

NOTES ON THE SILVERSIDES OF THE GENUS *MENIDIA* OF THE
EAST COAST OF THE UNITED STATES, WITH DE-
SCRIPTIONS OF TWO NEW SUBSPECIES.

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INTRODUCTION.

This paper is primarily the outcome of difficulty encountered in attempting to identify some fresh-water forms of *Menidia* of Florida, which will be referred to in detail on another page. In 1892 the present writer discovered, in a collection made by Mr. Vinal N. Edwards and himself at Woods Hole, a lot of specimens which were then thought to be *M. beryllina*; this discovery was recorded by Kendall & Smith in the Bulletin of the United States Fish Commission for 1899. The Florida examples just mentioned suggesting this form were compared with the Woods Hole specimens, and both with Potomac River fish. This led to the examination of all available specimens of the genus and all the literature on the subject, with the results set forth in these notes. With all the collecting previously done at Woods Hole, it is somewhat remarkable that a form noticeably different from the common silverside and exceedingly common at Woods Hole should so long escape detection, but not more remarkable than subsequent discoveries at the same place by Dr. Hugh M. Smith.

The material upon which the conclusions embodied in this paper are based is comprised in the large collections of the United States National Museum, representing a wide range of localities on the coast; excellent collections from the east coast of Florida, made by Prof. Barton W. Evermann and Mr. Barton A. Bean; west coast of Florida, by Professor Evermann and the writer; Louisiana and Mississippi, by Professor Evermann; the coast of Texas, by Professor Evermann; North Carolina, Potomac River, and Woods Hole, by Dr. Hugh M. Smith; Florida, Georgia, South Carolina, North Carolina, Chesapeake Bay, Potomac River, Delaware Bay, Woods Hole and vicinity, Gloucester, Massachusetts, and the coast of Maine, by the writer; the Potomac River, by Mr. Millard C. Marsh. Hundreds of specimens have been examined and compared, but only a few from the most important localities, taken for the most part at random, are given in the comparative tables.

For encouragement and assistance I am deeply indebted to Dr. Hugh M. Smith, assistant in charge of the Division of Scientific Inquiry, and Prof. Barton W. Evermann, ichthyologist of the United States Fish Commission, and particularly to Mr. B. A. Bean, assistant curator of fishes, United States National Museum, who rendered the Museum collections easily accessible and who was ever ready and willing to give any possible assistance.

In the publication of these notes the main objects in view are—

1. To call attention to an overlooked opportunity for a remunerative and comparatively inexpensive fishing industry and a neglected delicacy in the way of food-fish.
2. To contribute something toward the knowledge of the relationship and natural history of these fishes.

THE SILVERSIDES.

The silversides belong to the family *Atherinidae* and are represented by three genera on the Atlantic coast of the United States: *Atherina*, *Kirtlandia*, and *Menidia*. The first of these is essentially West Indian, no species of it being positively known to occur farther north than Florida. It may be easily distinguished from the other genera by its less compressed form, the rounder body, and heavier head, flattened and wide on top. *Kirtlandia* more closely resembles *Menidia*, in fact was until recently considered a member of that genus. It may be readily recognized, however, by its gashed or lacinated scales, those of *Menidia* being entire. The scales are also firmer and more glossy than in *Menidia*, which renders this form less desirable as food. *Kirtlandia* is found as far north as Long Island. In early summer it is very abundant in Chesapeake Bay.

The genus *Menidia* is the one with which this paper is particularly concerned. It comprises several species of small slender fishes bearing a broad silvery stripe along the sides, whence their name silversides. One or more species abound along the whole coast from Nova Scotia to Texas. In general appearance they resemble the smelt (*Osmerus*) and in some places are known as "sand smelt" and "green smelt," and are sometimes mistaken for the young of the common smelt, from which they can easily be distinguished by the absence of the adipose fin of the smelt and the presence of a small spinous dorsal fin which the smelt does not possess.

ABUNDANCE.

In the south, silversides abound in the shore waters at all seasons. One form inhabits fresh water in Florida, occurring in the St. Johns River as far up, at least, as Lake Monroe; another fresh-water form occurs about Vicksburg and Edwards, Miss., and Natchez, Tenn. In more northern latitudes in the spring and early summer they appear

in countless numbers along sandy shores, in brackish creeks, channels, and estuaries. One species is found in the Potomac River as far up as Washington.

To illustrate their abundance and the ease with which they can be caught, a few instances may be given: At one time a 15-foot bag seine (Baird collecting seine) was hauled at Morehead City, N. C., on a sand bar. The bag, holding a bushel or more, was filled at every haul. In an arm of Casco Bay, Me., a 75-foot seine of the same kind as the above was hauled in a muddy channel and 2 or 3 bushels taken at a haul; this called forth remonstrances from the inhabitants, who thought it an unwarranted slaughter of young smelts.

Dr. Hugh M. Smith furnishes the following notes regarding the abundance of silverside at Woods Hole during the summer of 1899:

Menidia notata.—"Brit." This is one of the most abundant fishes of southern Massachusetts. It occurs in very large schools in Vineyard Sound, Buzzards Bay, and Nantucket Sound, usually associated with *M. beryllina*. In the Woods Hole region it appears in April, and is found until December. In November, when the schools seem to become larger and denser, the fish is exceedingly numerous in Great Harbor, about the wharves. Examples upwards of 6 inches long are common.

Both species* of silversides are exceedingly abundant about wharves, and on sandy, gravelly, and sometimes grassy shores. At times the seine catch will consist of over 95 per cent silversides; and no seine haul fails to contain some. On August 31, 1899, there were enormous schools along the eastern side of Vineyard Sound at Lambert Cove, and the seine was literally packed with them; one haul contained not less than 20 bucketfuls of uniform size (3 inches). These fishes must be among the most abundant fishes of the region and the most valuable food for many of the other fishes, including squeteague, sea bass (locally called "rock bass"), scup, mackerel, bonito, sea robin, blue-fish, cunner, gar, needle-fish, etc., besides terns and gulls.

These fishes and the anchovies (*Anchovia*) undoubtedly contribute extensively to the food supply of the above-mentioned fishes besides many others southward, and it is not impossible that they furnish the chief subsistence for many of them.

The extent to which the young blue-fish, squeteague, etc., feed upon the silversides suggests the question whether the extensive capture of silversides for commercial purposes be advisable. It might have an unforeseen injurious effect upon the abundance of more valuable fishes. The constantly increasing demand for fish-food has resulted in more extensive fisheries and new and improved appliances for fishing, as well as a market for fishes formerly valueless. All of these things have to some extent helped toward the decrease of the food-fishes, and in conjunction with impassable dams and other obstructions have caused the disappearance of anadromous fishes from some localities. It is impossible to tell the precise effect the disappearance of these fishes from a region may have had on the more permanent residents. Once it was thought that the cod fisheries of the coasts of Maine and Massachusetts were practically inexhaustible. It is noticeable, how-

* Referring to *M. menidia notata* and *M. beryllina cerea*.

ever, that the disappearance of cod from any locality on the Maine coast has been at times coincident with marked scarcity of members of the herring family in the same region.

A study of the reports of the department of marine and fisheries of Canada will reveal the fact that the success of the cod fisheries of the Gulf of St. Lawrence depends directly and absolutely upon the abundance of capelin or herring. A scarcity of either of these fishes is always accompanied by a scarcity of the cod. This is forcibly shown in an examination of the returns from local fisheries. Capelin or herring, as the case may be, may appear at some localities and not at others. In every instance there is a corresponding abundance or scarcity of cod during a season.

The shore cod fisheries of New England were at one time, and for a long time, believed to be declining, and they were. The subsequent increase in some localities can be accounted for in at least two ways: First, to artificial propagation; second, to reappearance of principal food, or perhaps to both. The silverside on the coast of southern New England is analogous to the capelin of the north; in fact, it is known as capelin in some localities. It is possible that in seasons of scarcity of some of the larger fishes of this region there may have been a corresponding though unnoticed scarcity of silversides.

SIZE AND USES.

Silversides are quite commonly designated as "small fry" or "brit." Different species vary in size, and individuals of the same species of course vary according to age. The species of *Menidia* of the Atlantic coast of North America attaining the largest size is *M. menidia notata*, the common silverside of the north, which, so far as known, reaches a maximum length of from 5 to 7 inches. Fish from 4 to 5 or 6 inches in length are not uncommon on the south coast of New England, but usually they are smaller. They swim in immense schools, fish of about the same size generally being found together.

On the California coast certain forms of silversides are of larger size and of considerable commercial importance, especially the "blue smelt" (*Atherinopsis californiensis*) and "little smelt" (*Atherinops affinis*). The first reaches a length of 18 inches, the other 1 foot.

On the Atlantic coast silversides are not of much commercial importance, although they are sold as bait for young blue-fish ("skipjacks") at some places along Long Island Sound, and sometimes appear on hotel bills of fare as "whitebait." When cooked properly they are delicious, and since they are so abundant they ought to contribute largely to the fishing industry and food supply of the Atlantic States.

The usual method of cooking "whitebait" is to roll the fish in cracker crumbs and fry them whole. "Whitebait" is usually 2.5 or 3 inches long. Larger fish may be cleaned like smelts, rolled in cracker crumbs

or in corn meal, and dry-fried. In Newfoundland large quantities of capelin are dried and shipped to London, where they are used as food, largely in the oyster houses. There is a possibility in this method of curing large silversides for the market. As a side venture some method of canning them, in an already established fish-cannery, might pay. All of these things, however, will be the natural outgrowth of a fishery for silversides when the demand for the fish increases.

The fact that silversides are the favorite food of many fishes suggests their use for bait. To this, there are at least two objections: They quickly soften, and they die rather too soon for live bait; but they are used in both ways for bait for young blue-fish and other fishes.

PROTECTION.

There is no doubt that as the excellent food qualities of the silversides become better known, a demand for them will be created that will give rise to extensive fisheries for them, especially as the smelt, to which the silversides is but a little inferior, is growing scarcer. The silversides, being strictly shore fishes, will more quickly feel the effect of extensive drafts upon their numbers than do the pelagic gregarious fishes, like the mackerel and blue-fish.

I have stated that one object of this paper is to call attention to an opportunity for a paying fishery, but it should be a fishery well regulated from the beginning. That such regulations may be intelligent, resulting in the most good to the greatest number, the economic relations of silversides to other fishes should be thoroughly studied, and a possible danger thus averted.

The importance of the subject will warrant emphasizing the fact that fishery regulations should be made before the need for them is established by sad experience. For "all the king's oxen and all the king's men" can never restore exhausted sea fisheries.

Feasible legislation is, however, a difficult matter, and fishery laws are too often of little other use than padding for the statute books. Legislation should be founded upon a thorough knowledge of the habits of the fish and their relation to other species. As with other fishes, it seems desirable that silversides should be unmolested during the period of the height of their spawning season, and inasmuch as they are found in schools of fairly uniform-sized fish, it would be an easy matter for the fisherman to avoid catching small fish, which would allow a size limit to be imposed.

