

4.—NOTES ON A COLLECTION OF FISHES FROM THE LOWER POTOMAC RIVER, MARYLAND.

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[Plates XVIII-XX.]

No systematic collecting has been done in the region drained by the Lower Potomac and its numerous tributary streams, and any contribution to a knowledge of the fish life of that section will probably be acceptable, as tending to aid in the elucidation of the problems of geographical distribution and variation. The only researches thus far made embracing the fish fauna of the region covered by this paper were undertaken by the Maryland Academy of Sciences, the results of whose investigations were embodied in an annotated list prepared by Messrs. Uhler and Lugger, published in the report of the commissioners of fisheries of Maryland for 1876, which was followed by supplements in the reports for 1877 and 1878. This list, enumerating 202 species, is the only one thus far compiled that essays to include all the fishes occurring in the waters of the State, and, while now subject to considerable revision in the matters of nomenclature and distribution of fishes, must serve as a comparison and guide for future inquiry.

The Lower Potomac River has a great wealth of fish, upon whose abundance and movements a large number of people are dependent. Not only is there a plentiful supply of desirable food-fishes which are more or less permanently found in the region, such as the yellow perch and striped bass, but there are very important annual migrations of anadromous species, as the shad and alewives; while the proximity to the Chesapeake Bay (whose commercial fisheries are of greater value than those of any other body of water of like size in the world) also contributes a generous supply of typically salt-water fish. The topographical conditions are favorable to the employment of seines, gill nets, pound nets, fyke nets, and other similar devices in almost unlimited numbers. This fact, together with the abundance of oysters and crabs, in addition to fish, makes this one of the most important fishing-grounds in the country.

In the summer of 1890 I made two short visits to St. George Island, Maryland (situated in the Potomac River, about 15 miles from its mouth), and at the suggestion of Dr. T. H. Bean, ichthyologist of the U. S. Fish Commission, obtained a small collection of fishes. Owing to the limited time available for collecting and lack of facilities for preserving the larger fishes, attention was chiefly directed to the smaller forms

inhabiting the shallow inshore waters, and many species that could otherwise have been taken do not, therefore, appear in the list. During the first visit, which extended from June 30 to July 6, the only means of capture was a small dip net with an improvised handle—an instrument of necessarily limited usefulness in such work. On the occasion of the second visit, which occupied one day, August 11, a 25-foot Baird seine was employed with satisfactory results.

The smaller species included in the list were secured in a series of brackish ponds on St. George Island, or in St. George River, an arm of the Potomac which separates the island from the mainland. Complete series of most of these were preserved. The larger fishes which are enumerated were taken with a line or in pound nets in the Potomac River adjacent to the island. Two specimens obtained in this locality in August, 1887, which were not observed in 1890, are also included. The names by which the fish are known among the local fishermen are given in quotation marks.

Although the collection was made in a hurried and unsystematic manner, and represents only a very small proportion of the fishes occurring in the region, the visit was not wholly lacking in scientific results, which emphasize the desirability of undertaking further investigations of the ichthyology of this river. Most of the species obtained possess no unusual interest. In a few cases, however, it has been possible to fully describe and figure for the first time the appearance of young individuals of certain common fishes; and, in another well-known species, an apparently hitherto unrecognized sexual distinction is recorded. The most interesting and important feature of the collection was the finding of a small fish (*Zygonectes luciae*) first described nearly forty years ago by the late Prof. Baird, and up to this time known only by his description, the type specimens apparently having been lost.

Ten figures, representing seven species, accompany this article, viz: *Zygonectes luciae*, male; *Fundulus majalis*, young; *Fundulus diaphanus*, male and female; *Fundulus heteroclitus*, male; *Cyprinodon variegatus*, male and young; *Gambusia patruelis*, female; *Menidia beryllina*; and *Paralichthys dentatus*. Some of these have never before been figured.

1. Brevoortia tyrannus (Latrobe). "Ellwife"; "Oldwife"; "Alewife"; Menhaden.

Large bodies of menhaden often ascend the Potomac River for a distance of 30 miles, and the vessel fishermen from Fairport not infrequently make good hauls off St. George Island. Schools of young fish swimming in serpentine shape can be seen breaking the surface of the inshore waters throughout the summer. All of a large number of young fish (about 2 or 3 inches long) examined were affected with a mouth parasite (*Cymothoa prægustator*). Occasionally, during periods of excessively dry weather, scattered schools of menhaden ascend the river as far as Mount Vernon, where the species is called "bugfish" by the fishermen.

2. Cyprinodon variegatus Lac. "Sheepshead minnow"; *Variiegated minnow*; *Short minnow*. (Pl. xviii.)

Although inhabiting the same waters as *Fundulus*, the variegated minnow does not appear to associate with the members of that genus. In small ditches communicating with the St. George River at high tide the movements and habits of the fish were studied with ease and profit. They were extremely shy and could not be taken with a dip net, however skillfully manipulated. In the pond of brackish water elsewhere referred to they occurred in great abundance, and numerous species of both

sexes and all sizes were seined. Large schools of the young are often left, by the receding tide, in shallow depressions in the sand.

