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## THE CYPRINODONTS.

BY S. GARMAN.

WITH TWELVE PLATES.

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## THE CYPRINODONTS.

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THE "Cyprinodonts," "Top minnows," or "Toothed Carps," as they are variously called, form a well defined group. An average of their shapes would approach that of a common Gold Carp with the tail rounded instead of notched. The species resemble the Carps, Cyprinidæ, in form, possession of a single dorsal fin, absence of a pouch on the stomach, lack of pyloric appendages, and in other features; but they are readily distinguished by scales on the head, and the teeth on the jaws, by the forms and dentition of the pharyngeals, the structure of the air bladder, and by their habits. In a general way it may be said of this family they are surface fishes, while the Carps, properly so designated, are fishes of the bottom. All the Cyprinodonts are small; none of them reach the length of a foot, most are less than six inches; and among them are found the smallest of the fishes, in species of which the individuals are fully mature at a length of less than an inch. From carnivorous they range to mud-eating, and from oviparous, laying numerous eggs, to ovoviviparous, producing comparatively few. Like other bony fishes some lay their eggs; others retain the embryo until the yolk is entirely absorbed; in a few of those that keep the embryo until fully developed, it is provided with albuminous nutriment, in addition to the yolk, within the egg, and is possessed of a peculiar temporary absorption system by which it avails itself of the provision. From ordinary sexual habits, such as most prevail among their allies, the Cyprinodonts vary to the extraordinary conditions, described below, in which the males and females are rights and lefts, that is, in which a dextral male pairs with a sinistral female, or a sinistral male with a dextral female. In this case sexes exist in nature that in a measure are

"Like those sweet birds that fly together,  
With feather always touching feather,  
Linked by a hook and eye,"

of the poet's imagination.\*

\* Translated by Moore from Abdallah's Persian, referring to the jaftak, "a sort of bird that is said to have but one wing; on the opposite side to which the male has a hook and the female a ring, so that when they fly they are fastened together."

Between the sexes in certain species of these fishes there are great differences in size and shapes; commonly the female is larger and less modified. The greater number belong to the fresh waters; many are inhabitants of brackish water or of the sea along the shores.

In the new world the known distribution extends from the basin of the great lakes and British America on the north to Argentina and Chili on the south, and from the Pacific to the West Indies and the Bermudas; in the old world it comprises the whole of Africa, Madagascar, the Seychelles, and the southern portions of Europe and Asia, from Spain to India and Japan. Marine species are known only near the surface; fresh water species carry the vertical distribution from the sea level up to altitudes of 13,000 feet or more; the highest points reached by any of the fishes.

Brownish or olivaceous, more or less tinted with greenish or yellowish, prevail in the ground colors. Metallic tints, especially those of silver, are common, most on the males. Apparently some of the species, or individuals, pass from the fresh to the salt waters; on these a change in the coloration obtains similar to that affecting *Salmo salar*, which in the land-locked stage, so called, is more brown with numerous spots of black, but which on reaching the sea becomes more silvery with obsolescent spots. This modification is marked in the common minnows of the Gulf coast, *Fundulus grandis*, and in *F. heteroclitus*, from the Gulf northward along the eastern coasts of the United States. Another variation is exemplified by *F. heteroclitus*, a general diffusion of brownish with corresponding decrease in the amount of silver, or in the brilliancy of coloration; this is noticeable on comparing the more modest coloration of the variety, *badius*, from Grand Menan with the more ornate representatives of the species from South Carolina to Florida. The male is the more highly colored of the sexes. Of some species the males are brilliant with striking combinations of red, orange, yellow, green, blue, gold, silver, white, or black, several of which colors sometimes unite in producing marked contrasts as compared with the plainer garb of the females. The fins of some of the males resemble the wings of gorgeous butterflies, in *Mollienisia* for instance. Among birds the female is commonly more modest in color than the male; this according to the Darwinian is beneficial, in that it renders the female less conspicuous when nesting; whether the benefit caused the difference is another question. Females of these fishes also are less conspicuous than the males; but necessarily the fact in this case is provocative of some other theory in explanation. Considerable changes in color-

ation, and in the shapes and sizes of their fins are undergone by males in the breeding season, for examples, in *Mollienisia* and *Xiphophorus*, the former in its enlarged and ornamented dorsal fin, the latter in its sword-shaped caudal, and both in the acquisition of brilliant colors over the body. By common experience collectors find males to be less numerous than females. The striking appearance of the male will no doubt be claimed as evidence of selection because of a possible benefit in enabling the female more readily to find him ; it may also be utilized in explaining the discrepancy in numbers since it must be effectual in making him an object of more prominence and a more frequent prey than the other sex for enemies of the species. From this one might be led to inquire whether the species is not on the way to extinction, or whether the females eventually are somehow to continue its existence on their own responsibility.

Plates IX. to XII. show admirably, so far as black and white may do it, various phases of the coloration in species of several genera. These plates are from the pencil of the artist Sonrel ; they were originally intended by Professor L. Agassiz for his work on the North American Fishes, of which the present is to be regarded as a continuation. The differences between the young stages, in which the sexes are alike, and the adult, in which males differ from females, of *Fundulus majalis*, are indicated on Plate IX. Very young individuals are blotched with black along the side ; adult males have vertical bands, while adult females are longitudinally banded, except at the base of the tail. On Plate X. variations within the species *Zygonectes Nottii* are shown to include all phases between such as exhibit a spot on each scale and those with longitudinal stripes or transverse bands or combinations of both bands and stripes. Plate XI. depicts, among the ordinary variations of form and coloration, a couple of the startling mixtures occasionally met with in *Gambusia Holbrookii*, Fig. 4 and 5, in which the specimen takes on a dress entirely at variance with that common to the species. The presence of parasites in certain individuals thus peculiarly marked suggests a possible connection of such variation with disease. The Professor has figured both sexes of *Mollienisia latipinna* on Plate XII., and has indicated the progressive modification of the male. Ornate as shadow and light have made these figures, without considerable more assistance, the imagination will yet fail to supply the tints, of blue, green, orange, silver and gold, necessary to represent the ornamentation of a living individual.

The most common form of body is slightly compressed ; it varies to

depressed in *Anableps*, and too much compressed in *Cyprinodon* and others. In all species the caudal region is compressed. The head and cheeks are covered with scales. The gills, four in number commonly, are well protected. Those forms subjected to the roughest treatment, from rocks or currents, as *Anableps*, have the walls of the gill-chamber of more than ordinary firmness. *Pseudobranchiæ* occur in few cases. The scales are comparatively large and firm; on *Rivulus* they are thin, and on *Orestias*, with age they become thick and tubercular on some portions of the body and head.

