coscinodiscus concinnus* and *Chaetoceras*), and blue-green algae (*Aphanothece castagnei* and *Lyngbya*).

DESCRIPTION.—Some of the features of *Cyprinodon laciniatus* that seem most significant from the standpoint of generic reference, and the most outstanding of its specific attributes, have already been mentioned. The tooth and scale characters are indicated further by Figure 1. Form and coloration are portrayed in Plate I. The fin rays (relatively few in all the fins) are enumerated in Tables I and II; the scale counts (higher than in *C. variegatus* and most other forms) in Table III; the counts of the lateral-line pores on the head in Table

IV;<sup>1</sup> and proportionate measurements in Table V. The proportions were derived by calculation, from determinations that were made with dial calipers reading to 0.1 mm. and estimated to 0.01 mm. The methods of measurement, except as specially defined, are as described by Hubbs and Lagler (1941: 18-20).

TABLE II  
FIN RAY COUNTS IN 41 TYPE SPECIMENS OF *Cyprinodon laciniatus*  
The pelvic rays are enumerated in Table I.

Fin	Number of Rays								Ave.
	9	10	11	12	13	14	15	16	
Dorsal .....	3	21	15	2	.....	.....	.....	.....	10.39
Anal .....	12	28	1	.....	.....	.....	.....	.....	9.73
Caudal .....	.....	.....	.....	.....	.....	14	17	10	14.90
Pectoral .....	.....	.....	.....	1	3	9	21	7	14.73

TABLE III  
SCALE COUNTS IN 17 TYPE SPECIMENS OF *Cyprinodon laciniatus*

Scale count	Minimum	Maximum	Average
Opercle to C. base .....	27	30	27.8
D. origin to A. origin .....	14	16	15.0
Predorsal .....	17	19	18.1
Around C. peduncle .....	17	19	17.8

TABLE IV  
COUNTS OF LATERAL-LINE PORES ON THE HEAD OF 15 TYPE SPECIMENS  
OF *Cyprinodon laciniatus*

The counts for the two sides of each specimen are added together.

Pores	Lachrymal						Preopercle					Mandible
	5	6	7	8	9	10	14	15	16	17	18	
Specimens ...	1	3	2	7	1	1	10	4	.....	.....	1	15

In both sexes the body is rather heavy, but never so deep or rhomboidal as in many other kinds of *Cyprinodon*. The predorsal contour of the male is nearly horizontal for about half

<sup>1</sup> The number and arrangement of lateral-line pores on the head has previously been employed as a character in the cyprinodonts only by Wales (1930: 68), in his description of *Cyprinodon diabolis*.

TABLE V  
 PROPORTIONAL MEASUREMENTS FOR 17 TYPES OF *Cyprinodon lactiniatus*

Catalogue number, U.M.M.Z. ....	134564				134566			
	Paratypes				Paratypes			
Holo-type	Male	Fe-male	Male	Fe-male	Male	Fe-male	Male	Fe-male
Sex .....	Male	Fe-male	Male	Fe-male	Male	Fe-male	Male	Fe-male
Standard length, mm. ....	46	43	40	43	38	41	40	38
Measurements in thousandths of the standard length								
Dorsal origin to snout tip .....	561	566	564	560	562	571	567	531
Pelvic origin to snout tip .....	558	580	572	559	566	600	585	559
Anal origin to caudal base .....	378	328	352	351	344	329	333	351
Body, greatest depth .....	396	387	375	376	393	377	362	366
Head, length .....	333	330	335	337	345	342	347	337
Depth .....	290	269	288	271	268	284	258	260
Width .....	231	207	227	225	220	224	218	215
Caudal peduncle, length .....	266	255	239	258	261	230	230	252
Least depth .....	173	170	167	170	169	162	156	158
Interorbital, least bony width .....	119	109	116	118	113	103	112	105
Preorbital, least width .....	57	59	60	58	61	61	55	57
Preorbital margin to preopercular angle .....	194	181	192	187	194	195	183	181
Eye margin to preopercular angle .....	142	140	142	139	146	146	135	136
Opercle, width .....	110	107	111	111	112	110	111	110
Snout, length .....	108	112	110	115	115	115	116	114
Eye, length .....	99	93	98	95	101	100	104	95
Mouth, width .....	130	131	132	122	121	123	132	129
Upper jaw, length .....	136	130	139	131	131	134	132	139
Dorsal fin, basal length .....	202	209	191	197	187	214	188	216
Height .....	264	275	224	255	244	225	224	244
Anal fin, basal length .....	110	102	89	88	93	95	94	89
Height .....	209	207	150	213	151	213	199	210
Caudal fin, length of middle ray .....	235	217	222	222	230	217	219	218
Pectoral, length of left fin .....	259	243	241	238	235	239	238	236
Pelvic, length of longer fin .....	102	101	94	103	97	95	95	98