Several young specimens, about seven-tenths of an inch in length, agree in having the body silvery white, with about eight irregular crossbars and with irregularly rounded blotches of similar color along the back, some of these communicating with the transverse markings; a narrow blackish bar at base of caudal; a rounded black spot on posterior part of dorsal; dorsal fin slightly behind (not in advance of) ventrals; a quadrate black spot about half width of eye immediately below that organ.

In the adult specimens collected and in the male figured the origin of the dorsal fin is well in front of the ventrals and not behind, as given by Jordan and Gilbert.*

The variegated minnow is known as the "sheepshead minnow" among fishermen of the island, a name arising from the resemblance between this fish and the sheepshead, and also, in some instances, from the belief that it is the young of that species.

Eighty-nine specimens.

3. *Fundulus majalis* (Walbaum). "Bull-minnow"; Mayfish. (Pl. XIX.)

The least abundant of the killifishes. In company with the two following species it enters the guts and ditches on St. George Island at high tide, and the specimens collected were taken in these situations. Eight adult specimens were obtained, four being of each sex. The males varied from 4.50 to 5.12 inches in length, and the females from 4.00 to 5.75 inches, the average length being 4.69 inches for males and 4.97 inches for females.

Nine specimens of apparently young fish are referred to this species. They much resemble *F. majalis* in general shape, but differ somewhat from the published descriptions in color, markings, fins, etc., as will appear from the following description:

Color in life, silvery white, becoming pale green on the back. Body with 7 to 9 dark transverse bars (black in life) one-half the width of eye in some specimens, narrower in others, beginning at the median line of the back, but not quite reaching the middle line below, the last bar much darker than the others and frequently taking the form of an irregular spot at the base of the caudal fin. Fins white, unmarked. Body elongated. Head long, depressed, terminating acutely; mouth terminal, slightly oblique. Eye somewhat less than snout and contained $1\frac{1}{2}$ times in interorbital space. Anal fin higher than and posterior to dorsal and equal to half length of head. Ventrals short, not reaching anal. Tail rounded. Head, 3; eye, 4; depth, $4\frac{1}{2}$. Dorsal, 13 or 14 (15 in one specimen); anal, 11. Scales in lateral line, 33 to 37; in transverse line, 13. Length, $\frac{7}{8}$ to $1\frac{3}{8}$ inches. Abundant in low, sandy places where shallow pools are left by the receding tide.

4. *Fundulus diaphanus* (Le Sueur). Spring minnow. (Pl. XIX.)

The most abundant of the killifishes, occurring with *F. heteroclitus* in tide ditches and brackish ponds.

Examination of a large series of specimens collected in this region leads to the conclusion that there are prominent sexual differences which do not appear to have been previously noted. Concerning the crossbars which form such a noticeable feature in this species, the current descriptions give 15 to 25 narrow, blackish bars on a silvery background. This description, so far as the fish collected by the writer in the

*Synopsis of the Fishes of North America.

Potomac River are concerned, seems to apply only to the females, while the males have a similar number of brilliant silvery crossbars on an olivaceous background. This conclusion is borne out by the examination of 71 adult males and 54 egg-bearing females.

The following description of the sexes, based on Potomac specimens, is offered:

Male.—Form elongated, slender. Head depressed, of moderate length. Dorsal fin low, beginning considerably in advance of anal and nearer base of caudal than snout. Anal short, deeper than dorsal. Ventrals about equal to portion of head posterior to eye, not reaching vent. Body uniformly olivaceous, darkest above, with about 20 silvery vertical bars, rather narrower than the interspaces, which are the color of the body. Dorsal usually plain, occasionally faintly mottled with black and white spots. Other fins plain. Mouth nearly horizontal, width of eye, on level with pupil, lower jaw projecting, angle of jaw half-way between eye and end of lower jaw. A dark purplish spot on opercle opposite eye.

Female.—Similar to male in form and size. The body marked by 15 to 20 dark transverse bars, much narrower and shorter than the silvery bars in the male, the interspaces lighter than in the male. Back sometimes spotted. Oviduct sheathing the anterior part of anal. Ventrals not reaching vent.

Eye large, $3\frac{1}{2}$ in head, $1\frac{1}{2}$ in interorbital space, and $1\frac{1}{3}$ in snout; head, $3\frac{1}{2}$; depth, $4\frac{1}{3}$. Dorsal, 13; anal, 11. Scales, about 45-15. Length, $3\frac{1}{2}$ or 4 inches.

Prof. Jordan, in his "Report of Explorations in the Alleghany Region of Virginia, North Carolina, and Tennessee,"* etc., records the capture at Luray, Virginia, in the Shenandoah River, of a specimen of *Fundulus diaphanus* "with about 15 silvery crossbands, most of them narrower than the dark interspaces; back and fins unspotted." That form of *F. diaphanus* formerly called *menona* is said† to occasionally have silvery crossbars instead of black ones. These are the only references to silvery transverse bars met with in the descriptions of this species.

All immature specimens are distinctly marked by dark vertical bars, on a pale olivaceous background. When the fish reaches the length of about 2 inches, the differential sexual characters, as before defined, begin to be manifested. A series of 102 young specimens was preserved, the smallest being seven-eighths of an inch long.

5. *Fundulus heteroclitus* (L.). Common killifish; Mud dabbler. (Pl. XIX.)