With the variety in habits there are great differences in structure. Such are particularly noticeable in the mouth. Generally the intermaxillary forms the upper border of the mouth and is dentigerous. Among those forms in which the mouth is most protractile the internarial processes of the intermaxillaries are narrow and elongate; but in species like *Cyprinodon* these processes are short and broad. *Belonesox* and *Haplochilus* have the intermaxillaries produced forward so that the snout is shovel-shaped. Ordinarily the upper jaw is narrow at the angle of the mouth; *Nothobranchius* has a mouth more like a perch. The mandibles of many are firmly joined at the symphysis; but in *Poecilia* and allies the connection is very loose. Exceptional species of *Haplochilus* have vomerine teeth. On Plates I. to V., the teeth of many of the genera and species are shown. The variations range from the simple conical firmly set teeth of *Haplochilinae* to the compressed tricuspid teeth of *Cyprinodon*, or to the broad oar-shaped movable ones of *Poeciliæ*. The number of series varies from one to many. Funduloids usually have on each jaw a series of larger teeth behind which there are several series of smaller ones in a viliform band. There are African species which have two series of larger ones to each jaw, and between them a band of smaller ones. The pharyngeal teeth vary nearly as much as those of the mouth. In some they are simple conical hooks; in others they have a shoulder, more or less blade-like, below the hook; and in still others, some or many of the teeth lose the cusps and enlarge to become stout, broad-crowned molars. These teeth are rigidly set in most cases, but in *Poecilia*, as Duvernoy has pointed out, they are more or less movable. In certain aspects the affinities of the genera are rather more apparent in them than in the teeth of the jaws.

To some extent the teeth are convenient for purposes of classification,

but reliance is not to be placed entirely on them. The same may be said of the anal fin, or other features, when taken alone. By means of the anal the family might readily be subdivided into three groups: a first, in which the anal is not modified on the male, a second, in which it forms a clasper without an urogenital tube, and a third, in which a tube passes to the extremity of the fin; but in the first we should have *Haplochilinæ* with conical teeth and *Cyprinodontinæ* with compressed tricuspidate, and in the second *Gambusiinæ*, with conical, and *Poeciliinæ* with compressed teeth, while in the third would be placed the conical toothed *Anablepinæ* with the compressed tricuspidate toothed *Jenynsiinæ*, both of which are still more widely separated by the eyes and the ventral fins. To depend on the teeth alone would bring together the *Cyprinodontinæ*, *Jenynsiinæ*, and some *Poeciliinæ*, by the compressed and fixed dentition; by the conical shapes, *Haplochilinæ*, *Gambusiinæ*, and *Anablepinæ* would be included; and by the oar-shaped and movable, only a part of the *Poeciliinæ* would be placed. The unnatural nature of such arrangements is sufficiently evident.

Five or six branchiostegal rays are most common; in a few types the number is smaller.

With the variety in the food, the gill rakers vary in the different genera from short and tubercular to elongate.

The greatest departure from the average vertebra is seen in *Anableps* where each side of each segment of the column over the body chamber has an elongate triangular process, grooved on the upper side, to the end of which the rib is attached. Great breadth of back with shortness and greater strength of rib is secured in this genus by means of these processes. At the base of the tail behind the terminal vertebra the processes forming the support of the central portion of the caudal are broad and fan-like posteriorly throughout the family; in some instances the hindmost pair ankylose, and form a single broad expanse, in which the original lines of separation are hardly visible. In number the vertebræ vary considerably. *Anableps* has more than fifty; certain species of *Cyprinodon* have hardly half as many. A peculiar modification of several of the vertebræ is to be noticed on males of some species, in which the anal fin is modified and carried forward; an inferior process from the centra of two or more of the vertebræ over the hinder portion of the body cavity is sent down to furnish support for the base of the transformed fin, Plate VIII. In *Poecilia* there are two of these stays; in *Gambusia* there are two in one species, and three, with more or

less modification, in others; and in *Heterandria*, *Glaridodon*, and *Girardinus*, there are three. In addition, on the stays, lateral processes are prominent in some; while in others the inferior stay alone is to be discovered. On *Xiphophorus* there are four or five of the stays. Another feature of the modification occurs in the males of some species, of *Glaridodon* for example, in which the basal spines, to which the anterior anal rays are articulated, are much broadened. This is most pronounced in forms on which the clasper is longest, and it furnishes a broader base of attachment for the muscles controlling the movements of the organ.

By recent discussion attention has been directed to a decrease in the number of vertebræ, of fishes in general, in and toward the torrid zone, and several theories have been propounded to account for the phenomenon. The species of this family, and others, have been somewhat carefully studied,—first, to determine the facts, and, second, to test the theories. It is found that those species making most use of the vertebra and the column have the greatest number of vertebræ whatever the temperature, as may be seen in the different genera together inhabiting Cuban waters, or those of Brazil, or in the different species of a single genus like *Orestias* in Lake Titicaca. It is true a decrease obtains, with few exceptions, in the direction of warmer waters, but warmth of water in such instances is attended by both increase in the amount of food and decrease in the need of it, thus lessening the comparative activity of the species. Some would ascribe the differences directly to natural selection. This hypothesis of course cannot be proved; it begs the entire question. It is also found that with the decrease in the number of vertebræ, there is in some cases a decrease in the number of fin rays and scales.

The stomach is an enlargement of the intestine; it is not particularly distinct, and is without a pouch or caecal appendages. As with higher animals, the intestine is shorter in proportion to the greater amount of flesh in the food. Variation in regard to feeding habits in the species of a genus are readily indicated by comparisons of this organ. *Fundulus* in general has a comparatively short intestine; but in *F. Kansae* the tract is much elongated. *Lebias* has a medium length, while its nearest ally, *Cyprinodon*, has an intestine considerably longer. This organ in the mud-eating species is very long.

A membranous air bladder is present in all the known species of this

family. In females it forms a single large chamber behind and above the ovaries and intestine; in males of those species in which the anal fin is much carried forward, the stays from the vertebræ and the supports of the anal divide the air bladder into separate chambers.

The ovaries vary somewhat according to the modes of reproduction; the simpler forms are the oviparous. *Anableps* represents the most modified. The embryology of this genus as interpreted by Valenciennes and Wyman is liable to some corrections; these are noted below under the generic description. The development of another of the viviparous forms, *Gambusia*, has been well worked out by Ryder. The breeding female of some *Funduli* is provided with a tube upon the anal fin, which, though less developed, recalls that of the female *Rhodeus* of the Cyprinidae; it varies with the season. An urogenital tube on the anal fin is a marked feature of the male in *Anablepinae* and *Jenynsiinae*, Plates VII., VIII. The absence of this tube distinguishes other viviparous forms. In these latter the clasper varies much in length and structure; it may be barbed, or furnished with hooks, or provided with fleshy pads, or may end in a simple point without either barbs, hooks, or flaps.

The kidneys and testes resemble those of most fishes. Their secretions are not thrown together in a common receptacle, as was supposed to be the case by Valenciennes in *Anableps*. The structure of the separate receptacles is sketched on Plate VII., and described below.

A minor sexual character is that of the small spines appearing on the fins of males in several genera in breeding time; and another is seen in the growths of the fins, anal and dorsal in particular, at the same time.

As in the organs of nutrition, excretion, and generation, there are considerable differences in the sensory apparatus. The peculiar eye of *Anableps*, half of which looks up and half down, has been well known since the time of Artedi. This genus has a tubular nostril; also possessed, less developed, by one or more of the other genera.

The affinities of the Cyprinodonts to Esocidæ, Cyprinidæ, and others, were pointed out by Professor Agassiz in his *Poissons Fossiles*. The family was differentiated quite early, as is shown by the Tertiary fossil types, *Lebias* and others; its derivation is to be traced through extinct forms. A search for direct connecting links with other recent families is not a promising field of inquiry.