BREEDING HABITS.

There are no external marks to distinguish sex, even in the breeding season. The females average larger than the males, and in a school, contrary to the usual rule among many fishes, seem to be more numerous. Out of 380 specimens of *M. menidia* from Woods Hole

which were examined, 204 were females and 146 males. The females averaged 4.05 inches, the males 3.67 inches in length.

These fish breed during the spring and early summer, and doubtless some of them throughout the summer. During the first week in April the common silverside (*M. menidia*) was found full of spawn at Morehead City, N. C. They spawn on the sand and in the sedge in shallow water close to shore.

In a brief paper,* published nearly twenty years ago, Ryder gave some interesting observations upon the eggs of the silversides which he called *Menidia notata*. He said:

The mature eggs of *Menidia notata* measure about a line in diameter, and are covered with a thick, strong egg membrane. When first taken from the parent fish, the germinal matter of the ovum is spread mainly over the surface of the vitellus, and in the latter a number of highly refringent oil globules of various sizes are embedded. In the space of ten hours the batch of ova studied by the writer had the germinal disk independently of impregnation.

Probably the most striking peculiarity about the ova of *Menidia* is the garniture of threads which are attached to one pole of the egg, covering a very small area of insertion on the outer surface of the egg membrane. There are four of these filaments, and when the eggs are first emitted they are coiled around the egg membrane externally in a spiral manner. Very soon after oviposition they commence to uncoil from around the egg, and when a number are stirred or shaken about in a small dish they soon become entangled together so as to hang together in bunches or strings. These threads are about eight times the length of the diameter of the ovum, and are apparently composed of the same tough material as that which enters into the formation of the egg membrane itself. In the immature condition, and when the ovarian egg is still far from full grown, I find the threads present on the outside of the zona or membrane, closely adherent to the latter. In this condition the membrane is relatively thicker than in more mature eggs, and the nucleus is quite conspicuous at the center of the immature vitellus.

The filaments at the point of attachment to the egg membrane are somewhat enlarged, but have no bulbous base as in the case of those found on the ova of the silver gar. The egg is heavier than sea water, the oil drops embedded in the yolk seeming to have no tendency to buoy them up.

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The eggs being taken at night renders it possible that the species is a nocturnal spawner, while the singular threads or filaments may be the means by which the parent fish is enabled to suspend its ova to some fixed support in the water as they are emitted from the oviduct. This might be accomplished by the female while the eggs were expelled by simply passing her body over the stems or leaves of marine plants in her vicinity. This affords an explanation of the remarkable threads which are attached to and at first encircle the egg. We can not escape the conclusion, at any rate, that these threads are of the nature of a protective contrivance either to suspend the eggs to foreign objects or else to entangle them together in masses, such as we find to be the case with the eggs of the silver gar, where the filaments are, however, scattered over the whole surface of the egg.

Professor Ryder noted that a full-grown female of this species would not yield more than 300 eggs; but in this respect, as well as in regard to the number of filaments, the observations of Prof. W. J. Moenk-

*On the thread-bearing eggs of the silversides (*Menidia*), by John A. Ryder (Bulletin of the U. S. Fish Commission 1883, 193).

haus are so different that it seems likely that the two observers may have examined different species. This supposition is also warranted by the fact that the specimens came from different localities. Professor Moenkhaus says:

Menidia notata.—Eggs were obtained in abundance from June 1 to July 2, 1901. At Cold Spring Harbor eggs were taken until July 15. The eggs are usually not perfectly spherical, but have various slight irregularities. At one pole there is a tuft of about 50 filaments, very elastic and several times the diameter of the egg in length. These become matted together, forming a central core around which the eggs are clustered like grapes around the stem. The protoplasmic disk is comparatively large. The eggs when ripe are exceedingly easily expressed, so that the fish must be handled rather carefully. A good-sized female yielded 1,413 eggs.

Dr. Bumpus has published the following notes* regarding the spawning time of silversides on Cape Cod:

Two species of *Menidia* (*gracilis* and *notata*) abound in the neighborhood of the laboratories. The following has been taken from the notes kindly furnished by Dr. C. Judson Herrick:

"On June 5, 1896, Mr. Edwards found *Menidia notata* spawning at Hyannis in vast numbers. At this time the fish had selected a point in the beach grass above the low-tide level, and at low tide the eggs were consequently exposed to the sun and dried. Mr. Edwards noted great quantities of spawn and milt, and collected about a quart of the former.

"During the last days of June and the first ten days of July of the present year the fish were very scarce, though Dr. Herrick found a few ripe females and a very few males. The eggs adhere to each other in thick, ropy masses, and to any foreign object with which they come in contact by means of long threads. Both fertile and unfertile eggs sink to the bottom, and the first cleavage plane appears in about one hour. The eggs may be artificially hatched in jars of running water, the period of incubation being ten days. The young fish, which carry a small yolk-sac, are about 6 mm. in length. Fry were skimmed from the surface of the harbor on July 4, and measured 1.5 cm. in length. On July 9 fry similarly taken measured 2.25 cm. in length.

"The eggs of *Menidia gracilis* resemble those of *Menidia notata*, but the species seems to breed later, since many ripe females were taken during the first week in July. The eggs, however, do not undergo artificial fertilization as readily as those of the first species."

FOOD OF THE SILVERSIDES.

The silversides subsist upon minute animal and vegetable organisms, particularly small crustaceans, and doubtless devour a great many floating eggs of other fishes. Dr. Smith informs me that he has found several with young lobsters about three-fourths inch long in their stomachs. As may be seen in the appended tables, the bulk of the food of the common northern silverside consists of small crustaceans, but they eat whatever meat falls within their reach, not disdaining the eggs and young of their own kind. That they feed both at the surface and at the bottom is clearly shown by the character of the food. Copepods, other free-swimming crustaceans, and insects are frequently eaten; and often mud, algæ, and diatoms from the bottom are found in their stomachs.

*H. C. Bumpus, Science, N. S., vol. VIII, No. 207, p. 4, December 16, 1898.

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The following detailed data show the nature of the stomach contents of series of silversides from Woods Hole, collected at frequent intervals between April and December, 1900, by Mr. Vinal N. Edwards. Incidentally, the length, sex, and spawning condition are given.

Stomach contents of silversides from Woods Hole.

[Great Harbor, April 1, 2 p. m.; bottom grass and mud; temperature of water 37° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	<i>Inches.</i>			
1	4.12	Male	Gonads small.....	Copepods.
2	4.60	Female.....	.....do.....	Fragment 1.5 inches long of slender fish.
3	4	Male .....	.....do.....	Full of copepods.
4	4.25	Female.....	.....do.....	Do.
5	4.25	.....do.....	.....do.....	Do.
6	3.50	Male .....	.....do.....	Copepods and 1 amphipod.
7	3.37	Female.....	.....do.....	Empty.
8	3.75	Male .....	.....do.....	Full of copepods.
9	3.12	Female.....	.....do.....	Empty.
10	2.75	Male .....	.....do.....	Do.

[Eel Pond, April 5, 10 a. m.; bottom grass and mud; temperature of water 38° F.]

1	4.75	Male	Gonads well advanced	Full of small copepods.
2	4.12	Female.....	.....do.....	Do.
3	4.37	Male .....	.....do.....	Do.
4	4	Female.....	.....do.....	Copepods and mysis.
5	4.06	.....do.....	.....do.....	Full of copepods.
6	4.25	.....do.....	.....do.....	Do.
7	3.75	.....do.....	.....do.....	Mysis and copepods.
8	3.75	.....do.....	.....do.....	Distended with copepods.
9	4.94	Male .....	.....do.....	Mysis and copepods.
10	4	Female.....	.....do.....	Full of copepods.

[Great Harbor, April 12, 10 a. m.; bottom grass and sand; temperature of water 59° F.]

1	4.06	Female.....	Gonads well advanced	Copepods and mysis.
2	3.62	.....do.....	.....do.....	Copepods.
3	4.25	Male .....	.....do.....	Copepods and 1 mysis.
4	3.75	.....do.....	.....do.....	Mysis and a few copepods.
5	3.56	.....do.....	.....do.....	Few copepods.
6	4.37	Female.....	.....do.....	Do.
7	4.31	.....do.....	.....do.....	Full of copepods.
8	3.50	Male .....	.....do.....	Copepods and mysis.
9	2.94	.....do.....	.....do.....	Do.
10	3.12	Female.....	.....do.....	Do.

[Great Harbor, April 16, 10 a. m.; bottom grass and mud; temperature of water 40° F.]

1	4.56	Female.....	Gonads advanced	Full of small copepods.
2	4	.....do.....	Gonads small.....	Do.
3	4.25	.....do.....	Gonads large.....	Copepods and mysis.
4	4	.....do.....	Well advanced.....	Full of mysis.
5	4.62	Male .....	.....do.....	Distended with copepods.
6	4	Female.....	Gonads large.....	Do.
7	3.56	Male .....	.....do.....	Full of mysis.
8	3.37	.....do.....	.....do.....	Full of copepods.
9	3.56	.....do.....	.....do.....	Do.
10	3.12	.....do.....	.....do.....	Do.

[Eel Pond, April 20, 11 a. m.; bottom mud and eelgrass; temperature of water 44° F.]

1	3.75	Male	Gonads large.....	Copepods.
2	4.37	Female.....	Well advanced.....	Few copepods and mysis.
3	3.56	Male .....	.....do.....	Full of copepods.
4	4.18	Female.....	Gonads small.....	Do.
5	4	.....do.....	Well advanced.....	Full of mysis and copepods.
6	3.87	.....do.....	Gonads small.....	Full of copepods.
7	3.43	Male .....	.....do.....	Do.
8	4	.....do.....	.....do.....	Do.
9	3.31	Female.....	Gonads large.....	Empty.
10	3.87	.....do.....	Gonads small.....	Full of copepods.

Stomach contents of silversides from Woods Hole—Continued.

[Great Harbor, April 27, 2 p. m.; bottom sand and eelgrass; temperature of water 46° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	<i>Inches.</i>			
1	4.66	Female...	Advanced	Full of mysis.
2	4.12	.....do	Well advanced	Do.
3	4	.....do	Well advanced	Full of copepods.
4	4	Male	Advanced	Full of mysis.
5	4.25	.....do	.....do	Distended with mysis.
6	3.81	Female...	Gonads small.....	Full of copepods.
7	3.62	Male	Well advanced	Do.
8	3.81	.....do	.....do	Mysis.
9	4	Female...	Advanced	Full of copepods.
10	3.81	.....do	Well advanced	Copepods.

[Eel Pond, May 1, 10.30 a. m.; bottom mud and eelgrass; temperature of water 47° F.]