Next to *F. diaphanus* this is the most abundant killifish in the region. 120 specimens were preserved, of which 81 were adult and 39 were immature individuals.

This species is subject to considerable variation in color, depending on sex and age. The complete series of specimens obtained has permitted a satisfactory diagnosis of even the smallest examples.

Among 36 adult males, the largest specimen is $4\frac{1}{2}$ inches long. As the male approaches maturity the distinct dorsal ocellus, which is more or less constant in the young, usually disappears, and it is rarely seen in adults, although in a few specimens the vestiges remain in the form of a dark spot on the already dark or mottled fin; the ocellus is rarely found in examples over $2\frac{1}{2}$ inches long. In some adults the white spots on the body, instead of being disposed in narrow vertical stripes and irregularly scattered over the sides, as usually described, are found on the anterior part of each

* Bulletin U. S. Fish Commission, VIII, 1888, p. 103.

† Manual of the Vertebrates.

scale and form well-defined longitudinal and diagonal stripes, as in the specimen figured.

The female is usually described as having no transverse markings, but sometimes a "few faint vertical shades." Of the 45 adults preserved, 42 are marked with about 15 distinct dark crossbars narrower than the interspaces. The largest female obtained was $4\frac{1}{4}$ inches in length.

Large specimens have head $3\frac{1}{2}$; eye 4 in head, 1 in snout, 2 in interorbital space; depth $3\frac{3}{4}$.

Immature males differ greatly from the adults. The following description, based on a full series, applies to young males:

Body above light olive, below yellow, the sides marked by about 24 alternate dark and silvery transverse stripes, the former usually being considerably wider. As the size of the fish increases the back becomes darker and blends with the dark bars, leaving only the silvery bars, which become less distinct. In the smaller examples the silvery bars are about as wide as the dark ones. Dorsal dark, with a prominent white spot involving the last 3 or 4 rays, margined with black above and anteriorly. Anal much deeper than dorsal. Head, $3\frac{1}{2}$ to $3\frac{3}{4}$; eye, $3\frac{1}{4}$ in head, $1\frac{1}{2}$ in interorbital space, $\frac{3}{8}$ to $\frac{7}{8}$ in snout; depth, $3\frac{3}{8}$. Dorsal, 11; anal, 10 to 12. Scales, 37-13. Length, $1\frac{3}{4}$ inches.

All immature females have the colors of the adult females, but are somewhat paler, the blackish bars being more distinct. Head, $3\frac{3}{4}$; eye, $3\frac{1}{2}$ in head, $\frac{3}{4}$ in snout; depth, $3\frac{3}{4}$.

In 13 specimens from $\frac{7}{8}$ to $1\frac{5}{16}$ inches long, the differential sexual characters, as before defined, are distinctly present, the stripes being somewhat more prominent than in the half-grown fish. The dorsal markings in the males, however, are absent in such small examples. Head, $3\frac{1}{2}$; eye, $3\frac{1}{2}$; depth, 4. Dorsal, 11 or 12 (14 in one specimen); anal, 10 or 11. Specimens of *F. heteroclitus* of this size bear a strong superficial resemblance to *Zygonectes luciae*, but are found to differ widely on close examination.

6. *Zygonectes luciae* (Baird). (Pl. xviii.)

Under the name *Hydrargyra luciae*, Prof. Baird, in the Smithsonian Report for 1854, described a small minnow from Great Egg Harbor, New Jersey. The types are unfortunately not extant, so far as known, and since that time the fish has not been met with, although Dr. T. H. Bean, in 1887, made diligent search in the region in which Prof. Baird collected his specimens.

Two specimens, evidently males, taken on St. George Island, appear to agree remarkably well with the description of this fish, and no other disposition seems possible than to refer them to this lost species, a view which is shared by Dr. Bean. Prof. Baird's description is as follows:

General form elongated, though of rather short appearance. Head constituting less than one-fourth of total length. Insertion of anal slightly in advance of origin of dorsal, and rather more developed than the latter. Ventrals very small; their extremity reaching the anus. Tail large. D. 8; A. 9; C. 6, I. 8, 7, I. 5; V. 6; P. 15. Dark olive green above, lower part of sides and beneath rich ochre yellow. Sides with 10 or 12 broad, well-defined, vertically disposed dark bars, nearly as large as their interspaces, which are of a faint tint of greenish white. All the fins but the dorsal are of a uniform yellowish, lighter than the abdomen. Dorsal, yellow on the terminal half, the basal portions olivaceous, with a large black spot posteriorly, and immediately anterior to it a white one. The dark spot is bordered above and behind by the yellow part mentioned. In one specimen the posterior half of the base of the dorsal fin is dull white, with a large subcircular spot of black in the center. Length about 1 inch. Female similar, the dorsal unspotted, the yellow less intense,

The two specimens obtained in the Potomac River have the following characteristics:

Designation.	1.	2.
Length (inches)	1 $\frac{1}{4}$	1 $\frac{1}{4}$
Head in length without caudal	3 $\frac{1}{2}$	3 $\frac{1}{2}$
Depth in length without caudal	4 $\frac{1}{2}$	4 $\frac{1}{2}$
Eye in head	3+	3+
Eye in snout	$\frac{3}{8}$	$\frac{3}{8}$
Eye in interorbital space	1 $\frac{1}{2}$	1 $\frac{1}{2}$
Dorsal rays	8	8
Anal rays	10	10
Scales in lateral series	35	34
Scales in transverse series	11	10

The dorsal fin has its origin posterior to that of the anal and is lower than the latter; when flexed, its extremity is opposite the tip of the anal. The ventral fins are small, about equal to head back of eye and half the length of the pectorals, their extremity reaching the anus.