## HISTORY.

It is only in tracing the origin of a couple of the generic names, *Fundulus* and *Pœcilia*, that the history of the Cyprinodonts is carried back farther than the time of Artedi, 1738. *Fundulus* was originally applied to species of the Cyprinidæ, the habits of which kept them near the bottom and made the name more appropriate than it is in its present use among the "Top minnows," as placed by La Cépède. The earliest mention is that of Albertus Magnus, 1478, lib. 7, tract. 1, cap. 8, who applies *Fundula* to a fish that is probably *Cyprinus gobio* of Linné, *Gobio fluviatilis* of Fleming. *Figulus*, 1540, and Gesner, 1556, connect the name *Fundulus* with species of *Gobio* or *Cobitis* (*Misgurnus*). Gesner, 1558, refers both forms, *Fundula* and *Fundulus*, to *Cobitis barbatula*. Schwenckfeld, 1603, gives *Fundulus* seu *Fundula* a similar connection, and in this is followed by Aldrovandi, 1613. Schonevelde, 1624, presents the Italian form, *Fondola*, under *Cobitis fluviatilis*, and the Latin, *Fundulus*, under *Gobio fluviatilis*. Charleton, 1677, has "Gobio fluviatilis, *Fundulus* (quia degit in fundo:) the *Gudgeon*, aut *Pink*." Willughby, 1686, and Rzaczynski, 1721, speak of *Fundulus* as a name for *Cobitis fluviatilis*, or an allied fish. Artedi, 1738, places "*Fundulus* seu *Grundulus* Figul. f 1 b," among the synonyms of *Cobitis barbatula*, Syn. Pisc., p. 2, and again has *Fundulus* among those of *Gobio fluviatilis*, p. 11, and in the *Philosophia*, p. 65, he notes it as an instance of diverse application of vulgar names. Klein, 1744, Miss., IV., 60, under one of his species of *Enchelyopus* mentions the name as applied to *Gobio fluviatilis*. Wulff, 1765, and Müller, 1774, bring the name within the Linnæan period. In all these cases it has been used as a vernacular or common name. La Cépède, 1803, first made it the name of a genus, transposing it from the Cyprinidæ to the Cyprinodonts, from fishes of the bottom to those of the surface.

*Pœcilia* also has a pre-Linnæan history. As *Pœcilias* it served Schwenckfeldt, 1603, as a name for a fish, probably *Cobitis fossilis* (*Misgurnus*). Rzaczynsky, 1742, makes a similar use of it. Schonevelde, 1624, applies *Pœcilia* to a form possibly the same. Artedi, 1738, Syn., p. 3, puts at the end of his synonymy for *Cobitis cœruleoœsens* (*Misgurnus fossilis* LaC.) "*Pœcilia* Schonev., p. 56, forte?" Referring to Schonevelde, Klein, 1744, Hist. Pisc. Miss. IV., 59, remarks upon the name under a species of his *Enchelyopus*, possibly *Cobitis fossilis* of authors. The name is first used as that of a genus, by Bloch, Schneider, 1801, among the Cyprinodonts, and there is nothing on which to base a claim for priority in other or earlier usage.

The direct history of the Cyprinodonts begins with Anableps anableps of Artedi, 1738. In his *Synonymia* this author mentions the genus, with references to his *Genera*, and to Seba's work, saying, "Est piscis antea non descriptus; cuius adcuratam delineationem in opere D. Sebae dedimus." In the *Genera* he gives the generic characters "*Membrana Branchiostega Ossiculis sex. Pinna unica, exigua, in extremo dorso,*" remarking for the species "*Novus piscis, quem in Sebae thesauro descripsi.*" His description, in the third volume of the *Thesaurus*, occupying four pages folio with figures noting the peculiarities of the eye and anal fin among other features, was not published till 1761, after Anableps had been mentioned by Linné in several editions of the "*Systema*," and described and figured by Gronow, 1754. Linné's, 1766, *Cobitis heteroclita*, now *Fundulus*, was the second species of the family to be recorded. Another species, now of the same genus, was made known by Schoepff, 1788, and received a Latin name, *Cobitis majalis*, at the hand of Walbaum, 1792. Bloch, Schneider, 1801, added a new genus and the fourth species, *Poecilia vivipara*. La Cépède, 1803, established the genus *Cyprinodon*, with a new species, *C. variegatus*, also the genera *Fundulus* and *Hydrargyra*, the latter of which is now placed as a subgenus in the former. The next genus in sequence was *Lebias* of Cuvier, 1817, with the species *L. calaritana*. This was followed by *Mollienisia* of Lesueur, 1817, who also added a new species, *Hydrargyra diaphana*. Rüppell, 1828, made known a new species, *Lebias dispar*, from the Red Sea. Valenciennes, 1828, also contributed a species, his *Fundulus brasiliensis*, to the number known previous to 1830 and accepted as valid at the present writing. Several of these had already repeatedly been described and named; their history, and that of subsequent additions and changes of names, is sufficiently indicated in the synonymy given below with the various genera and species.

Before establishment as distinct, the family history of the Cyprinodonts is merged with that of the Cyprinidae, which may be traced to Rafinesque's "*Ordine Cyprinidi*," of 1810. This group was made to contain a species of *Mugil* and three species of *Cyprinus*. In the *Analyse*, 1815, Rafinesque characterized his 16th family, "*Cyprinia. Les Cypriniens*," as follows: "*Point d'appendices aux nageoires pectorales, tête étroite, point de seconde nageoire dorsale adipeuse; souvent des dents et opercules quelquefois écaillieux.*" This family comprised genera now distributed among seven or eight families. In the second of its sub-families, the *Gymnopomia*, he placed

Cyprinodon and Hydrargyra of La Cépède, but located Fundulus and Anableps in his 18th family, the Cylindrosomia. Cuvier, 1817, reduced the family, "Les Cyprins," so that it comprised only true Cyprinidæ and Cyprinodonts. Of the latter he recognized four genera, Anableps, Pœcilia, Lebias, and Cyprinodon. Fleming, 1822, used the name Cyprinidæ, with the characters: "Jaws and teeth feeble. The plates of the pharynx thickly set with teeth. Stomach destitute of a pouch, and the intestine without cæca." As subgenera his family contains Cyprinus, "Gobitis," Anableps, "Pœcilia," Lebias, and Cyprinodon. Latreille, 1825, names the family "Cyprinides," and enlarges it by a genus not now admitted.