\* No pelvic fin.



the distance to the occiput, then curves downward to continue, at an angle of about  $35^\circ$  with the horizontal, to the tip of the muzzle, with a slight convexity (not apparent in smaller males) over the orbit. The head is rather wide, but the body in the male becomes sharply compressed posteriorly, appearing wedge-shaped in top view. The contours of the female are more evenly rounded in both dorsal and lateral aspects.

Instead of being markedly dilated and almost spinelike as it is in *Cyprinodon variegatus artifrons* (Hubbs, 1936: 223), the first dorsal ray is slenderer than the second. The second ray is usually but not always unbranched, and either does or does not reach to the tip of the front angle. The third anal ray is branched, the second rarely forked. The anal rays are unusually thick and often gnarly.

There is some sex dimorphism in the color pattern, but less than in many other forms of the genus. In the adult males the sides are crossed by many narrow silvery bars, narrower than the gray interspaces. The cross markings tend to increase in number with age, by the interpolation of dark spots and dashes in the light bars, or of light spots and dashes in the interspaces. The adult females also have numerous bars, but the appearance is reversed in that the dark elements appear as the bars and are narrower than the silvery ground color. The number of dark bands in the female increases from approximately 9 at 24 mm. to about 20 at 52 mm., through a process of interpolation of new bars, at first narrow and broken.

In both sexes the entire back, above a line joining the upper orbital rim with the upper end of the caudal base, is dappled with dark and light and marked with irregular spots which tend to be dusky in the male and blackish in the female. The subocular bar is rather conspicuous just below the eye but diffused outward on the cheek.

The fins exhibit a moderate amount of sexual dimorphism in coloration. In the adult males the dorsal is uniformly dusky; in the adult females the base of the fin is dusky and the posterior spot is weak to absent; in the young the spot is large and separated by a definite light area from the dark region near the

middle of the base of the fin. The caudal has a narrow blackish bar at the end of the scaly base, and, in the males only, a terminal dusky to blackish bar about as wide as the pupil. The melanophores on the interradiial membranes of the anal fin of the adult males are increased in number outward but do not form a definite border. The pectorals in the adult males are rendered blackish toward the lower border by small, thick-set melanophores; in the females the fin is paler, but bears some large melanophores along the upper rays. The pelvics are darker in the males than in the females.

The life colors of the adult males may be described as they were partly retained on the freshly preserved specimens. The pearl gray sides are diffused with rose, and the belly, throat, pectoral base, lower cheeks, and mouth corners are faded rosy, salmon-ocher, or yellowish orange; this color, or yellowish, is extended onto the pectoral fin, fading rapidly outward. Pale to deep silver-blue reflections shine from the scales over the fore-back, above a line joining the middle of the eye with the origin of the dorsal fin (these blue anterodorsal reflections in the male seem to be a generic character). Pale silvery blue reflections also appear on the preopercle; the opercle is more silvery. The basal rays of the caudal, anal, and pelvic fins are distinctly yellowish. The dorsal and anal are watery yellow; in some the anal has a chalky blue overcast except near the margin. The caudal is watery white between the yellowish base and the blackish margin.

The females are similarly but in general less intensely colored. Over the sides there is a faded rosy hue (yellowish in a large specimen). The scale centers of the back and sides are yellowish, with pale bluish borders.

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*Hubbs and Miller*

PLATE I

Holotype (adult male, above) and adult female paratype of *Cyprinodon laciniatus*. Photograph by Clarence Flaten.