The vertical bars are 10 to 12 in number, and are sharply defined, their width being equal to the interspaces and slightly increasing toward the tail. They begin and end abruptly, not reaching the median line above or below by about half the width of the eye.

The opercles, cheeks, and chin are thickly covered with dark spots, largest on the cheeks and opercles, and least numerous on the cheeks.

Field notes giving the color of the fish when alive agree with Prof. Baird's description. The upper parts were of a dark-green color, which faded into a reddish yellow on the sides and abdomen; the inferior fins were pale yellowish; the vertical bars were rich black, with a bluish reflection. The dorsal showed a pale tip and anteriorly a dark base; behind there was a jet-black rounded spot about two-thirds the width of the eye and involving rather more than half the width of the fin, margined anteriorly and inferiorly by a pure white spot.

The species appears to belong in the genus *Zygonectes*, as defined by Prof. Jordan, which differs from *Fundulus* in the smaller size of the fishes, the fewer dorsal rays, and the origin of the dorsal behind the front of the anal.

The two specimens secured were taken in company with a large number of fish of a similar size and appearance with which they were at first thought to be identical. These have the distinct dark crossbars, but lack the dorsal ocellus and the yellowish color on the under parts. The absence of these features alone would suggest that they are females of *Zygonectes lucia*, but when taken in connection with 10 to 12 rays in the dorsal fin and the position of the latter anterior to the anal, must necessarily place the fish in the genus *Fundulus*.

7. *Lucania parva* (Baird & Girard). *Rainwater fish*.

Not given by Uhler and Luger in the list of the fishes of Maryland. It occurs in about twice the abundance of *Gambusia patruelis*, with which it is almost invariably taken. Most abundant in brackish muddy ponds and tide ditches.

Males with body olive green, the scales marked by black crescentic bands covering about the middle third of the exposed portion. An obscure, narrow, lateral stripe. Under parts and lower fins yellowish. A large elongated black spot at the base of dorsal anteriorly, involving about three rays and extending upwards from back to

middle of fin; posterior to the black spot is a yellow area (white in alcoholic specimens) without spots; the remaining part of the fin is irregularly spotted with black, more especially the base and extremity, leaving, in many specimens, an elongated space only sparingly marked with fine spots. Edges of anal and ventral fins jet black and of caudal and pectoral fins dusky. Females similar, larger, with fins unmarked. Dorsal, 10 to 12; anal, 10 or 11; head, $3\frac{1}{2}$; eye, 3; depth, $3\frac{3}{8}$; scales, 26 (25 to 27)—8 (or 7). Length of mature specimens, $1\frac{1}{8}$ to $1\frac{3}{8}$ inches. 146 specimens.

8. *Gambusia patruelis* (Baird & Girard). *Top minnow*. (Plate xx.)

Very abundant in shallow muddy ditches and in the brackish ponds elsewhere alluded to, always associated with *Lucania* and occasionally with the *Funduli* and *Menidia*. All of the larger females taken were distended with eggs, which are relatively large but few in number. Specimens collected July 1 contained from 18 to 30 ova, each one-sixteenth of an inch in diameter, which were not in an advanced stage of incubation. Examples obtained August 11, however, were found to contain well-developed embryos, which would doubtless have been extruded within a few days. Jordan* says the young are born in spring, which suggests that possibly two broods are raised in a single season. The stomach contents of one fish incidentally examined consisted chiefly of filamentous and unicellular algae, diatoms, amorphous vegetable matter, and fragments of a mosquito.

Of the 69 specimens obtained, 68 were females, a circumstance illustrating the well-known relative scarcity of males. In the series collected the females have a few small scattered dark spots on the body and an obscure dark line along the side; dorsal shows about 2 or 3 transverse rows of black spots, anal edged with black, tail irregularly spotted, the spots tending to form 2 to 4 narrow transverse bars; usually a dark spot, purple in life, on side above vent; no "oblique dark band below orbit" (Jordan & Gilbert), although in a small proportion of the specimens there is a faint, dusky spot; snout with a very pronounced upward inclination. Male without purple spot on side, anal plain, snout less spatulate. Dorsal, 7 to 9; anal, 9 or 10; head, $3\frac{1}{2}$; eye, 3; depth, $3\frac{3}{8}$; scales, 28 (27 to 29)—7 (or 8). Length of adult females, $1\frac{1}{4}$ to $1\frac{3}{8}$ inches; of male, 1 inch.

9. *Anguilla anguilla* (L.). "*Eel*."

A single specimen, 4 inches long, was seined in a brackish pond inhabited by killifishes, silversides, etc.

10. *Tylosurus marinus* (Bloch & Schneider). "*Garfish*."