Authors are somewhat divided among themselves on the question whether the distinct history of the family of Cyprinodonts should begin with Agassiz, 1834, or with Bonaparte, 1838. In this they seem to ignore entirely an earlier work, that of Wagner, 1828. The independent existence of the family commonly known as Cyprinodontidæ really began with his work in *Isis*, XXI., col. 1053, the article on the genus Lebias. His references and the amount of dependence on Valenciennes make it evident that the paper by the latter in Humboldt's "Observationes" was published as early as 1828, if not earlier; the completed volume bears the date 1832. Wagner's words leave no doubt whatever of his intentions, though mistaking in a couple of details, as is shown by the following: "Die Gattung Lebias bildet mit den Gattungen Pœcilia, Fundulus, Cyprinodon, und Molenesia Lesueur, wenn sich letztere Gattung durch weitere Untersuchung bestätigen sollte, eine sehr schöne kleine Familie, welche ich die Familie der Cyprinoïden genannt habe, wegen ihrer grossen Verwandtschaft mit den Cyprinus-Arten, wovon sie sich jedoch durch die Zähne in dem Ober- und Unterkiefer, durch die Lage der Riicken- und Schwanzflosse und die Zahl der Strahlen der Kiemenhaut unterscheiden. Einige dieser Familie gebären lebendige Junge, so wenigstens einige Pœciliien. Schwimmblase ist bey einigen vorhanden, bey andern fehlt sie oder ist nicht untersucht. So fand sie Humboldt bey Pœcilia bogotensis, wo sie doppelt ist, die erste Abtheilung ist eyförmig, die zweyte 2-3 mal länger als die erste. Nach Valenciennes Untersuchungen fehlt sie bey Pœcilia unimaculata. Ich fand eine einfache, ansehnliche Schwimmblase, wie ich oben erwähnte, bey Lebias lineato-punctata. Der Magen und Darmcanal der bisher untersuchten Gattungen scheint gleich gebildet und denen der Cyprinus-Arten analog zu seyn." The exceptions to be taken to the foregoing relate only to Pœcilia bogotensis, which is one of the Characnidæ,

and to the air-bladder, which so far as now known is present in all members of the family. Wagner gives a diagnosis as follows:

"Familia, *Cyprinoidæ*. Corpus oblongum, subcompressum vel teretiusculum squamatum; caput supra depresso, squamis tectum; maxillæ amplæ; apertura oris parva, transversa; dentes in utroque labro et in pharynge. Membrana branchiostega radiis 4 ad 6. Pinna dorsalis unica, anali opposita vel subopposita. Pisces parvuli, fluviatiles, fere omnes Americæ indigeni. *Genera quinque.*".

The five genera are those above mentioned. After all synonyms are eliminated, *Fundulus brasiliensis* Val. is the only new species. The statements quoted are certainly enough for the establishment of the family. The next question concerns the adoption of the name he gave it. The name *Cyprinidæ* was fixed upon the carps by Fleming when the "Top minnows" were included, it is true; but it belongs to the carps also by virtue of Rafinesque's use of *Cyprinidi*, in 1810, when these minnows were not included. The word *Cyprinoïdæ* is incorrectly written; etymologically corrected, it is identical with *Cyprinidæ*. It seems to have been Wagner's intention to coin a different word. This is shown both in the form he gives the name as he writes it and in the reason given for bestowing it, "wegen ihrer grossen Verwandtschaft mit den *Cyprinus-Arten*." As he has failed to give a distinct title, it is left for us to adopt the next subsequent applied to the family as such. Cuvier, 1829, employed the name *Cyprinoïdes*, as also *Cyprins*, for the *Cyprinidæ* inclusive of the Cyprinodonts; in this he has not retained the advance made by Wagner. Bonaparte, 1831, accepted the family *Cyprinidæ* from Fleming and Cuvier, and made three sections in it,—*Anableptini*, *Pæciliini*, and *Cyprinini*. The sections are made in 1838 to rank as sub-families; a new one, *Leuciscini*, is added to the *Cyprinidæ*, while the *Pæciliini* are removed to form, by name only, the family *Pæciliidæ*, modified to *Pæciliinidæ* in 1839, to *Pæciliidæ* again in 1840, including *Anableptini* and *Pæciliini* only. Previous to Bonaparte's use of his name for either family or sub-family, Kirby, in 1837, had used *Poeciliidæ* for a family of insects. *Pœcilioidei* of Fitzinger, 1832, was applied to *Umbridæ* only.

Agassiz, 1834, four years previous to Bonaparte's separation of the family *Pæciliidæ* by name and six years before a diagnosis of the family was published by him, again separated and named the family of Cyprinodonts as distinct from the *Cyprinidæ*, remarking, "Après l'exposition de ces caractères [of the *Cyprinidæ* properly so-called], on pressent déjà que j'exclus

de cette famille tous les genres qui, dans le règne animal de Cuvier, suivent les Loches proprement dites, savoir les *Anableps*, les *Pœcilia*, les *Lebias*, les *Fundulus*, les *Molinesia* et les *Cyprinodon*, pour en faire une petite famille à part, sous le nom de *Cyprinodontes*." To this family he refers again in 1839, in 1844, and in 1854. It was adopted by Müller, 1843 and 1846, Müller and Troschel, 1848, Gill, 1856, Poey, 1858, Kner and Steindachner, 1865, Fitzinger, 1873, and others, under the name first given, and under the form Cyprinodontidæ, its adoption has been pretty near general. Valenciennes, 1846, retained Cuvier's name Cyprinoïdes, without separating the families and was imitated by Poey, 1855, with the orthography Cyprinoidei and Cyprinoidea. Owen, 1846, renders the name Cyprinodontidæ, mentioning "Umber" as the type, and this form of the title has been somewhat generally accepted, but with the exclusion of the Umbridæ. Swainson, 1839, divided the Cyprinidæ and put his Cyprinæ in the Salmonidæ as a sub-family, while he raised the remainder to family rank as the Cobitidæ with three sub-families, Cobitinæ, Anablepidæ, and Poecilinæ. McClelland, 1839, has in his family Cyprinidæ, what he calls "a small group" containing Pœcilia, Lebias, Aplocheilus, Fundulus, Molinesia, and Cyprinodon. MacLeay, 1842, placed the Poecilianæ, Cobitinæ, and Platycarinæ in his Apalopterinæ, a division of the Cyprinidæ. Bleeker, 1859, divides his Cyprinodontoidei into Cyprinodontini, Aplocheilini, Orestiasini, and Anablepini. In 1863, the family became Cyprinodontoides, the sub-families Cyprinodontiformes, with stirps Tellianini, Cyprinodontini, and Belonesocini, and Aplocheiliformes, with stirps Orestiasiformes and Anablepiformes. Gill, 1856, adopted the Cyprinodontes; in 1861, his family became the Cyprinodontoidæ, with sub-families Cyprinodontinæ and Hydrargyrinæ; in 1865 he took up Poeciliidæ, as from Bonaparte; in 1872 he grouped together the Esocidæ, Umbridæ, and Cyprinodontidæ under the name Cyprinodontoidea; and in 1894, ignoring the fact that it was preoccupied in insects, he again prefers Poeciliidæ. This last, or his Cyprinodontidæ of 1872, is the equivalent of the Cyprinodontidæ of Günther and later authors. Günther, 1866, subdivides the Cyprinodontidæ into *Cyprinodontidæ carnivoræ*, containing the Cyprinontina, the Fundulina, Jenynsiina, and the Anablepina, and the *Cyprinodontidæ limnophagæ*, including such genera as are here placed in the Poeciliinæ.

In the present writing the characters and contents of the family and of the genera vary somewhat from those of other authors, as is indicated in the synopsis below. Though the structure of the eye, of the anal fin and of

the ventrals, together with the great differences in skeletal and embryonic features, might demand rank as a family, the Anablepinæ are included.

### CYPRINODONTES.

*Cyprinoidæ* Wagner, 1828, Isis, XXI, col. 1054.