1	4.37	Female...	Well advanced	Mysis.
2	4.25	.....do	Gonads small.....	Full of mysis.
3	4.18	Male	Gonads large.....	Full of copepods with some mysis.
4	4.12	Female...	Gonads small.....	Full of mysis.
5	3.37	.....do	.....do	Copepods.
6	3.75	.....do	.....do	Copepods and mysis.
7	4.31	.....do	.....do	Do.
8	3.87	Male .....	.....do	Full of copepods and mysis.
9	3.75	.....do	.....do	Full of mysis.
10	4.25	Female...	.....do	Do.

[Great Harbor, 2.30 p. m.; bottom eelgrass and sand; temperature of water 48° F.]

1	4	Male	Gonads large.....	Full of copepods.
2	4.37	Female...	Well advanced	Do.
3	4.31	Male	Advanced	Do.
4	3.75	Female...	Gonads small.....	Do.
5	4.5	.....do	.....do	Do.
6	3.56	Male	Gonads large.....	Do.
7	3.75	Female...	Gonads small.....	Copepods.
8	3.87	Male	Gonads large.....	Do.
9	3.25	.....do	Well advanced	Empty.
10	2.94	.....do	Gonads large.....	Do.

[Eel Pond, May 16, 10.30 a. m.; bottom eelgrass and sand; temperature of water 52° F.]

1	3.87	Female...	Advanced	Distended with copepods.
2	3.87	.....do	.....do	Full of several species of winged insects.
3	3.87	.....do	Gonads small.....	Distended with copepods.
4	3.87	.....do	.....do	Empty.
5	3.5	Male	Advanced	Full of copepods.
6	3.31	Female...	Gonads large.....	Empty.
7	3	Male	Advanced	Do.

[Great Harbor, May 25, 10 a. m.; bottom grass and sand; temperature of water 55° F.]

1	3.81	Female...	Ripe	Full of copepods.
2	4.37	.....do	Nearly ripe.....	Do.
3	4.25	.....do	Well advanced	Distended with copepods.
4	4.18	.....do	Ripe	Do.
5	3.56	.....do	.....do	Few copepods.
6	3.87	Male .....	.....do	Full of copepods.
7	3.37	.....do	.....do	Very few copepods.
8	3.5	.....do	.....do	Copepods.
9	3.62	Female...	Well advanced	Few copepods.
10	2.75	Male	Ripe	Full of copepods.

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Stomach contents of silversides from Woods Hole—Continued.

[Eel Pond, May 30, 2 p. m.; bottom grass and mud; 10 bushels of fish taken; temperature of water 56° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	<i>Inches.</i>			
1	4.5	Female...	Ripe.....	Distended with copepods.
2	4.18	Male.....	do.....	Full of copepods.
3	4.43	Female...	do.....	Do.
4	4.31	do.....	do.....	Distended with copepods.
5	4.31	do.....	Advanced.....	Do.
6	3.43	Male.....	Ripe.....	Copepods.
7	3.18	do.....	do.....	Do.
8	3.12	do.....	do.....	Full of copepods.
9	3.25	Female...	do.....	Copepods.
10	2.87	Male.....	do.....	Few copepods.

[Great Harbor, June 9, 10.30 a. m.; bottom grass and sand; temperature of water 60° F.]

1	4	Female...	Ripe.....	Copepods.
2	4.62	do.....	do.....	Distended with copepods.
3	3.87	do.....	do.....	Few copepods.
4	3.94	do.....	do.....	Do.
5	4	Male.....	do.....	Full of copepods.
6	3.87	do.....	do.....	Copepods.
7	3.87	Female...	Advanced.....	Do.
8	3.5	do.....	Ripe.....	Do.
9	3.62	do.....	do.....	Very few copepods.
10	2.75	Male.....	do.....	Full of copepods.

[Eel Pond, June 11, 11 a. m.; bottom grass and mud; no silversides seen at the surface for three weeks; temperature of water 62° F.]

1	4.5	Female...	Ripe.....	Few copepods.
2	4.25	do.....	Well advanced.....	Full of copepods.
3	4.37	do.....	Ripe.....	Do.
4	4.5	do.....	Well advanced.....	Do.
5	4.43	do.....	Ripe.....	Do.
6	4.43	do.....	Nearly ripe.....	Few copepods.
7	4.12	do.....	Ripe.....	Very few copepods.
8	4	do.....	Advanced.....	Distended with copepods.
9	3.37	Male.....	Ripe.....	Copepods.
10	2.87	do.....	do.....	Do.

[Katama Bay, June 15, 11 a. m.; bottom sand and stones; fish very scarce, but 20 taken in 5 sets of seine; temperature of water 65° F.]

1	5.25	Female...	Ripe.....	Full of Menidia eggs.
2	5.18	do.....	do.....	Eggs with embryos; amphipods.
3	4.5	do.....	do.....	Empty.
4	4.81	do.....	do.....	Full of small ova with embryos.
5	3.94	do.....	do.....	?
6	4.25	do.....	do.....	Empty.
7	3.81	do.....	do.....	Do.
8	3.37	Male.....	do.....	Some small ova with embryos.
9	3.43	do.....	do.....	Copepods.
10	3.25	do.....	do.....	Few copepods and Menidia eggs.

[Eel Pond, June 23, 10 a. m.; bottom grass and mud; no silversides seen at the surface; temperature of water 64° F.]

1	4.5	Female...	Well advanced.....	Full of copepods.
2	4.75	do.....	do.....	Copepods.
3	4.37	do.....	do.....	Do.
4	4.5	do.....	do.....	Do.
5	4.25	?.....	do.....	Full of copepods.
6	4.37	?.....	do.....	Do.
7	4	Female...	Well advanced.....	One small annelid.
8	3.75	do.....	do.....	Full of Menidia eggs.
9	2	Male.....	do.....	Full of copepods.
10	2.43	Female...	do.....	Do.

Stomach contents of silversides from Woods Hole—Continued.

[Great Harbor, June 30, 1 p. m.; bottom grass and sand; silversides scarce; temperature of water 65° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	<i>Inches.</i>			
1	4.5	Female	Nearly ripe	Copepods and Menidia eggs.
2	4.5	do	Ripe	Menidia eggs, copepods, mysis.
3	3.56	do	do	Empty.
4	4.18	do	Not well advanced	Few mysis.
5	4.06	do	Well advanced	Empty.
6	3.37	Male	Ripe	Few copepods.
7	3.31	do	do	Very few copepods.
8	3.12	do	do	Empty.
9	3.62	do	do	Copepods.
10	3.37	Female	do	Empty.

[Hadley Harbor, July 5, 2 p. m.; bottom grass and mud; silversides very scarce; temperature of water 66° F.]

1	4.56	Female	Well advanced	Few mysis.
2	4.18	do	Spent	Full of mysis.
3	3.5	Male	Well advanced	Few copepods.
4	4.37	Female	Spent	Full of young squid (Loligo).
5	3.87	do	do	Empty.
6	3.68	do	do	Do.
7	3.81	do	do	Few mysis.
8	3.75	do	do	Empty.
9	3.5	Male	Well advanced	Few mysis.
10	3.43	do	do	Empty.

[Katama Bay, July 13, 11 a. m.; bottom sand and weeds; silversides very abundant; temperature of water 72° F.]

1	5.5	Female	Spent	Small crustaceans.
2	4.62	Male	Gonads large	Small crustaceans and 1 shrimp (Cragon).
3	4.06	do	do	Empty.
4	3.94	Female	Spent	?
5	4	Male	Gonads large	Algæ and Menidia eggs.
6	4	Female	Spent	?
7	3.56	Male	Gonads large	Empty.
8	3.5	do	do	Some small crustaceans.
9	3.5	Female	do	Alga and fish egg (Menidia).
10	3.48	do	do	

[Great Harbor, July 17, 11 a. m.; bottom eelgrass; temperature of water 70° F.]

1	4.68	Female	Spent	Empty.
2	4.43	do	do	Very few copepods.
3	4.81	do	do	Annelid setæ and algæ.
4	4.31	do	do	Do.
5	4.5	do	do	Do.
6	3.87	do	do	Larval crabs.
7	3.81	Male	do	Do.
8	3.5	do	Gonads large	Do.
9	3.62	Female	Spent	Empty.
10	3.18	Male	do	Annelid setæ?

[Katama Bay, July 27, 1 p. m.; bottom sand and gravel; temperature of water 72° F.]

1	4.62	Male	Spent	Embryo worms?
2	4.56	Female	do	
3	4.37	do	do	
4	5	do	do	Little algæ.
5	4.25	do	do	Empty.
6	4			
7	4.25	Female	Spent	Eggs and embryo worms? Larval decapods and other species.
8	4.37	do	do	
9	3.62	Male	do	Eggs and embryo worms? Larval decapods and other species.
10	3.75	do	do	Do.

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Stomach contents of silversides from Woods Hole—Continued.

[Great Harbor, July 31, 10 a. m.; bottom sand and grass; silversides very scarce; temperature of water 71° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	<i>Inches.</i>			
1	4.5	Female...	Spent.....	Empty.
2	4	Male.....	.....do.....	Do.
3	4.06	.....do.....	.....do.....	Very few amphipods.
4	4.12	Female...	Gonads small.....	Empty.
5	4.75	Male.....	Gonads very small.....	
6	4.75	Female...	.....do.....	Do.
7	4.12	Male.....	.....do.....	Annelid setae and other material?
8	3.5	.....do.....	Gonads large.....	Small mysis.
9	3.43	.....do.....	Gonads small.....	Empty.
10	2.87	.....do.....	.....do.....	Do.

[Katama Bay, August 8, 12 m.; bottom sand and gravel; silversides very scarce; temperature of water 73° F.]

1	4.5	Female...	Spent.....	Full of sand and diatoms.
2	4.5	.....do.....	.....do.....	1 menidia 1.5 inches long.
3	4.37	Male.....	.....do.....	Full of sand and diatoms.
4	4.37	.....do.....	.....do.....	Do.
5	4	.....do.....	.....do.....	Do.
6	4.37	Female...	Spent.....	Empty.
7	4.31	.....do.....	.....do.....	Full of sand and diatoms.
8	4.25	.....do.....	.....do.....	Do.
9	4.25	.....do.....	.....do.....	Do.
10	4.25	.....do.....	.....do.....	Do.

[Katama Bay, August 15, 1 p. m.; bottom sand and gravel; very many silversides; temperature of water 70° F.]

1	4.68	Male.....	Spent.....	Full of fine algæ.
2	4.56	Female...	.....do.....	1 shrimp.
3	5.18	.....do.....	.....do.....	Small amount fine algæ.
4	4.62	.....do.....	.....do.....	Full of amphipods.
5	4.5	Male.....	.....do.....	Empty.
6	4.18	Female...	.....do.....	Do.
7	4.25	.....do.....	.....do.....	Do.
8	4	Male.....	.....do.....	Do.
9	3.37	.....do.....	.....do.....	Do.
10	2.81	.....do.....	.....do.....	Do.