Examples under 8 inches in length are not infrequently seen in small companies around the wharves and shores. The fish move rapidly over the surface, feeding on small minnows and also on fragments of crabs and fish thrown into the water by line fishermen. This species ranges over the entire river to the limit of tide water, specimens being occasionally taken above Washington.

11. *Menidia notata* (Mitchill). *Silversides*.

Very numerous, but less so than *M. beryllina*, with which it associates. The specimens taken varied in length from seven-eighths of an inch to $3\frac{1}{2}$ inches, the average size being about $1\frac{1}{2}$ inches. The dorsal formula varied considerably, IV-I,8, IV-I,9, V-I,8, V-I,9, V-I,10 all occurring, but V-I,8 and V-I,9 being the most prevalent.

* Manual of the Vertebrates.

The anal rays were found to number from I,22 to I,27. In the following table is given a record of the examination of a series of this species taken at random from among the largest specimens obtained:

No. of specimen.	Length.	Dorsal.	Anal.	Head.	Depth.	Eye.	Scales.
	<i>Inches.</i>						
1	2	V-I, 9	I, 25	4+	4½	3	45
2	2	V-I, 10	I, 25	4½	4½	3-	45
3	1½	V-I, 9	I, 22	4+	4½	3	43
4	1½	IV-I, 9	I, 23	4½	4½	3	45
5	1½	V-I, 8	I, 23	4	4½	3	43
6	1½	IV-I, 8	I, 22	4	6	2½	43
7	1½	V-I, 8	I, 24	4½	6	3½	45
8	2	V-I, 8	I, 25	4½	4½	3	46
9	1¾	IV-I, 8	I, 23	4	4½+	3	44
10	1¾	V-I, 9	I, 27	4½	4½	2½	46

12. *Menidia beryllina* (Cope). *Silversides*. (Plate XX.)

This species, originally described by Cope from the Potomac River, occurs abundantly in large schools in this portion of the Potomac. The writer has also taken specimens at Washington, D. C.

The examples examined appear to differ in some minor details from the published descriptions of the species, as will be seen from the appended comparative table, which represents fish taken at random from a large series. The dorsal formula would seem to be V-I,10 rather than V-I,11, the latter being found only once in a large number of specimens and being less frequent than V-I,9. The anal rays vary from I,15 to I,18, the latter representing the maximum and not the average, as usually given, which would seem to be I,16 or I,17.

No. of specimen.	Length.	Dorsal.	Anal.	Head.	Depth.	Eye.	Scales.
	<i>Inches.</i>						
1	2½	V-I, 10	I, 17	4½	6	3	40
2	2½	V-I, 10	I, 17	4½	8	3+	40
3	2½	V-I, 10	I, 18	4	5½	3	38
4	2½	V-I, 10	I, 18	4	5½	3	39
5	2½	V-I, 10	I, 16	4½	6	3	40
6	2½	V-I, 10	I, 17	4	6	3	39
7	2½	V-I, 11	I, 16	4	6	3	38
8	2½	V-I, 9	I, 16	4	6	3	40
9	2½	V-I, 10	I, 15	4½	6+	3	39
10	2½	V-I, 10	I, 18	4½	6	3-	40
11	2½	V-I, 10	I, 15	4½	5½	3	40
12	2½	V-I, 10	I, 18	4+	5½	3-	40
13	3½	V-I, 9	I, 16	4½	6	3	40

Specimens numbered 5, 7, 8, 9, 11, and 13 in the table resemble *Menidia peninsula* in the number of anal rays, but differ from that species in having from 9 to 11 rays in the second dorsal, instead of 8.

The silvery stripe in this species is said to be on "two half rows of scales," but this designation will not strictly apply to the specimens from the lower Potomac. In all those examined the stripe involves different rows in different portions of the fish. Anteriorly it is found on the lower half of the fourth row and the upper half of the fifth row; toward the middle, opposite the dorsal fins, it involves the central portion of the fourth row and the tips of the scales in the third and fifth rows; toward the tail the line appears to rise and covers the lower half of the third row and the upper half of the fourth row.

13. *Scomberomorus maculatus* (Mitchill). "*Spanish mackerel.*"

This fine food-fish is not uncommon in the mouth of the Potomac and for a short distance upstream. Considerable numbers are taken some seasons in pound nets and other devices. The fish are usually small, averaging only $1\frac{1}{2}$ pounds in weight, but some years there appears to be a run of much larger individuals. In August, 1888, the writer saw a specimen weighing $7\frac{1}{4}$ pounds taken in this locality in a pound net; this seems to be the maximum weight attained by the species.

14. *Pomatomus saltatrix* (L.). "*Tailor*"; *Bluefish*.

The bluefish which ascend the Potomac are similar in size to those frequenting the Chesapeake; that is, they usually weigh from 1 to 3 pounds. Some years, as in 1888, there is a run of fish weighing 6 or 8 pounds, but individuals so large are rarely taken. Here, as elsewhere, the fish is erratic in its appearance and abundance.