*Cyprinodontes* Agassiz, 1834, Mém. Soc. Sci. Nat. Nench., I, 35, — 1839, Poiss. Foss., V, pt. 2, p. 47, — 1844, I. c., I, pp. xvii, 170, — 1854, Am. Jour., XVII, 353; Müll., 1843, Wieg. Arch., IX, (1) 320, — 1846, Abh. Ak. Wiss. Berl., 183; Müll. & Tr., 1848, Schomb. Fauna, 632; Gill, 1856, Smith. Rep., 264; Poey, 1858, Mem., II, 383; Kn. & St., 1865, Abh. Wien Ak., 1, ext. p. 24; Kner, 1867, Novara Fische, 344; Fitz., 1873, Sb. Wien Ak., LXVII, (1) 34.

*Pæciliini* and *Anableptini* (Sections) Bonap., 1831, Saggio, 94, 113, — 1838, Nouv. Ann. Sci. Nat., Bologna, II, 132 (sub fam.), — 1840, Syst. Vert., 53, — Nouv. Ann. Bolog., IV, 195.

*Pæciliini* and *Anableptini* Bon., 1850, Cousp. Syst. Ichth.

*Pæciliæ* McClell., 1839, J. As. Res., XIX, (2) 424.

*Pæciliinini* Bon., 1839, Sel. Tab. Anal., 14.

*Pæciliæ* and *Anableps* Swains., 1838, Classif., I, 365, — 1839, l. c., II, 190, 311.

*Pæciliidæ* Bon., 1838, Nouv. Ann. Bologna, II, 132, — 1840, l. c., IV, 194, — Syst. Vert., 52, — 1841, Tr. Linn. Soc., XVIII, 299, — 1845, Spec. gen., 8 (as *Pæciliidæ* the name was first applied to a family of Coleoptera by Kirby, in 1837).

*Pæciliinidæ* Bon., 1839, Sel. Tabl., 14.

*Pacilianæ* MacLeay, 1842, Ann. N. H., 204.

*Pæciliidæ* Bon., 1846, Cat. Meth. Pesci, 25, — 1850, Conspl. Ichth.; Gill, 1865, Can. Nat., — 1894, Mem., Am. Nat. Ac., VI, 133, — P. U. S. Mus., XVII, 115.

*Pæciliidæ* Bonap., 1841, Fauna Ital., Pesci; Doderl., 1879, Atti Ac. Sci. Pal., (2) VI, 56.

*Cyprinodontidæ* Owen, 1846, Lect. Comp. Anat., 48 (type named belongs to Umbridæ); Grd., 1859, Mex. Bd., II, Fishes, 66, — P. R. R. Rep., X, 302; Rich., 1856, Encycl. Brit., XII, — 1860, Ms. Nat. Hist., Fish, 153; Gth., 1866, Cat., VI, 299, — 1880, Intr., 613; Stor., 1867, Mass. Fish, 127; Gill, 1872, Arr. Fam., 15; Day, 1878, Fish. Ind., 521; Steind., 1880, Denk. Ak. Wien, XLII, 85; Jor. & G., 1882, B. 16 U. S. Mus., 326; Seeley, 1886, Fish. Eur., 22, 369.

*Cyprinodontidi* Poey, 1868, Report., II, 209, 410, — 1876, An. Soc. Esp., V, 140.

*Cyprinodontoidei* Blk., 1859, Enum., 155, — 1860, Zesde Bijd., 59, 99, — Cypr., 479, — 1862, Mém. Poiss. Guin., 116, — 1875, Poiss. Madag., 101, 1879, Enum., 24.

*Cyprinodontini* Blk., 1860, Cypr., 481, — 1863, Atl., III, 139.

*Cyprinodontoidæ* Gill, 1861, Cat., 51.

*Cyprinodontinæ* Gill, 1861, Cat., 51.

*Cyprinodontoides* Blk., 1863, Atl., III, 139.

*Cyprinodontiformes* Blk., 1863, l. c.

*Cyprinodontidæ carnivoræ* Gth., 1866, Cat., 301, — 1880, Intr., 614.

*Cyprinodontidæ limnophagæ* Gth., 1866, Cat., VI, 339, — 1880, Intr., 617.

In the following references, besides Cyprinodonts other fishes were included.

*Cyprinia* Raf., 1815, Analyse, 88.

*Cyprinus* Cuv., 1817, R. An., II, pp. viii, 190.

*Cyprinidæ* Flem., 1822, Phil. Zool., II, 386; Bonap., 1831, Saggio, 113, — 1839, Selach. Tab. Anal., 14; McClell., 1839, Cypr., 424; MacLeay, 1842, Ann. Mag., IX, 203.

*Cyprinides* Latr., 1825, Fam. R. An., 122.

*Cyprinidæ* Cuv., 1829, R. An., II, pp. xii, 269; Val., 1846, C. V. Poiss., XVIII.

*Cobitidæ* Swains., 1839, Classif., II, 309.

*Cyprinoidei* Poey, 1855, Mem., I, 390.

*Cyprinodontoidea* Gill, 1872, Arr. Fam., 15.

Commonly among the fishes of this group the head is somewhat broad and flat on the crown, the body is compressed and moderately arched on the

back, and the body cavity is rather short and deep. The head and body are covered with scales. The mouth is anterior, its upper margin is formed by the intermaxillaries, and its cleft varies from vertical to horizontal in the different genera. The eyes are lateral. Teeth are borne on mandibles and intermaxillaries, in one to many series, and in cardiform groups on the upper and lower pharyngeals. A single dorsal, on the hinder portion of the body. Air bladder simple in the females, membranous, without ossicula. Alimentary tract short to long. No blind sac on the stomach. No pyloric appendages. No adipose fin. No barbels. But few species possess pseudobranchiæ or vomerine teeth.

The descriptions of a number of species lack the details of most importance in comparisons; in consequence it is not possible to satisfactorily place such forms in synopses.

Teeth compressed;

	PAGE
CYPRINODONTINÆ	19
anal not modified on the male;	
jaws firmly joined; teeth fixed;	
cusps three;	
series of teeth on each jaw one;	
body deep; intestine long	<i>Cyprinodon</i> 19
body elongate; intestine medium	<i>Lebias</i> 29
ventrals absent;	<i>Tellu</i> 35
cusps two; body elongate;	
series of teeth several	
intestine short; D. and A. long	<i>Characodon</i> 35
series of teeth two	<i>Girardinichthys</i> 38
series of teeth two	<i>Neolebias</i> 39
anal modified, without a tube; teeth chisel or	
oar-shaped, hooked	PŒCILIINÆ      40
anal process long;	
teeth chisel shaped, broad;	
jaws firmly joined, teeth fixed	<i>Glaridodon</i> 40
jaws loosely joined	
teeth movable	<i>Girardinus</i> 45
anal process short	
jaws loosely joined; teeth movable	
series of teeth on each jaw one	<i>Platypæcilius</i> 48
series of teeth several	
D. long; body short	<i>Mollienisia</i> 49
D. short; body short	<i>Pœcilia</i> 52
caudal of male sword-shaped	<i>Xiphophorus</i> 67
anal modified, with a tube;	
pupil entire; pelvis entire	JENYNSIINÆ      69
males rights and lefts	<i>Jenynsia</i> 69
Teeth conical, in bands;	
anal modified, with a tube;	
pupil divided; pelvis divided	ANABLEPINÆ      70
males and females rights and lefts	<i>Anableps</i> 70