[Woods Hole, August 25, 2 p. m.; bottom sand and eelgrass; silversides very plenty; temperature of water 72° F.]

1	4.06	Female...	Spent.....	Fine algæ.
2	4.81	.....do.....	.....do.....	Empty.
3	3.43	.....do.....	.....do.....	Do.
4	3.18	Male.....	.....do.....	Fine algæ.
5	3.5	Female...	.....do.....	Empty.
6	3	Male.....	.....do.....	Fine algæ.
7	3.31	.....do.....	.....do.....	Full of copepods.
8	3.06	.....do.....	.....do.....	Do.
9	2.87	Female...	.....do.....	Empty.

[Katama Bay, August 29, 2 p. m.; bottom sand and gravel; silversides very plenty; temperature 73° F.]

1	4.5	Female...	Spent.....	Empty.
2	3.81	.....do.....	.....do.....	Do.
3	3.5	.....do.....	.....do.....	Do.
4	3.87	.....do.....	.....do.....	
5	3.37	.....do.....	.....do.....	Amphipods.
6	3.12	Male.....	.....do.....	Copepods.
7	3.25	.....do.....	.....do.....	Empty.
8	3	Female...	.....do.....	Copepods.
9	3	Male.....	.....do.....	Empty.
10	2.75	Female...	.....do.....	Fragments of minute crustaceans.

Stomach contents of silversides from Woods Hole—Continued.

[Katama Bay, September 11, 1 p. m.; bottom sand and gravel; silversides very plenty; temperature of water 72° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	<i>Inches.</i>			
1	3.75	.....	Spent.....	Empty.
2	3.5	Male.....	.....do.....	Do.
3	3.37	.....do.....	.....do.....	Do.
4	3.25	Female.....	.....do.....	Mysis?
5	3.18	Male.....	.....do.....	Do.
6	3	Female.....	.....do.....	Do.
7	2.87	Male.....	.....do.....	Full of minute copepods and Cladocera.
8	2.87	.....do.....	.....do.....	Do.
9	3.18	Female.....	.....do.....	Empty.
10	2.81	.....do.....	.....do.....	Do.

[Katama Bay, September 24, 2 p. m.; bottom sand and grass; silversides very plenty; temperature of water 65° F.]

1	4.06	Female.....	Gonads small.....	Small shrimp.
2	3.81	.....do.....	.....do.....	Empty.
3	4.87	.....do.....	.....do.....	Do.
4	3.37	Male.....	.....do.....	Few young prawns (Pandalus).
5	3.5	.....do.....	.....do.....	Do.
6	3.62	.....do.....	.....do.....	Do.
7	3.62	.....do.....	.....do.....	Wasp and several species of diptera.
8	3.5	Male.....	.....do.....	Young prawns.
9	3.5	.....do.....	.....do.....	Do.
10	3	.....do.....	.....do.....	Empty.

[Wareham River, September 25, 1 p. m.; bottom mud and grass; silversides very plenty; temperature of water 66° F.]

1	5	Male.....	Gonads very minute.....	Empty.
2	5	.....do.....	.....do.....	Do.
3	5	Female.....	.....do.....	Small shrimp.
4	5	.....do.....	.....do.....	Winged ants and diptera.
5	5.5	Male.....	.....do.....	Empty.
6	5	Female.....	.....do.....	Do.
7	5	.....do.....	.....do.....	Prawn.
8	4.75	.....do.....	.....do.....	Empty.
9	4.87	Male.....	.....do.....	Do.
10	4.25	.....do.....	.....do.....	Ants.

[New Bedford, October 5, 11 a. m.; bottom mud and algae; silversides very plenty; temperature of water 65° F.]

1	3.87	Male.....	Gonads very small.....	Winged ants.
2	4.06	.....do.....	.....do.....	Do.
3	3.75	.....do.....	.....do.....	Empty.
4	3.43	.....do.....	.....do.....	Young prawns.
5	3.68	.....do.....	.....do.....	Ant.
6	3.5	Female.....	.....do.....	Do.
7	3.87	.....do.....	.....do.....	Young prawn.
8	3.5	Male.....	.....do.....	Empty.
9	3.68	.....do.....	.....do.....	Do.
10	3.18	.....do.....	.....do.....	Amphipods.

[Woods Hole, October 11, 10 a. m.; bottom grass and sand; silversides very plenty; temperature of water 64° F.]

1	4.37	Female.....	Gonads large, diseased.....	Young prawns.
2	3.43	Male.....	Gonads small.....	Do.
3	3.5	.....do.....	.....do.....	Do.
4	3.5	.....do.....	.....do.....	Do.
5	3.5	.....do.....	.....do.....	Winged ants.
6	3.31	Male.....	.....do.....	Empty.
7	3.31	Female.....	.....do.....	Do.
8	3.25	Male.....	.....do.....	Do.
9	3.37	.....do.....	Gonads very small.....	Do.
10	2.62	.....do.....	.....do.....	Do.

Stomach contents of silversides from Woods Hole—Continued,

[Katama Bay, October 20, 11 a. m.; sand and gravel; silversides very plenty; temperature of water 57° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
1	4.18	Female...	Gonads small.....	Empty.
2	4.	Male.....	do.....	Vegetable fiber, sand, many diatoms (<i>Pleurosigma</i>).
3	4.12	do.....	do.....	Fair-sized prawns.
4	3.94	do.....	do.....	Alga and diatoms.
5	4	do.....	do.....	Filled with diatoms of different kinds.
6	3.75	Female.....	do.....	Distended with ooze and diatoms (<i>Pleurosigma</i>).
7	3.56	Male.....	do.....	Do.
8	3.43	Female.....	do.....	Fine alga.
9	3.43	do.....	do.....	Distended with diatoms, principally <i>Pleurosigma</i> .
10	3.12	Male.....	do.....	Do.

[Eel Pond, November 5, 10 a. m.; bottom mud and grass; temperature of water 66° F.]

1	4.62	Female...	Gonads very small.....	Small prawns (<i>Pandatus</i>).
2	4	do.....	do.....	Empty.
3	3.75	do.....	do.....	Brown ooze and diatoms.
4	4.25	do.....	do.....	White ooze and diatoms.
5	4	Male.....	do.....	Empty.
6	4.06	Female.....	do.....	Brown ooze and diatoms of several kinds.
7	4	do.....	do.....	Do.
8	3.87	do.....	do.....	Do.
9	3.75	do.....	do.....	Do.
10	3.62	do.....	do.....	(?)

[Great Harbor, November 13, 10 a. m.; bottom sand and grass; silversides very abundant; temperature of water 50° F.]

1	5.25	Female...	Gonads very small.....	1 young prawn.
2	5.75	do.....	do.....	Do.
3	5.25	do.....	do.....	Do.
4	5.25	do.....	do.....	Do.
5	5.5	do.....	do.....	Empty.
6	5.12	do.....	do.....	Do.
7	5.18	do.....	do.....	Do.
8	4.06	Male.....	do.....	1 young or small prawn.
9	4.87	do.....	do.....	2 small prawns.
10	4	Female.....	do.....	1 small prawn.

[Eel Pond, November 15; silversides very abundant.]

1	5.87	Female...	Gonads small.....	2 small prawns.
2	5.75	do.....	do.....	1 small prawn.
3	5.5	do.....	do.....	Do.
4	5.43	do.....	do.....	Do.
5	5.5	do.....	do.....	Empty.
6	5.18	do.....	do.....	Do.
7	5.25	do.....	do.....	1 small prawn.
8	5.37	Male.....	do.....	Do.
9	5.06	do.....	do.....	Do.
10	4.87	do.....	do.....	Empty.

[Eel Pond, November 20, 2 p. m.; bottom grass and mud; silversides very abundant; temperature of water 49° F.; very slender fish.]

1	5.37	Female...	Gonads very small.....	3 prawns, largest 1, inches long.
2	4.87	do.....	do.....	2 prawns.
3	4	do.....	do.....	Empty.
4	4	do.....	do.....	Few copepods.
5	3.62	do.....	do.....	Some alga and few fish eggs.
6	3.5	do.....	do.....	Few small fish eggs.
7	3.25	do.....	do.....	Empty.
8	3.5	Male.....	do.....	(?)
9	3.37	do.....	do.....	Empty.
10	2.87	do.....	do.....	Do.

Stomach contents of silversides from Woods Hole—Continued.

[Off the dock, Woods Hole, December 7, 2 p.m.; fish at surface; temperature of water 45° F.]

No.	Total length.	Sex.	Spawning condition.	Stomach contents.
	<i>Inches.</i>			
1	3.43	Female...	Gonads very small.....	Empty.
2	3.37	.....do.....	.....do.....	Do.
3	3.43	Male.....	.....do.....	Do.
4	3.5	.....do.....	.....do.....	Do.
5	3.37	.....do.....	.....do.....	Do.
6	3.37	Female.....	.....do.....	Do.
7	4	Male.....	.....do.....	Do.
8	3.43	.....do.....	.....do.....	Do.
9	3	Female.....	.....do.....	Do.
10	3.25	?.....	.....do.....	Do.

[Off the dock at Woods Hole, December 21; silversides very abundant at the surface; temperature of water 36° F.]

1	3.37	Female...	Gonads very small.	Empty.
2	3.37	Male.....	.....do.....	Do.
3	3.25	.....do.....	.....do.....	Do.
4	3.37	.....do.....	.....do.....	Do.
5	3.43	Female.....	.....do.....	Do.
6	3.75	?.....	.....do.....	Do.
7	3.25	Female.....	.....do.....	Do.
8	3.5	.....do.....	.....do.....	Do.
9	3.18	.....do.....	.....do.....	Do.
10	2.75	Male.....	.....do.....	Do.

DESCRIPTIONS AND SYNONYMY.

As regarded by Jordan & Evermann in Fishes of North and Middle America, the genus *Menidia* now includes ten species and one subspecies in the United States, five of which and the subspecies are found on the Atlantic coast. These are *M. gracilis*, *M. gracilis beryllina*, *M. peninsulae*, *M. audens*, *M. notata*,* and *M. menidia*.

An examination of a large series of specimens from localities ranging from Halifax, Nova Scotia, to Texas and comparison with the types of some of the species force the conclusion that a readjustment of the nomenclature is necessary. On the Atlantic coast the species are at present arranged in two groups, one of which is characterized by a long anal fin, the other by a comparatively short one. The first group comprises *M. menidia* and *M. notata*; the second *M. gracilis*, *M. gracilis beryllina*, *M. peninsulae*, and *M. audens*.

In the following pages are given a key to the eastern United States species, a redescription of each species, notes and references having an important bearing on the question of their relationship, and tables of measurements from a number of localities.