15. *Stromateus alpidotus* (L.). "*Harvest fish.*"

Uhler and Lugger remark regarding this species: "Occurs in Sinnepuxent Bay and in the southern part of Chesapeake Bay." A number of years' observations warrant the statement that the harvest fish is not uncommon in the waters adjacent to St. George Island, where individuals are seen every year, usually in the months of August and September, whence the name. The specimen which gives the species a place in this list was taken in August, 1887, in the St. George River; it was 2 inches in length. An interesting and well-recognized habit of the species is that of swimming beneath the body and among the tentacles of jelly-fishes; all the harvest fish observed in this region have been in this position. This is doubtless for protection.

16. *Lepomis gibbosus* (L.). "*Sunfish*"; "*Tobacco-box*"; "*Pumpkin-seed*"; *Robin perch* (Norfolk, Virginia).

Occurs abundantly in a small pond of brackish water on St. George Island inhabited by *Gambusia*, *Lucania*, *Menidia*, *Fundulus*, *Cyprinodon*, etc. The fish is eaten at times by the native inhabitants of the island, although this would seem to be only a caprice, with the wealth of more desirable fish close at hand.

Concerning the hitherto mooted question as to whether the male or female fish guards the nest, the weight of recent testimony appears to favor the former and confirms a single observation made at St. George Island. One day in July a crab was seen to invade the nest of a pair of sunfishes. The female retired to an adjacent growth of water plants, while the male made savage darts at the intruding crab or approached it cautiously from the rear, apparently inviting a chase. This continued for some minutes, when the crab appeared to tire and beat a retreat, whereupon the male sought his mate and both returned to the nest. The sex of the fish was afterwards verified by dissection.

Eighteen adults and 40 young specimens were preserved.

17. *Roccus lineatus* (Bloch). "*Rock*"; *Rockfish*; *Striped bass*.

Not common during summer, but quite abundant in spring and fall. Frequently found on hard sandy or gravelly bottom overgrown with *Ulva intestinalis*. In summer the specimens taken are usually under 3 pounds.

18. *Archosargus probatocephalus* (Walbaum). "*Sheepshead.*"

To the shy habits and restricted feeding grounds the apparent scarcity of this species is to be attributed. An oyster bed in deep water is the place where the fish

can most frequently be found, and certain areas of this kind in the lower Potomac, known as "sheepshead rocks," have become famous for miles around. The fishermen often sink a number of long poles in favorite locations, and on these the barnacles soon grow and become attractive food for the sheepshead, which can often be taken in considerable quantities around the hurdles. In line fishing, blue and fiddler crabs and maninoses are the best baits.

Mr. P. L. Uhler, in the list of the fishes of Maryland, refers to this fish as weighing from 10 to 25 pounds; but specimens even as large as the minimum weight mentioned must now be very rare in the Chesapeake and are never seen in the lower Potomac, where the fish usually range from 4 to 7 pounds.

On St. George Island, sheepshead intended for the table are often kept alive for several weeks in pens made for the purpose.

19. *Liostomus xanthurus* Lac. "*Spot*"; "*Crocus*."

Perhaps the most important food-fish in this region during the summer, although too small to be of great commercial value; enormous quantities are consumed locally at hotels and in private families, and it deservedly ranks as the best pan-fish. It is often called "crocus" by the local fishermen, a designation also shared by the croaker, of which name it is a corruption.

20. *Micropogon undulatus* (L.). "*Crocus*"; "*Grumbler*"; *Croaker*.

Although not uncommon, the croaker is much less abundant than its near relative, the spot, with which it associates. The largest individuals appear to occur towards the end of summer.

21. *Menticirrus nebulosus* (Mitchill). *Whiting*; *Kingfish*; *Barb*.

This fish must be of very rare occurrence in the Potomac River. Uhler and Luggier refer to it as being occasionally met with in the lower part of Chesapeake Bay. A small specimen was taken with a line in the St. George River in August, 1887.

22. *Cynoscion maculatum* (Mitchill). "*Trout*"; *Spotted weakfish*.

Occurs throughout the summer in varying abundance. In June the fish are mostly small, weighing only one-half a pound, but in August there is an advent of large fish ranging from 1 to 3 pounds, which remain in the region until October.

23. *Batrachus tau* (L.). "*Toadfish*."

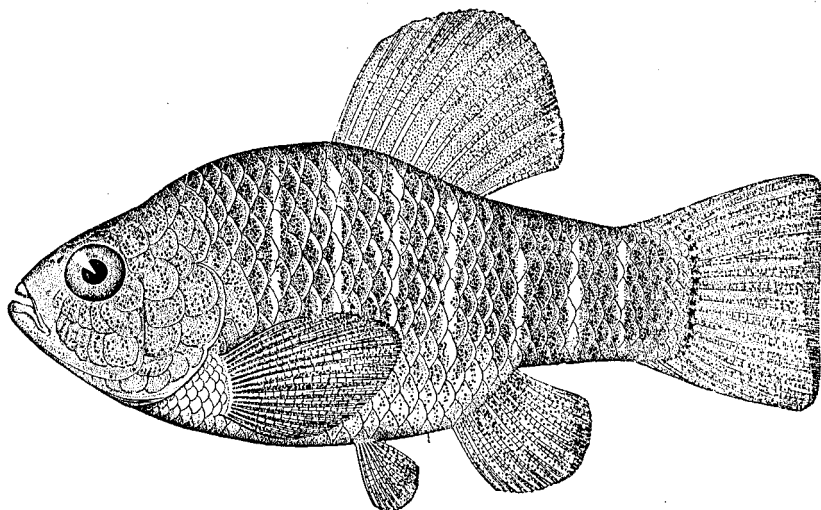
Exceedingly numerous, especially on oyster beds in shallow water. Takes the hook freely and at times is very troublesome to anglers. Not esteemed for food, on account of its extreme ugliness, but is sometimes eaten by negroes and is said to be well flavored.