	PAGE
Teeth conical, in bands ;	
anal modified, without a tube ;	
pupil entire ; pelvis entire	GAMBUSIINÆ 80
intermaxillaries produced	<i>Belonesox</i> 80
intermaxillaries not produced ;	
A. smaller than D. and farther back	<i>Pseudoxiphophorus</i> 80
A. and D. small; D. backward of A. ;	
mouth wide; chin low	<i>Gambusia</i> 82
mouth narrow; chin steep	<i>Heterandria</i> 90
Teeth conical; pupil entire; pelvis entire ;	
anal not modified	HAPLOCHILINÆ 93
ventrals absent ;	
pharyngeal teeth slender	<i>Orestias</i> 145
pharyngeal teeth thick, molars	<i>Empetrichthys</i> 116
ventrals present ;	
jaws with teeth in a single series	<i>Lucania</i> 93
jaws with teeth in bands ;	
pseudobranchiæ absent ;	
intermaxillaries produced	<i>Haplochilus</i> 124
intermaxillaries not produced ;	
D. and A. nearly equal ;	
origin of D. forward of A.	<i>Fundulus</i> 95
first spine of D. strong	<i>Adinia</i> 94
caudal forked	<i>Fundulichthys</i> 115
origin of D. backward of A.	<i>Zygonectes</i> 116
D. smaller than A. and farther back	<i>Rivulus</i> 134
body and head compressed	<i>Cynolebias</i> 143
body sharp-edged behind vent	<i>Pterolebias</i> 141
pseudobranchiæ present ;	
mouth resembling that of Fundulus	<i>Haplochilichthys</i> 156
mouth resembling that of perch	<i>Nothobranchius</i> 158

## CYPRINODONTINÆ.

## CYPRINODON.

Plate I. Fig. 1-4, teeth.

*Cyprinodon* La C.; 1803, Poiss., V, pp. xxxi, 486; Raf., 1815, Anal., SS; Cuv., 1817, R. Au., II, 199,—1829, R. An., II, 281,—1836, R. An., I, 533; Flem., 1822, Phil. Zool., II, 386; Val., 1828, Humb. Obs., II, 164,—1846, C. V. Poiss., XVIII, 145; Wagner, 1828, Isis, XXI, col. 1056; Schinz, 1836, Abb. Fische, 217; Guer., 1838, Icon., Poiss., 29; Stor., 1846, Syn., 183,—Mem. Am. Ac., 435; Dum., 1856, Ichth., 410; Blkr., 1860, Cypr., 481,—1863, Atl. Cypr., III, 139; Gill, 1861, Cat., 51; Gthr., 1866, Cat., 301,—1880, Intr., 614; Jor. & G., 1882, B. 16 U. S. Mus., 328.

*Lebias* Les., 1821, J. Phil. Ac., II; Swains., 1838, Classif., I, 366,—1839, II, 190, 311.

*Lebias* Schinz, 1836, Abb., 216; Guer., 1838, Icon. Poiss., 28; DeK., 1842, N. Y. Fish, 215; Stor., 1846, Syn., 179,—Mem. Am. Ac., II, 431.

*Poecilia* (part) Goldf., 1820, Haudb., II, 17; McClell., 1839, As. Res., XIX (2), 424.

*Trifasciatus* Poey, 1861, Mem., II, 305, 383—1863, Rep., II, 209, 411,—Mem., II, 305, 383.

*Jordanella* Goode, 1880, P. U. S. Mus., II, 117; Jor. & G., 1882, B. 16 U. S. Mus., 327.

## TELLIA.

*Tellia* Gerv., 1853, Ann. Sc. Nat., XIX, 15, Extr. p. 10; Blk., 1860, Cypr., 481; Gth., 1866, Cat., VI, 308.

*Tellianini* Blk., 1863, Atl., III, 139.

In form and general characters this fish agrees with *Lebias*, but it lacks the ventral fins. The relations existing between *Tellia* and *Lebias* are somewhat similar to those existing between *Fundulus* and *Empetrichthys*. The affinities of *Tellia apoda* and *Lebias calaritana* are such as to suggest a possible derivation from the latter.

Algiers.

**Tellia apoda.**

*Tellia apoda* Gerv., 1853, Ann. Sc. Nat., XIX, 15,—1866, Compt. Rend., LXIII, Val., 1858, Compt. Rend., XLVI, 715; Blk., 1860, Cypr., 484; Gth., 1866, Cat., VI, 309; Playf. & Let., 1871, Ann. Mag. N. H., VIII (4), 390; Sauv., 1880, Nouv. Arch. Mus., III (2), 6, 15.

D. 15; A. 13.

Body compressed; head rather large. Mouth opening obliquely upward. Teeth in a single series in each jaw, tricuspid. Dorsal origin a little in front of the posterior third of the length of the body. Caudal convex.

“ La couleur paraît grisâtre, mais elle est relevée chez plusieurs individus de bandes brunes verticales, rappelant celles des *Cyprinodon* [*Lebias*] *calaritanus* et *fasciatus*.”

Head waters of the River Tell. (Gervais.)

## CHARACODON.

*Characodon* Günther, 1866, Cat., VI, 308.

Shaped like some of the more elongate species of *Cyprinodon*. Body and head compressed; caudal portion moderately deep; back somewhat regularly arched. Mouth medium, directed upward; upper jaw protractile; mandibles short, firmly united. Teeth in bands; outer series larger, chisel-shaped, with a notch forming two cusps; inner small. Eye lateral, rather large. Dorsal and anal behind the middle, opposed. Intestine not much convoluted.

Central America; Cape San Lucas; Coahuila, Mex.

**Characodon lateralis.**

Plate I. Fig. 9, teeth.

*Characodon lateralis* Gthr., 1866, Cat., VI, 308, — 1868, Tr. Zool. Soc., VI, 480, pl. 82, fig. 2; Eig., 1893, P. U. S. Mus., XVI, 56.

*Characodon bilineatus* Bean, 1888, P. U. S. Mus., X, 371, pl. 20, fig. 2; Eig., 1893, l. c., 56.

*Characodon variatus* Beau, 1888, l. c., 370, pl. 20, fig. 1, — 1892, P. U. S. Mus., XV, 286; Eig., l. c., 56; Woolm., 1894, B. U. S. F. Comm., 62.

*Characodon ferrugineus* Bean, 1888, P. U. S. Mus., X, 372, pl. 20, fig. 3, 4; Eig., l. c., 56.

B. 4; D. 12; A. 12; V. 6; P. 17; Ll. 32; Ltr. 11–12; Vert. 15+18.

Body compressed, moderately stout, caudal pedicel deep, back gently arched. Head about one third of length to base of caudal; very little arched transversely. Snout short, not as long as the eye; chin steep. Mouth medium; upper jaw protractile. Teeth in outer series bicuspid. Eye large, nearly equal to interorbital space, one third longer than snout, two sevenths of head. The specimen examined had four branchiostegal rays on each side, whether this is normal must be decided from others. Fins small; dorsal origin about five sevenths of the distance from snout to caudal; anal opposed to dorsal; posterior margin of caudal subtruncate.