Although the different forms when mixed together are readily distinguished by the eye, it is difficult to represent their differences by measurements or figures. The differences are small, and to show them in comparative tables requires a larger series of each form than has been accessible. The depth is exceedingly variable, depending upon a variety of circumstances. For instance, a fish in spawning condition will be far deeper than one not in that condition.

* On page 2840, part III, Jordan & Evermann state that owing to the perfect intergradation between specimens from Florida to Nova Scotia, this form should stand as a subspecies of *M. menidia*.

A careful study of many specimens shows that in the same species from different localities some differences are noticeable. These differences are not individual variation, neither are they constant enough to constitute distinct species, nor will the conditions permit of their being called subspecies. They are rather group differences, constituting what perhaps may be termed geographical races.

It might be asked what is meant by "geographical race." This is difficult to explain, but as intended to be understood here is, as said before, a group of slight variation not satisfying the conditions of species or subspecies—these two being interpreted as (1) a form between which and another closely related form a structural gap exists; (2) one of two closely related forms, one of which has sprung from the other, between which there is no gap, but the differences grade into each other through different localities. A subspecies may be termed an incipient species. According to this definition, then, a "race" may be called an incipient subspecies; in other words, an indication of how a subspecies may originate—through some change in environment. To illustrate: *M. peninsulae*, occurring at Pensacola (the type locality) and at Indian River, Florida, each locality group differing somewhat from the other should intergrade through successive localities to form a subspecies at Indian River. As a matter of fact, they can not be told apart; but intermediate groups, occupying localities of somewhat different conditions, differ slightly as groups but not always sufficiently as individuals to cause even a suspicion of another species. There may even be groups intervening which do not differ from the typical species.

Key to the species of Menidia of the east coast of the United States.

(This key will apply exactly only to those close to the typical examples. Difficulty will be found with the intergrading or mixed forms.)

- a. Anal rays 15 to 17, rarely 19; scales 38 to 41.
 - b. Snout equal to or longer than eye; anal base shorter than head.
 - c. Body generally deep, depth 4.5 to 5.5 in length to base of the caudal. Light colored; often somewhat speckled on sides; large salt-water form. Eastern Florida to Texas *M. peninsulae*.
 - cc. Body generally slender, depth 5 to 7 in length to base of caudal; small fresh-water forms.
 - d. Origin of spinous dorsal nearer base of caudal than tip of snout; depth 6. Small, light colored, fresh-water form. Lower Mississippi Valley *M. audens*.
 - dd. Origin of spinous dorsal midway between tip of snout and base of caudal; * depth 5 to 7. Small, usually dark colored, fresh-water form. Florida.
 - M. peninsulae atrimentis*.
 - bb. Snout mostly shorter than eye; anal base longer than head; body compressed laterally. Potomac River *M. beryllina*.
 - e. Snout blunter than the above; body rather round and caudal peduncle usually shorter. Coastwise, Massachusetts to South Carolina *M. beryllina cerea*.
- aa. Anal rays 20 to 27; scales 39 to 50-8 to 10.
 - f. Origin of spinous dorsal nearer base of caudal than tip of snout; scales 39 to 45-7 or 8 *M. menidia*.
 - ff. Origin of spinous dorsal about midway between tip of snout and base of caudal; scales 45 to 50-8 to 10 *M. menidia notata*.

*This character holds strictly good in our typical specimens from the east coast of Florida and St. Johns River, but the majority of those from "Salt Lake," west coast of Florida, have the fin somewhat nearer caudal, in this respect approaching *M. audens*.

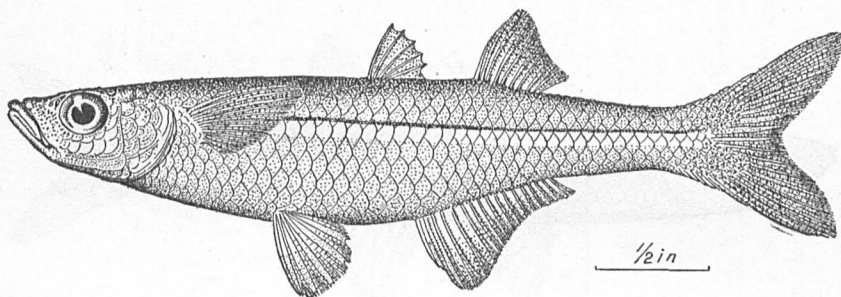
Menidia peninsulae (Goode & Bean).

Chirostoma peninsulae Goode & Bean, Proceedings of U. S. National Museum 1879, 148.

Menidia peninsulae, Jordan & Gilbert, Proceedings of U. S. National Museum 1882, 266, and Synopsis, 407, 1883; Jordan & Evermann, Fishes of North and Middle America, 797, 1896.

This is the most common silverside of Florida and the Gulf States; found, so far as now known, only in salt water. From the different localities they differ considerably in appearance, according to their environment. On clear, sandy beaches they are very light colored; in weedy places, often thickly punctate with black, giving them a dusky appearance. In the original description specimens from Lake Monroe were included with *M. peninsulae*. They are found to differ in some respects, and are presented in this paper under another head. *M. peninsulae* attains the largest size of the species with short anal fins. We have specimens from both coasts of Florida and from Louisiana, Mississippi, and Texas.

This species most clearly resembles *M. beryllina*, from which it differs chiefly in the longer snout, which equals eye; the base of the anal mostly shorter than the head, never longer, and its larger adult size. Color, as in *M. beryllina*; from some localities darker than the typical Potomac River fish. Total length 3.50 inches; head 4.20 in length without tail; depth 5.50 in same; eye 3 in head; snout 3+ in same; D. v-i, 8; A. i, 16; scales 39-8. From one of the type specimens. Color, light greenish; edges of scales with dark dots; lips and top of head dusky; a dusky streak along base of anal.



Menidia peninsulae (Goode & Bean). Figure from a specimen from Titusville, Fla.

Specimens from Pensacola (type and cotypes) range in measurements as follows: Total length 2.5 to 3.75 inches; head 4 to 4.3; depth 4.5 to 5.5; eye 3+ to 3.16; snout 3+ to 3.16; D. iv to vi, i, 8 to 10; A. i, 15 to 17; scales 38 to 43-8 to 9.

From Wechawatchee River, Hernando County: Total length 2.75 to 3.25 inches; head 4 to 4+; depth 5 to 5.5; eye 3 to 3+; snout 3 to 3+; D. iv to v, i, 8 or 9, mostly iv-i, 8; scales 39 to 41.

From Tarpon Springs, Florida: Total length 2.12 to 2.87 inches; head 3.4 to 3.75; depth 4.66 to 5.25; eye 2.6 to 3; snout 3.2 to 3.4; D. iv to vi, i, 8 to 10, mostly v-i, 9; A. i, 14 to 16, mostly i, 16; scales 38 to 40.

From Anclote Sponge Kraals, Florida: Total length 2.25 to 2.62; head 3.5 to 4; depth 4.75 to 5.25; eye 2.6 to 3; snout 3 to 3.25; D. v to vi-i, 9, mostly v-i, 9; A. i, 14 to 16, mostly 15; scales 38 to 41.

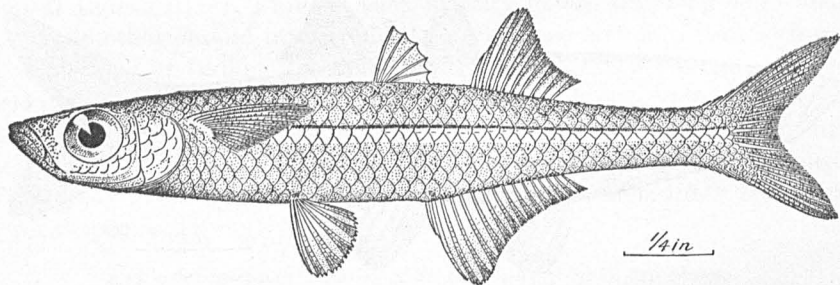
From Titusville: Total length 1.25 to 3.25; head 4 to 4.25; depth 4.75 to 5, mostly 5; eye 2.75 to 3, mostly 3; snout 3 to 3.25, mostly 3; D. iv to vi-i, 9 to 10, mostly v-i, 9; A. i, 15 to 17, mostly 16; scales 37 to 39.

From Grand Plains Bayou, Mississippi: Total length 2 to 3.75 inches; head 4 to 4.5; depth 5.25 to 6; eye 2.6 to 3; snout 3 to 3.5; D. iv to v-i, 9 to 10; A. i, 16 to 17, mostly i, 17; scales 37 to 41.

Menidia peninsulæ atrimentis, new subspecies.

Attention was first attracted to this form by a specimen from South Lake, near Indian River, having a peculiar *Labidesthes*-like appearance—long snout and slender form—but lacking the small scales of *Labidesthes*. Examination of all available specimens of *Menidia* from southern waters revealed similar examples, though not all so slender, from a number of localities in Florida. First, those from Lake Monroe which Goode & Bean included with *M. peninsulæ*; from Lake Jessup, collected by R. E. Earll; then specimens from South Lake at Titusville, Fla., collected by Evermann & Bean; "Salt Lake," near Tarpon Springs, Fla., collected by Evermann & Kendall, and from St. Johns River at Palatka, and from Lake Monroe, collected by the writer.

Total length 2.5 inches; head in length to base of caudal fin 4; depth in same length 6; eye 2.88 in head; snout 3+ in head: D. v-i, 9; A. i, 15; scales 40-8. Very slender; lower jaw longer than eye; spinous dorsal wholly anterior to origin of anal, midway between tip of snout and base of caudal; base of anal much shorter than head, 5 in length of body, equal to distance from base of last rays of soft dorsal to base of upper rudimentary rays of caudal; height of soft dorsal 1.88 and anal 1.66 in head. Color in spirits, straw; scales of back thickly punctuated with black on edges, giving the back a very dusky appearance; few black dots on the sides, not defining the edges of the scales; top of head, snout, and chin black, the black composed of fine dots. Lateral silver stripe overlying black.



Menidia peninsulæ atrimentis Kendall, new subspecies.

This fish is much more slender than *M. peninsulæ*, its nearest relative in southern waters; darker in color and found in waters more nearly fresh. It may be distinguished by its slender form, really longer head and larger eyes, although the measurements of specimens of this species often show the same relative proportions, owing to the fact that many of the *M. peninsulæ* are young and these are more slender than the adults. There is considerable variation, and it seems to intergrade with *M. peninsulæ*, but has not been found to attain so large an adult size as the latter. It seems to be confined to fresh or nearly fresh water. The type (No. 50010, U. S. National Museum) is one of 33 specimens collected by Evermann & Bean in South Lake, Titusville, Florida, January 15, 1896.

(*ater*, black; *mentum*, chin.)

Specimens from South Lake range in measurements as follows: Head 4 to 4.33, mostly 4; depth 5.66 to 6.25; eye 2.89 to 3.25, mostly 3; snout 3; D. v-i, 9 and 10; A. i, 16 to 18; scales 40 to 43.