24. *Paralichthys dentatus* (L.). "*Flounder*"; *Summer flounder*; *Plaice*. (Plate xx.)

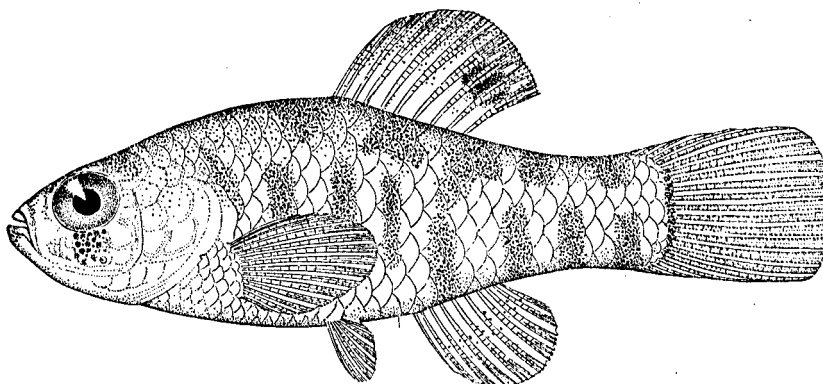
The common flounder of the lower Potomac during the summer months; it takes the hook readily, and when of large size is one of the most valued food-fish of the river.

Uhler and Luggier did not find this fish in Chesapeake Bay or its tributaries, but say that it has been occasionally taken on the coast of Worcester County.

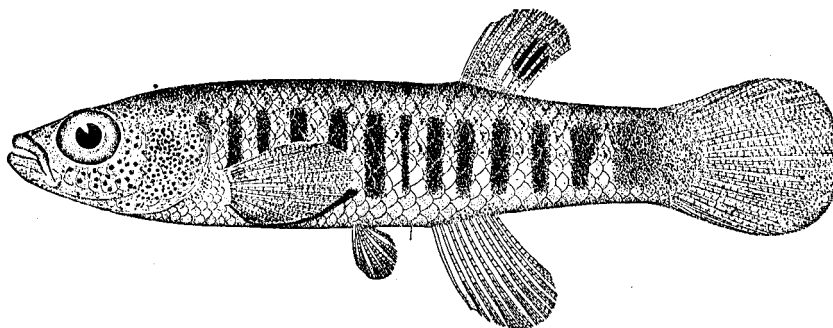
The specimen figured was about 6 inches long. The superior surface was of a uniformly brownish-olive color, with ten distinct ocelli consisting of a dark-brownish center with a pale border. The basal part of the caudal was obscurely spotted, and a single dark spot appeared on the middle of a few of the dorsal and anal rays.



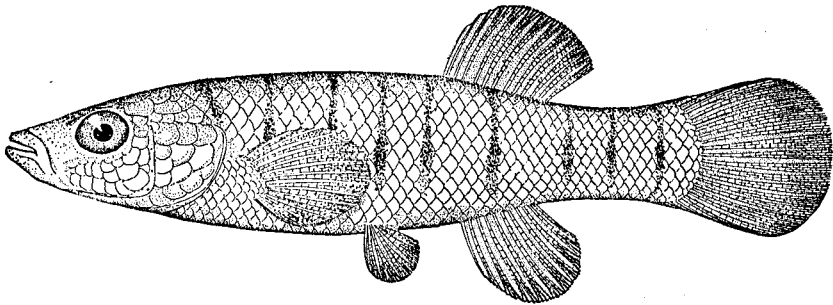
CYPRINODON VARIEGATUS. *Variegated Minnow*. Male. Twice natural size.



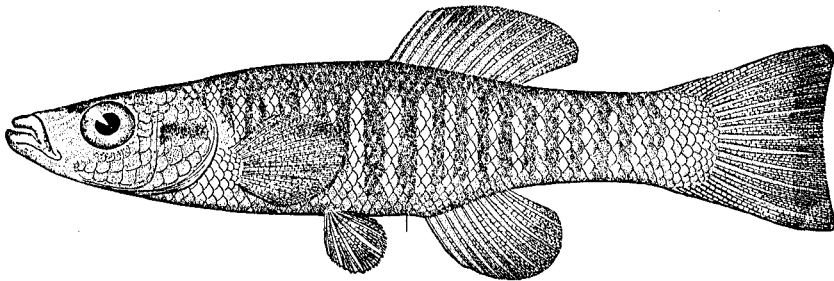
CYPRINODON VARIEGATUS. *Variegated Minnow*. Young. Six times natural size.