Olive to reddish brown, with scattered small spots of darker on the back, a darker band with or without spots of dark along the flank, more distinct posteriorly. Fins with fine dots of dark color.

Originally discovered in Central America; here described from Parras, Coahuila, Mexico.

**Characodon furcidens.**

*Characodon furcidens* J. & G., 1883, P. U. S. Mus., V, 354, 371; Jour., 1886, P. U. S. Mus., VIII, 368, — 1887, Rep. U. S. F. Comm., 836; Eig., 1893, P. U. S. Mus., XVI, 56.

D. 15–17; A. 13; Ll. ca. 50; Ltr. 15.

Comparatively elongate, not greatly compressed. Head rather low, broad, depressed. Caudal peduncle somewhat long and slender, about length of head. Anterior teeth larger, bicuspid. Eye three tenths of head. Interorbital space nearly half of head. Origin of dorsal midway from base of pectoral to caudal; fin low, not as high as long; base three fifths of the length of the head. Anal originating below seventh dorsal ray. Pectorals three fifths, and ventrals one half as long as the head. Caudal subtruncate, upper lobe a little the longer.

Males mottled with darker on the flanks, or plain. Vertical fins each with several bars of brownish, and a dusky subterminal bar. A narrow streak of dark along the middle of each scale on the back. Females with

several short bars of dark on the posterior half of the body ; fins as on the male. Some spots of dark on the caudal pedicel.

Longest specimen three and one fourth inches.

Cape San Lucas, Lower California. (Jordan.)

### Characodon Luitpoldii.

*Characodon Luitpoldii* Steind., 1894, Anz. Wien Akad., 147.

D. 13-14; A. 15-16; V. 6; P. 16; Ll. 39+4; Ltr. 16, above the vent.

Body elongate, compressed ; caudal section deep. Head little more than four and one half times in the body length, or five and three fifths times in the total ; forehead broad, flattened ; upper profile slightly concave. Snout about three and one third, eye four and two fifths, and forehead two times in the length of the head. Mouth cleft directed upward ; lower jaw longer ; outer teeth bicuspis ; inner small, pointed, in viliform bands.

“ Die Rückenlinie steigt minder rasch und unter schwächerer Bogenkrümmung zur Dorsale an als die Bauchlinie vom vorderen Kopfende an bis in die Nähe der Ventrals sich senkt. Letztere Flosse in der Mitte der Rumpflänge eingelenkt. Der innere Ventralstrahl durch eine Hautfalte an den Bauchrand geheftet und zugleich auch in seiner vorderen Längenhälfte mit dem der entgegengesetzten Seite ähnlich wie bei den *Gobiinen* verbunden.

“ Der Beginn der Anale füllt  $1\frac{3}{4}$  bis nahezu 2 mal näher zur Caudale als zum vorderen Kopfende, der der Anale liegt ein wenig hinter dem Beginn der Dorsale. Caudale am hinteren Rand fast abgestutzt mit abgerundeten Ecken. Die unter der Mitte der Rumpfhöhe eingelenkte Pectorale um circa  $\frac{2}{3}$  einer Augenlänge kürzer als der Kopf.

“ Rumpfseiten dunkel silbergrau, jede Schuppe derselben im mittleren Theile mit einem helleren Fleck. Schuppen an der Oberseite des Kopfes durch besondere Grösse ausgezeichnet.

“ Patzcuaro-See in Mexico.” (Steindachner.)

Largest specimen 13.6 cm. On comparison it may be this species will have to be united with *C. furcifrons*.

### ? Characodon atripinnis.

*Goodea atripinnis* Jor., 1880, P. U. S. Mus., II (1879), 300; J. & G., 1882, Bull. 16 U. S. Mus., 348.  
*Characodon atripinnis* Beau, 1888, P. U. S. Mus., X, 370; Eig., 1893, P. U. S. Mus., XVI, 56.

D. 12; A. 13; Ll. 37-40; Ltr. 13.

Body compressed, back nearly straight, caudal pedicel deep. Head

depressed, broad, short, one fourth of the length. Mouth small; lower jaw prominent. Teeth small, tricuspid. According to Bean the small inner teeth were overlooked in the original description. Eye two sevenths of the head, little more than half of the interorbital space. Fins small; dorsal slightly in advance of anal; caudal short; pectorals not reaching the ventrals.

Bluish above; a silvery streak along each row of scales. Vertical fins chiefly black, especially on the distal half. Intestinal tract considerably convoluted, and filled with mud. From a salt lake in a volcanic basin.

Guanajuato, Mexico. (Jordan.)

The position of this species is still to be questioned. Bean says, "a recent examination of the types of *Goodea atripinnis* Jordan, proves the existence of villiform teeth behind the incisors, and throws *Goodea* into the synonymy of *Characodon*." Jordan says *Goodea* "differs from most of the other Cyprinodontidæ in its tricuspid teeth. From *Cyprinodon*, *Jordanella*, *Fitzroyia*, *Characodon*, and *Jenynsia*, the genera thus far known with tricuspid incisors, it is distinguished by the elongate intestines, and by the freeness of the dentary bones. The aspect is wholly unlike *Cyprinodon*, resembling rather *Fundulus*."

*Characodon* has two cusps on the teeth and has mandibles rather firmly joined. These are characters of more weight than the presence of viliform teeth. From the description, we should hesitate in placing the species *atripinnis* in *Characodon*; but, in deference to the more recent researches, it is provisionally allowed to remain there until we are able to examine specimens.

#### GIRARDINICHTHYS.

*Girardinichthys* Blkr., 1860, Cypr., 481.—1863, Atl. Ichth., III, 139.  
*Limnurgus* Gthr., 1866, Cat., VI, 309.

Compressed in body and head; caudal pedicel of moderate depth. Head short, narrow forward. Snout short, blunt, chin very steep. Mouth small, directed upward; lower jaws longer, firmly united; upper short, very protractile. Compressed teeth in the outer series. Gill openings wide; membranes short, partly united, free from the isthmus. Scales medium. Intestine short. Bases of dorsal and anal short, opposed, behind the middle of the body; rays numerous. Anal fin not modified in the male.

Mexico.

**Girardinichthys innominatus.**

Plate 1. Fig. 11, teeth.

*Lucania* sp. Grd., 1859, P. Phil. Ac., 119.*Girardinichthys innominatus* Blkr., 1860, Cypr., 484, — 1863, Atl., III, 139; Jor. & C., 1877, B. Buf. Soc., III, 142; Jor., 1878, B. U. S. G. Surv., IV, 411, 432; Eig., 1893, P. U. S. Mus., XVI, 56.*Limnurgus variegatus* Gthr., 1866, Cat., VI, 309.

B. 5; D. 19; A. 24 (25); V. 6; P. 15; Ll. 40; Ltr. 15.

D. 20-21; A. 22-23; V. 6; Ll. 44 (Günther.)

Body and head compressed, back flattened anteriorly, arched from the occiput through the dorsal fin. Head one fourth of the length to the caudal fin, convex transversely, concave from orbit to nape, narrowing forward. Snout shorter than the eye, thick, blunt, very steep on the chin. Eye large, two sevenths of the head, two thirds of the interorbital space. The median teeth in the outer series resemble those of Characodon, the lateral are subconical. A few small hooked teeth behind the outer series. Dorsal origin midway from occiput to caudal, and little further back.