From Lake Monroe as follows: Head 4+ to 4.5; depth 5.5 to 7; eye 3; snout about 3; D. iv to vi-i, 9 to 11; A. i, 16 to 18, mostly 17; scales 38 to 42. From Palatka, not essentially different from Lake Monroe specimens.

From Salt Lake, near Lake Butler, Tarpon Springs, Florida, as follows: Head 3.8 to 4, mostly 4; depth 5.25 to 6; eye 2.6 to 3, mostly 3; snout 3 to 3.25, mostly 3; D. iv to vi-i, 8 to 10; A. 14 to 19; scales 36 to 40.

Menidia audens Hay.

Menidia audens Hay, Bulletin U. S. Fish Commission, 1882, 64; Jordan & Gilbert, Synopsis, 908, 1883; Jordan & Evermann, Fishes of North and Middle America, 798, 1896.

Found in the fresh waters of Mississippi and Tennessee, and differs from *peninsulae* only in its more slender form. The types are small, all but one being young fish.

Length 3 inches; head 4.5; depth 6; eye 2; snout 3+; D. iv-i, 9; A. i, 17; scales 40-9. Anal base equal to or slightly larger than head; height of first rays of anal equal to height of first rays of soft dorsal, about 1.25 in head.

Specimens range in measurements as follows: total length 1.5 to 3 inches; head 4 to 4.5; depth 6 to 6+; eye 2.33 to 3; snout 3+ to 3.5; D. iv to v-i, 9 to 10; A. i, 17 to 19, mostly 19; scales 39 to 42-9 to 10.

Comparative table of average measurements.

No. of specimens.	Name and locality.	Total length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.
<i>M. peninsulae.</i>									
10	Grand Plains Bayou, Miss.....	2.53	4.16	5.56	2.76	3.28	iv-i, 9	1, 16	38
7	Pensacola, Fla.....	2.03	4.15	5.05	3.02	3.02	vi-i, 9	1, 16	39
10	Anclote, Fla.....	2.53	3.76	4.98	2.91	3.17	v-i, 9	1, 16	39
10	Tarpon Springs, Fla.....	2.53	3.58	5	3.35	3.22	v-i, 9	1, 15	39
4	Wechawatchee, Fla.....	3.03	4	5.18	3+	3+	v-i, 8	1, 16	39
10	Titusville, Fla.....	2.22	4.14	4.93	2.96	3.25	v-i, 9	1, 16	38
	General average of 50 specimens.	2.56	3.95	5.10	3	3.18	v-i, 9	1, 16	39
<i>M. peninsulae atrinensis.</i>									
10	Lake Monroe, Fla....	1.80	4.31	5.90	3+	3	v-i, 10	1, 17	39
3	St. Johns River, Palatka, Fla.....	2.16	4.19	6.19	3+	3	v-i, 10	1, 17	40
10	South Lake, Titusville, Fla.....	2.53	4.07	5.71	3+	3	v-i, 9	1, 16	38
7	Salt Lake, near Tarpon, Fla.....	1.90	4	5.44	2.97	3.64	v-i, 9	1, 16	38
	General average of 30 specimens.	2.09	4.27	5.86	3-	3+	v-i, 9	1, 17	39
<i>M. audens.</i>									
5	Vicksburg, Miss.....	1.82	4.25	6+	2.76	3.16	iv-i, 10	1, 19	40
1	Memphis, Tenn.....	2	4.16	6	3+	3+	iv-i, 10	1, 19	41
1	Edwards, Miss.....	1.50	4	6	3.60	3+	v-i, 9	1, 19	40
	General average of 7 specimens.	1.80	4.20	6	2.77	3.11	iv-i, 10	1, 18	40

Menidia beryllina (Cope).

Chirostoma beryllinum Cope, Transactions American Philosoph. Society, 1866, 403.

Menidia beryllina, Jordan & Gilbert, Synopsis, 408, 1883; H. M. Smith, Bulletin U. S. Fish Commission, 1890, 70, pl. xx, fig. 2.

Menidia gracilis, Jordan & Evermann, Check-list, 331, 1896, and Fishes of North and Middle America, 797, 1896.

Menidia gracilis beryllina, Jordan & Evermann, Check-list, 331, 1896; Fishes of North and Middle America, 797, 1896.

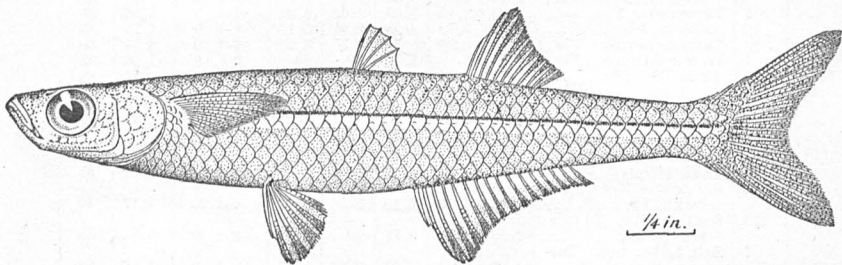
This species was first described by Cope from the Potomac River near Washington in 1866; but strangely enough there are no subsequent records of its having been taken in that neighborhood until H. M. Smith, in 1890, mentions having taken it near Washington, and that it occurs in large numbers in the Lower Potomac; it is recorded in 1891 by the same writer from Pasquotank River and Edenton Bay, North Carolina; then in 1894 by Kendall & Smith from Woods Hole and New Bedford, Mass., and it is mentioned in the same paper as being common at Washing-

ton. In 1897 the writer collected many specimens in the Potomac near Washington. Bean records its capture at Watermill, Long Island.

In Fishes of North and Middle America, Jordan & Evermann, without having examined and compared many specimens, assign the Lower Potomac, Albemarle region, and Woods Hole forms to Günther's *Menidia gracilis*, and leave the Upper Potomac form for Cope's *M. beryllina*, representing that fish from the fresh waters of the Potomac are deeper bodied.

From an examination of a large number of specimens from the localities mentioned, it is found that they seem to intergrade. Specimens from Truro, Falmouth, Woods Hole, New Bedford, Long Island, Chesapeake Bay, Albemarle Sound, Mattamuskeet Lake, North Carolina, and Sampit River, South Carolina, seem to run smaller and of a different general appearance from the typical Potomac fish, possessing sufficient differences to entitle them to a subspecific name. Specimens from St. Georges Island, Lower Potomac, as a rule are rather more slender than those from about Washington, otherwise they do not differ, except in average smaller size. The small size accounts for the slenderness, for small individuals from the vicinity of Washington are just as slender.

Assuming that the numerous specimens collected in the Potomac River in the vicinity of Washington are Cope's *Menidia beryllina*, with the description of which they agree very well, our studies compel us to assign the form called *M. gracilis* to this species. This seems especially justifiable, since the difference is only one of size,



Menidia beryllina (Cope).

and that so slight that it is hardly of subspecific value; furthermore, Günther's *M. gracilis* is *sine patria* and his description does not fit this form better than it does the others. This arrangement will restrict the name *M. beryllina* to the Potomac River form.

Redescription of *Menidia beryllina*.

Length 3 inches; head 4.5; depth 5.50; eye 2.8; snout nearly 4; D. iv-i, 10; A. i, 15; scales 39-9. Lower jaw equal to snout; spinous dorsal entirely in advance of origin of anal, midway between tip of snout and base of upper rudimentary rays of caudal; base of anal longer than head; its height in front greater than height of front of soft dorsal, 1.4 in head; height of soft dorsal 1.75. Color in spirits, straw; sides of head silvery; scales of back edged with dark dots; faint dark dots on rays of soft dorsal; dusky streak at base of anal; lateral silvery stripe overlying black. Specimen from the Potomac River, Washington, D. C., June, 1897, collected by Kendall. (U. S. National Museum No. 50012.)

Specimens from Washington present the following range of measurements: Total length 2.37 to 3 inches; head 4.4 to 4.5; depth 4.83 to 5.33; eye 2.6 to 3; snout 3.25 to 3.5; D. iv to v-i, 9 to 10, mostly iv-i, 10; A. i, 16 to 18; scales 36 to 41.

From Lower Potomac: Total length 2.5 to 2.62 inches; head 4 to 4.5; depth 5.5 to 6; eye 3 to 3+; D. v-i, 9 to 11, mostly v-i, 10; A. i, 15 to 18; scales 38 to 40.

Menidia beryllina cerea, new subspecies.

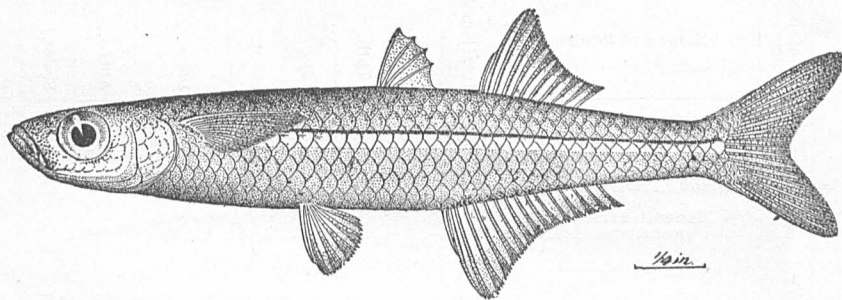
Menidia beryllina, H. M. Smith, Bulletin U. S. Fish Commission, 1891, 192 and 195; Kendall & Smith, Bull. U. S. Fish Commission, 1894, 21; Bean, Bulletin American Museum of Natural History, IX, 1897, 357; Bean, Annual Report New York State Museum, 1900, 102.

Menidia gracilis, (in part) Jordan & Evermann, Check-list, 351, 1896, and Fishes of North and Middle America, 797, 1896.

As previously mentioned, a small *Menidia*, abundant at Woods Hole during the summer months, has hitherto been considered *M. beryllina* or *M. gracilis*. A great many specimens have been examined, and there seems to be considerable variation, some specimens being markedly different from *M. beryllina*, others resembling it more closely. The relative measurements as usually taken do not show differences so much as similarities, so it will be necessary to state that most of those from Woods Hole seem to be much unlike *M. beryllina*, while those from Falmouth have a general resemblance but are considerably smaller.

The New Bedford fish are mostly like those from Woods Hole, but larger specimens were obtained there which are hard to distinguish from the *M. beryllina* from St. Georges Island, Lower Potomac.

Dr. Bean, having examined some of our specimens from Woods Hole, concurs in the opinion that they are the same species as those taken by him at Long Island in fresh water, notwithstanding the fact that many of the Woods Hole specimens were found in salt water and that the original *beryllina* is a fresh-water fish.



Menidia beryllina cerea Kendall, new subspecies.