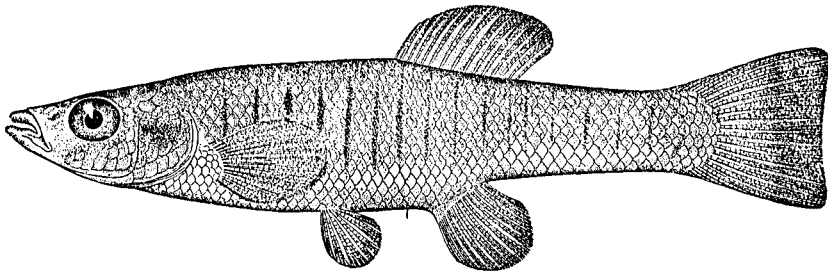
ZYGONECTES LUCIÆ. Male. Four times natural size.



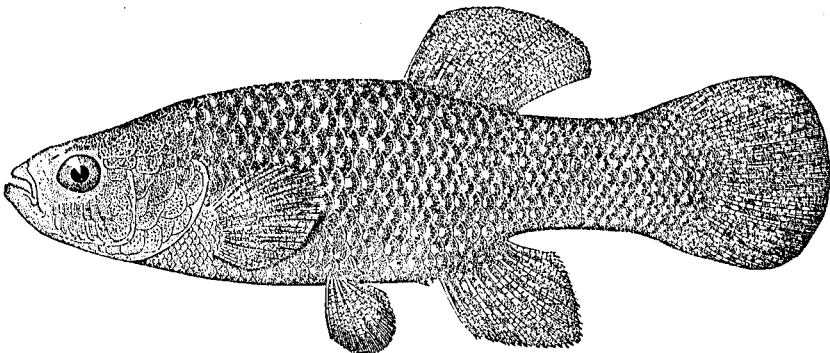
FUNDULUS MAJALIS. *Mayfish*. Young. Four times natural size.



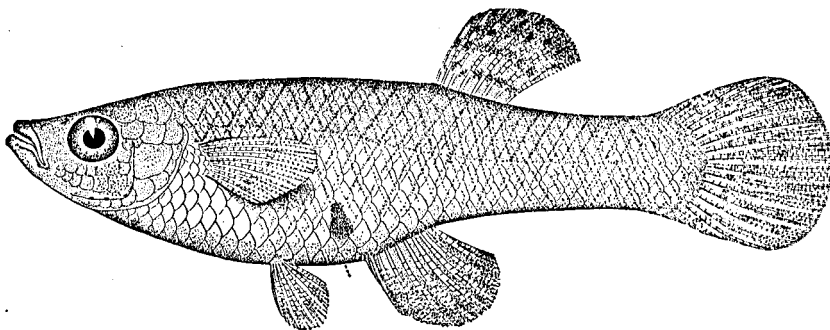
FUNDULUS DIAPHANUS. *Spring Minnow*. Male. One and one-fifth times natural size.



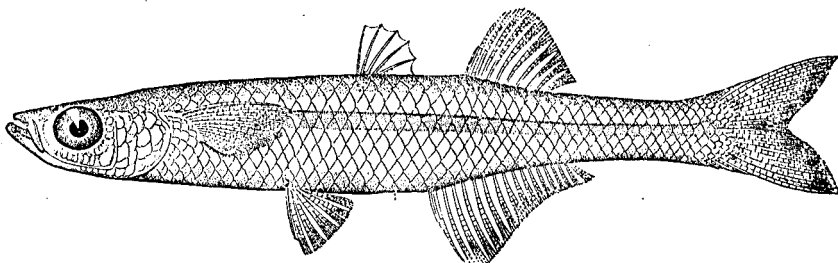
FUNDULUS DIAPHANUS. *Spring Minnow*. Female. One and one-fifth times natural size.



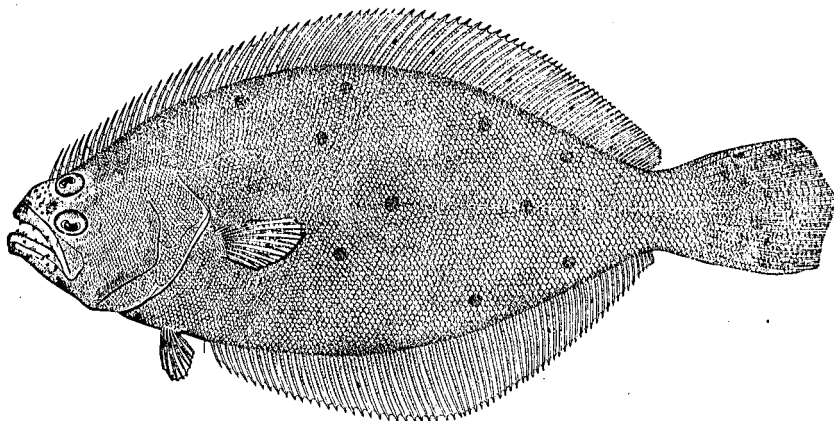
FUNDULUS HETEROCLITUS. *Common Killifish*. Male. Natural size.



GAMBUSIA PATRUELIS. *Top Minnow*. Female. Two and one half times natural size.



MENIDIA BERYLLINA. *Siversides*. One and one-fourth times natural size.



PARALICHTHYS DENTATUS. *Summer Flounder*. Immature. Two-thirds natural size.