Olivaceous, dark to light, with more or less confluent transverse bands of brown on the flanks. Fins olivaceous, somewhat freckled or spotted with brown.

City of Mexico.

**NEOLEBIAS.***Neolebias* Steind., 1893, Notes Leyd. Mus., XVI, 78.

“ Mundspalte klein, seitlich und horizontal entwickelt. Unterkieferhälften fest vereinigt. Zwei Zahnreihen im Zwischen- und Unterkiefer; Zähne der Aussenreihe gegen das freie Ende zu in 2 stark divergirende Aeste gespalten, Zähne der Innenreihe noch zarter, stark zugespitzt. Schnauze kurz (vorne stark oval gerundet), Anale hinter dem Ende der Dorsale in vertikaler Richtung beginnend. Ventrals unter dem Beginn der Caudale eingelenkt.”

**Neolebias unifasciatus.***Neolebias unifasciatus* Steind., 1893, Notes Leyd. Mus., XVI, 78.

D. 10; A. 8; Ll. 34.

“ Körperform gestreckt oval, stark comprimirt. Die obere Kopflinie erhebt sich mässig mit der Rückenlinie bis zum Beginn der Dorsale, hinter welcher sich die Rückenlinie fast ebenso gleichmässig bis zur Caudale senkt.

“ Die Oberseite des Kopfes ist in der Stirnregion und am Hinterhaupte

## EMPETRICHTHYS.

*Empetrichthys* Gilb., 1893, N. A. Fauna, No. 7, pt. 2, p. 233.

Head and body compressed, mouth oblique, chin steep. Teeth conical, in bands. Pharyngeal bones massive; teeth resembling molars, much as in *Fundulus majalis*. Branchiostegal rays five. Dorsal and anal opposed, behind the middle of the body. Intestine of moderate length.

Allied to Fundulus through the more compressed species.

**Empetrichthys Merriami.**

*Empetrichthys merriami* Gilb., 1893, l. c., p. 234, pl. 5.

B. 5; D. 11-13; A. 13-15; Ll. 33-34; Ltr. ca. 16.

Deeper and more compressed than *Umbra limi*, to which there is some resemblance. Head compressed, crown slightly convex. Mouth very oblique; maxillary reaching little behind front edge of the eye. Eye small, once the snout, half the interorbital space, one fifth of the head. Fins medium, angles blunt or rounded. Dorsal near midway from head to end of caudal, opposite the anal. Caudal broad, subtruncate. Pectorals rounded, extending half way to vent. Intestine one and one half times as long as the body.

Back brownish; lighter on flanks and below; irregularly blotched or clouded on the flanks with brown and white; fins brownish, more or less clouded with brown. Scales on the ventral surfaces in cases with lighter borders.

Ash meadows and the Pahrump Valley, Nevada, near the California line.  
(Gilbert.)

## ZYGONECTES.

*Zygonectes* Agassiz, 1853, Am. Jour. Sci., XVI, 135,—1854, Am. Jour., XVII, 353,—Fish. Tenn., 15; Grd., 1859, P. Phil. Ac., 113; Jor. & G., 1882, B. 16 U. S. Mus., 338.

*Micristius* Gill, 1865, Cau. Nat., ext. p. 24; Jor. & C., 1877, B. Buf. Soc., III, 142.

*Haplochilus* (part) Gthr., 1866, Cat., VI, 310.

Intermediate in general features between Fundulus and Haplochilus. Body compressed posteriorly, depressed forward. Crown flat. Snout short, broad. Mouth slightly oblique; upper jaws shorter, protractile, not expanded and produced as in Haplochilus; lower longer, firmly joined. Teeth conical, in bands. No vomerine teeth. Dorsal and anal behind the middle of the body, opposed, the former smaller and originating above or a little

der Afterflosse, ein wenig grösser als diese. Zwischenkiefer und Unterkiefer mit einer Binde feiner spitzer gekrümmter Zähne, deren äussere Reihe die hinteren überragt. Gaumen zahnlos. Schlundknochen mit kurzen dicken conischen Zähnen besetzt. Keine Nebenkiemen. Fünf Kiemenstrahlen. Seitenlinie schwach, gerade. Schuppen glatt, an hinteren Rand ganz. Grundfarbe dunkelgrün, metallisch glänzend, nach den Unterbauch in's Goldige übergehend. Auf dem hintern Dritttheil der Schuppen ein schwarzbrauner Fleck, wodurch am ganzen Körper alternirende Reihen von solchen Querflecken entstehen. Die hinteren Flossen goldgelb mit eben solchen Flecken. Ein einfacher Magen und grader kurzer Darm ohne Anhängsel. Einfache Schwimmblase. Die Eierstöcke führen nach aussen. Mozambique. (Peters.)

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## NOTES.

THE foregoing descriptions were drawn mainly from specimens in the collections at hand. When dependence was placed on literature the words of the original characterization have been put forward, rather than translations.

The scales of the lateral line were counted from the upper angle of the gill opening to the end of the series on the tail. The transverse series were usually taken from the origin of the dorsal fin to the anal. On many of the species the number of scales in the lateral line closely corresponds with the number of vertebræ.

All of the rays in the fins were enumerated. No special stress was placed on the shapes of the fins, as they change so much with age or in breeding males and females.

The gill rakers being normal in the younger stages and degrading and to some extent disappearing later, as in certain Salmonidæ, Pleuronectidæ, etc., little dependence was placed on them.

The majority of the teeth were hardly visible without the aid of lenses; consequently the figures represent them greatly enlarged. Size varying with the individual, the shapes were of most value in comparisons; yet in each figure (group), the details all having the same enlargement, comparative sizes of outer, inner, and pharyngeal teeth were preserved.

*Belonesocinæ*, being the earlier name, takes the place of *Gambusiinæ* on pages 19 and 80.

*Orestiasinæ* is to be inserted above *Orestias* on page 145.

*Nothobranchiinæ* is to precede *Haplochilichthys* on page 156.

Opportunity is here taken to express a hearty appreciation of the kindness of Prof. Dr. Karl Möbius, Dir. Zool. Mus. Berlin, and of his assistant Dr. Hilgendorf, in regard to examination of particular types, of that of Dr. B. W. Evermann, of the U. S. Fish. Comm., for certain publications, and of that of Prof. H. Garman, of the Ky. State College, for specimens.

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PLATE I.

(*m* = mandibular, *i* = intermaxillary, and *p* = pharyngeal teeth.)

- Figs. 1 and 2. *Cyprinodon variegatus* La C.  
*m* and *p* from specimen  $\frac{1}{4}$  inches.  
*m'* from specimen  $\frac{3}{4}$  inches.  
*m''* from specimen  $2\frac{1}{8}$  inches.
- Fig. 3. *Cyprinodon carpio* Gth.  
Fig. 4. *Cyprinodon Floridæ* Goode; Garm.  
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Fig. 6. *Lebias punctatus* Heck.  
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Fig. 9. *Characodon lateralis* Gth.  
Figs. 10 and 12. *Zygonectes Nottii* Ag.  
Fig. 11. *Girardinichthys innominatus* Blkr.  
Fig. 13. *Zygonectes cingulatus* C. V.; Jor. & G.  
Fig. 14. *Zygonectes olivaceus* Stor.; Ag.