A specimen from Cape Charles City, Va., seems to be much like the New Bedford fish just mentioned, but bears also resemblance to the Lower Potomac fish. The *M. beryllina*-like forms found farther south appear to be like this specimen. They are intermediate in appearance between the Potomac *M. beryllina* and Woods Hole *M. beryllina cerea*. This arrangement is not the conventional idea of intergradation, but inasmuch as this Woods Hole form is so different from *M. beryllina* as to require some distinguishing designation, it seems that the best that can be done with it is to consider it a subspecies.

This arrangement, then, will include specimens from Truro, Sandwich, Falmouth, Woods Hole, Wareham, and New Bedford, Mass., and Long Island, New York, Cape Charles City, Va., Albemarle Sound and Mattamuskeet Lake, North Carolina, and Sampit River, South Carolina.

Total length 2.37 inches; head 4.14; depth 5.8; eye 2.8; snout 3.5; D. iv-i, 10; A. i, 15; scales 39. Smaller adult size than in *M. beryllina*, less compressed laterally; head bluntly conic; profile from front of eyes to tip of snout more rounded than in *M. beryllina*, outline of muzzle less truncate, and caudal peduncle usually shorter; lateral stripe narrow, occupying fourth row of scales, counting from front of dorsal fin. Color, waxy translucent, thickly punctated with black on top of head and back; dots on edges of scales excepting those of throat; snout and chin black from concentration of dots.

(*Cereus*, waxen.)

U. S. National Museum No. 50011. Collected by B. A. Bean at Waquoit Bay, Mass. Specimens from Falmouth present the following range of measurements: Total length 1.5 to 2.5 inches; head 4 to 4.83; depth 4.5 to 6; eye 2.75 to 3.25; snout 3 to 4; D. iv to vi-i, 9 to 11, mostly v-i, 9 or 10; A. i, 15 to 18; scales 37 to 40.

From Woods Hole: Total length 1.87 to 2.25 inches; head 4 to 4.25; depth 4.6 to 6; eye 3- to 3+; snout 3 to 3.4; D. iv to vi-i, 9 to 10, mostly v-i, 9; A. i, 15 to 20; scales 38 to 41.

From Wareham River: Total length 1.37 to 1.62; head 3.6 to 4; depth 4.75 to 5.75; eye 2.6 to 3; snout 3+ to 3.5; D. iv to v-i, 9 to 10; A. i, 15 to 17; scales 37 to 40.

From Watermill, Long Island: Total length 2 to 2.93 inches; head 4.1 to 4.5; depth 5.44 to 6; eye 2.75 to 3.33; snout 3.14 to 3.33; D. v-i, 9 and 10; A. i, 17 and 18; scales 39 to 41.

From Albemarle Sound: Total length 1.87 inches; head 4.2 to 4.5; depth 6 to 6.33; eye 2.5 to 2.66; D. iv to vi-i, 9 to 11; A. i, 17 to 18; scales 40 to 42.

From Sampit River, South Carolina: Total length 2.12 to 2.87; head 4.16 to 4.75; depth 5.75 to 6.33; eye 2.5 to 3+; snout 3 to 3+; D. iv to vi-i, 9 to 11; A. i, 17 to 19; scales 37 to 40.

Comparative table of average measurements of *Menidia beryllina* and *Menidia beryllina cerea*.

No. of specimens.	Name and locality.	Total length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.
	<i>M. beryllina</i> .								
10	Potomac River, Washington.	Inch. 2.84	4.50	5.07	2.86	3.44	v-1, 10	1, 17	38
10	Potomac River, St. Georges Island.....	2.58	4.20	5.90	3	(?)	v-1, 10	1, 17	(?)
	General average of 20 specimens.....	2.83	4.30	5.63	2.93	3.44	v-1, 10	1, 17	39
	<i>M. beryllina cerea</i> .								
10	Falmouth, Mass.....	2.09	4.16	5.34	3	3.27	v-1, 10	1, 16	37
10	Woods Hole, Mass.....	2.07	4.14	5.17	3	3.09	v-1, 9	1, 16	39
10	Wareham River, Mass.....	1.60	3.43	5.12	2.87	3.28	v-1, 9	1, 16	37
10	Watermill, Long Island.....	2.08	4.26	5.72	3	3.26	v-1, 10	1, 17	40
5	Albemarle Sound, Edenton, N. C.....	1.85	4.28	6.20	2.60	.....	v-1, 10	1, 17	40
1	Lake Mattamuskeet, N. C.....	2.87	4.33	6	3.25	.....	v-1, 11	1, 18	39
8	Sampit River, Georgetown, S. C.....	2.39	4.44	6	2.81	3	v-1, 10	1, 17	37
	General average of 44 specimens.....	2.05	4.20	5.64	2.96	3.24	v-1, 9.5	1, 16	39

Menidia menidia and *Menidia notata*.

Examination of the types of *Menidia dentex* Goode & Bean from St. Johns River, Florida, and of specimens from Charleston, S. C., the type locality of *Atherina menidia* Linnæus, led to examination and comparison of specimens of *Menidia menidia* and *Menidia notata* from other localities ranging northward as far as Halifax, Nova Scotia, resulting in the discovery of the intergradation of the species of *M. notata* and *M. menidia*. Since *M. menidia* Linnæus (1766) has priority, the form called *M. notata* (Mitchill) must stand as *Menidia menidia notata* (Mitchill).

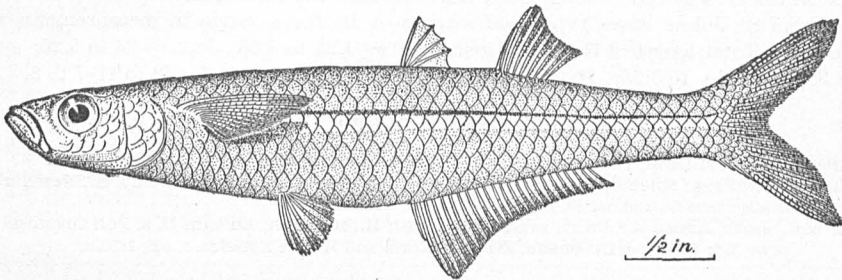
Beginning with the St. Johns River, *C. dentex* agrees most nearly with the description of *M. menidia*; northward the intergradation becomes more and more evident, reaching its height in the Chesapeake region, whence northward the characters

approach typical *M. notata*, agreeing perfectly in nearly all specimens north of Cape Cod.

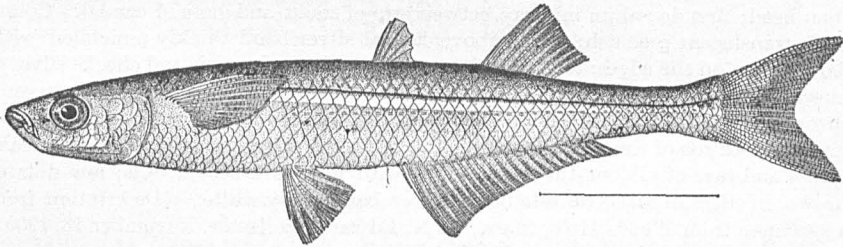
The differential characters heretofore considered specific were the more backward situation of the first dorsal, fewer scales in longitudinal and cross series, and the deeper body of *M. menidia*. From the accompanying comparative tables it will be seen that the scales increase in number, the first dorsal moves forward, and the body becomes more slender in many specimens from the successive northward localities.

In Chesapeake Bay the differential characters do not conform to the specific requirements; thus individuals with the backward position of the first dorsal have the slender bodies and more numerous scales of *M. notata* and vice versa. With specimens from Woods Hole agreeing perfectly with *M. notata*, mixed forms as well as perfect *M. menidia* are found, the majority being the *M. notata* form.

The range of *Menidia menidia*, as given by Jordan & Evermann in Fishes of North and Middle America, is from Cape Hatteras to Florida. Curiously, the range of *M.*



Menidia menidia (Linnaeus).



Menidia menidia notata (Mitchill).

notata, in the same work, is given south to Cape May, leaving an intervening space of many miles—Cape May to Hatteras—seemingly unoccupied by either form, but which is inhabited by the intergrading or mixed forms of *M. menidia* and *M. notata*.

The comparative tables appended represent localities covering the coast pretty fairly from St. Johns River, Florida, to Gloucester, Mass.; at least representative localities are shown sufficiently indicating the intergradation of the two forms. The intergradation, however, is not uniform. As has been said, and as may be seen from the tables, specimens have been taken in the Chesapeake which conform respectively to the descriptions of *M. menidia* and *M. notata*; at the same time others do not agree with the description of either, or rather partake of the characters of both forms to such an extent that it is impossible to say to which form it belongs. Specimens have been found at Wood Hole, even, which are essentially the *M. menidia* form. This is hardly an ideal intergradation, rather such as might be expected from the interbreeding of two closely related species and the occurrence of stragglers of either of the two forms or their hybrid offspring north or south of the point of the intermingling.

Menidia menidia (Linnæus).

Atherina menidia Linnæus, Systema Naturæ, vol. 1, ed. XII, 519, 1766, Charleston, S. C.; Lacépède, Histoire Naturelle Poissons, vol. v. 371.
Atherina bosci Cuvier & Valenciennes, Histoire Naturelle Poissons, x, 465, 1835.
Menidia dentex Goode & Bean, Proceedings U. S. National Museum, 1882, 429.
Menidia brasiliensis, Jordan & Gilbert, Synopsis, 408, 1883; not of authors.
Menidia menidia, Jordan & Evermann, Fishes of North and Middle America, 1, 800, 1896.

Head 4.66; depth 5; eye 3.25; snout 3.25; D. iv-i, 8; A. i, 22; scales 41-7. Mouth rather large; eye about equals snout; anal base .16 longer than head; origin of first dorsal nearer base of caudal fin than tip of snout. Color, light olivaceous; minute brown punctulations on the jaws, top of head, and around the posterior margin of the scales on the back. Silvery band along side about two-thirds the width of a scale of the series through which it runs. (Description taken from one of the types of *M. dentex*, 4.37 inches long, U. S. National Museum No. 18051.)

From St. Johns River types and cotypes of *M. dentex* range in measurements as follows: Total length 2.75 to 4.37 inches; head 4.25 to 4.66; depth 4.33 to 5.25; eye 3.33; snout 3+ to 3.33; D. iv to vi-i, 7 to 8; A. i, 20 to 24; scales 39 to 41-7 to 8.

Menidia menidia notata (Mitchill).

Atherina notata Mitchill, Trans. Literary and Philo. Society New York, 1, 1815, 446, New York.
Atherina viridescens Mitchill, Literary and Philosophical Society of New York, 1, 1815, 447, New York.
Atherinichthys menidia and *notata*, Günther, Cat., III, 406, 1861.
Menidia notata, Jordan & Gilbert, Synopsis, 407, 1883; H. M. Smith, Bulletin U. S. Fish Commission 1890, 690; Jordan & Evermann, Fishes of North and Middle America, 1, 800, 1896.

Total length 5.75 inches; head 4.66; depth about 6.66; eye 3.85; snout 3; dorsal v-i, 10; anal i, 23; scales 45-10. Pectoral about .16, and anal base about .2 longer than head; first dorsal fin midway between tip of snout and base of caudal. Color, back translucent greenish; scales above lateral silver band thickly punctated with dark brown on the edges; top of head, nose, and chin dusky; iris and cheeks silvery; lateral silver band from behind upper part of pectoral to base of caudal, passing through the fifth scale of oblique series below front of first dorsal, occupying the lower two-thirds of the scale; silvery band, bordered above by narrow black streak; spines and rays of all but the ventral fins with fine dark-brown dots; few dots of brown on edges of scales on side below silver band; belly white. (Description from a specimen from Woods Hole, Mass., V. N. Edwards, collector, November 13, 1900.)

Comparative tables of measurements of *Menidia menidia* and *Menidia menidia notata*.*

[Mouth of St. Johns River, Florida.†]

Length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.	Length of anal base compared with head.	Position of first dorsal.
Inch. 4.37	4.66	5	3.25	3.25	iv-1,8	1,22	41-7	.16 longer than head.	Nearer caudal than snout.
4.37	4.60	4.60	3.33	3.33	iv-1,7	1,21	39-8	.20 longer than head.	Do.
4.37	4.25	5.25	3.20	3.20	iv-1,8	1,24	40-8	About .20 longer....	Nearer caudal.
2.75	4.33	4.33	3+	3+	v-1,7	1,20	41-8	.....do	Do.
2.75	4.33	4.60	3+	3+	v-1,8	1,25	41-8	.....do	Do.
2.75	4.50	5	3+	3+	iv-1,7	1,23	40-8	.....do	Do.

*No attempt has been made to separate the two forms except by locality.
 †The specimens recorded from mouth of St. Johns River, Florida, are in the United States National Museum as types and cotypes of *Menidia dentex* Goode & Bean.

Measurements of Menidia menidia and Menidia menidia notata—Continued.

[Tybee Roads, Georgia, W. C. Kendall, collector.]

Length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.	Position of first dorsal.
<i>Inch.</i>								
3	4.50	6	2.60	3-	IV-1,7	1,21	39-6	Considerably nearer caudal than snout.
3.37	4.25	5.60	3+	3.20	IV-1,7	1,21	42-8	Somewhat nearer caudal.
3.37	4.68	5.80	3.20	3.20	IV-1,7	1,21	41-8	Much nearer caudal.
3.50	4.20	6	3+	3.20	VI-1,8	1,22	39-7	Considerably nearer caudal.
3.50	4.25	5.50	3.25	3+	IV-1,7	1,22	41-8	Some nearer caudal.
3.25	4.25	6-	3+	3+	IV-1,8	1,23	41-7	Slightly nearer caudal.
3.75	4.33	5.25	3+	3+	IV-1,8	1,21	39-8	Do.
3.75	4.25	5.50	3+	3+	IV-1,8	1,23	42-8	Considerably nearer caudal.
3.12	4	5.83	3+	3+	IV-1,8	1,23	41-8	Do.

[Scully Creek, South Carolina, W. C. Kendall, collector.]

3	.....	6	.....	.....	.....	1,22	39-7	Considerably nearer caudal.
3.75	.....	5.60	.....	.....	.....	1,22	41-8	Do.
3.12	.....	5.80	.....	.....	.....	1,22	39-8	Do.
3.25	.....	5.40	.....	.....	.....	1,22	41-8	Nearer caudal.
3.50	.....	6.50	.....	.....	.....	1,22	40-8	Considerably nearer caudal.
3.37	.....	5.66	.....	.....	.....	1,25	40-8	Do.
3.25	.....	5.75	.....	.....	.....	1,22	40-8	Do.
3.37	.....	5.50	.....	.....	.....	1,21	38-8	Slightly nearer.
3.25	.....	5.50	.....	.....	.....	1,22	39-8	Considerably nearer.
3.37	.....	5.66	.....	.....	.....	1,21	40-8	Slightly nearer.

[Charleston, South Carolina, R. E. Earll, collector.]

3.75	4.33	5.83	3.40	3.40	V-1,8	1,24	43-8	Nearer caudal.
4	4.50	5	3.33	3.33	IV-1,8	1,21	42-8	Do.
3.87	4.33	4.83	3.60	3.60	IV-1,7	1,23	42-8	Do.
3.50	4.50	5	3.25	3.25	V-1,7	1,24	41-8	Do.
3.25	4.25	5	3+	3+	V-1,7	1,21	42-8	Do.
3.56	4.40	5.60	3.20	3.20	IV-1,8	1,23	42-7	Do.

[Winyah Bay, South Carolina, W. C. Kendall, collector.]

3	.....	6.33	.....	.....	.....	1,23	42-8	Nearer caudal.
3	.....	6.16	.....	.....	.....	1,22	40-7	Slightly nearer caudal.

[Fort Macon, N. C., W. C. Kendall, collector.]

4.75	5	5+	3.20	3.20	V-1,9	1,23	44-8	Midway between tip of snout and base of caudal.
4.25	5	5.83	3.20	3.20	IV-1,8	1,22	45-8	Do.
4.75	4.80	4.80	3.20	3.20	IV-1,9	1,24	45-9	Slightly nearer tip of snout.
4.25	5	5+	3.25	3.25	V-1,9	1,24	45-8	Midway between tip of snout and base of caudal.
4.25	5	5.25	3.25	3+	V-1,7	1,21	45-6	Do.
4.12	4.80	4.80	3.20	3.20	IV-1,8	1,25	41-8	Do.
3.87	5	5	3.16	3-	IV-1,9	1,23	43-8	Slightly nearer base of caudal.
4.25	4.66	4.66	3.25	3.25	V-1,8	1,22	44-9	Midway between tip of snout and base of caudal.
3.87	.....	6-	.....	.....	.....	1,26	42-8	Slightly nearer caudal.
3.50	.....	5.16	.....	.....	.....	1,23	42-8	Do.
3.50	.....	4.66	.....	.....	.....	1,25	43-8	Do.
3.62	.....	5.75	.....	.....	.....	1,22	43-8	Considerably nearer caudal.
3	.....	5.60	.....	.....	.....	1,22	42-7	Do.
3.37	.....	5.80	.....	.....	.....	1,21	42-8	Do.
3	.....	5.60	.....	.....	.....	1,22	40-7	Midway between tip of snout and base of caudal.
3.25	.....	5.57	.....	.....	.....	1,23	40-8	Considerably nearer caudal.
3.62	.....	5.25	.....	.....	.....	1,22	41-8	Do.
3.75	.....	5.25	.....	.....	.....	1,24	42-8	Slightly nearer caudal.

[Wilmington, N. C. (U. S. National Museum).]

3.62	3.50	5.40	3.33	3.33	V-1,9	1,22	40-8	Nearer caudal.
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Measurements of *Menidia menidia* and *Menidia menidia notata*—Continued.

[Fortress Monroe, Va., W. C. Kendall, collector.]

Length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.	Position of first dorsal.
<i>Inch.</i>								
3.75	4.50	5.60	3.25	3.25	v-1, 7	1, 24	46-9	Considerably nearer base of caudal.
3.75	4.50	5.60	3.20	3.25	v-1, 8	1, 20	45-8	Do.
4	4.50	5.60	3.25	3.2	iv-1, 10	1, 26	46-8	Do.
4.50	5.20	6	3.25	3.25	iv-1, 9	1, 27	46-9	Midway between tip of snout and base of caudal.
3.25	4.50	5.33	3.25	3.25	iv-1, 9	1, 21	46-8	Do.
2.25	4+	6.20	3	3.25	iv-1, 9	1, 21	42-8	Nearer caudal.
2	4.25	5.25	3	3	v-1, 9	1, 22	44-8	Midway between tip of snout and base of caudal.

[Mouth of Rappahannock River, Virginia, W. C. Kendall, collector.]

2.50	4.33	5	3.25	3.25	iv-1, 9	1, 21	43-10	Midway between tip of snout and base of caudal.
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[Cape Charles City, Va., W. C. Kendall, collector.]

3.75	4.25	5.25	3.25	3.25	iv-1, 8	1, 22	44-8	Midway between tip of snout and base of caudal.
2.50	4.25	4.60	2.83	3.25	v-1, 8	1, 23	42-8	Do.
2.25	4.16	5	3	3.25	iv-1, 9	1, 24	42-8	Slightly nearer caudal.

[Woods Hole, Mass., V. N. Edwards, collector.]

4.75	4.60	6+	3.20	3.20	v-1, 9	1, 22	48-10	Midway between tip of snout and base of caudal.
4	5	6	3.20	3.20	iv-1, 8	1, 23	46-10	Do.
3.50	4.60	5.50	3.33	3.33	v-1, 8	1, 23	45-8	Do.
3.81	4.75	6.25	3.60	3.60	v-1, 9	1, 23	47-10	Somewhat nearer caudal.
4	4.50	7.08	3.80	2.71	v-1, 9	1, 25	48-10	Somewhat nearer snout.
3.74	4.44	6.66	3.60	3	v-1, 9	1, 23	46-10	Somewhat nearer caudal.
3.62	4.60	6.50	3.40	3	v-1, 10	1, 24	47-10	Midway between tip of snout and base of caudal.
4.06	4.60	6.75	3.80	3.16	iv-1, 9	1, 23	43-9	Do.
4	4.66	6.07	3.60	3	iv-1, 9	1, 23	43-9	Do.
4.25	4.75	7	3.80	3.16	iv-1, 9	1, 27	48-9	Considerably nearer caudal.
4.81	5	6.20	3.50	3	iv-1, 8	1, 23	46-8	Considerably nearer tip of snout.
5.25	4.50	4.75	4.16	2.68	v-1, 9	1, 24	46-9	Somewhat nearer caudal.
4.87	4.50	6.75	4	3	iv-1, 10	1, 23	46-10	Slightly nearer tip of snout than caudal.
5.06	4.62	6.50	3.50	3	v-1, 9	1, 25	48-10	Midway between tip of snout and base of caudal.
5.12	4.75	6.11	3.28	2.87	v-1, 10	1, 22	44-9	Do.
5.25	4.60	6.75	4.16	3.12	v-1, 10	1, 24	46-9	Do.
5.25	4.50	6.71	3.57	3.12	v-1, 9	1, 25	49-9	Do.
5.37	4.87	5.95	4.16	3.12	v-1, 9	1, 24	46-9	Do.
5.25	4.60	6.33	4.16	3.12	v-1, 9	1, 24	47-10	Do.
5.75	4.71	6.75	3.86	3	v-1, 10	1, 23	49-10	Somewhat nearer caudal.

[Gloucester, Mass., W. C. Kendall, collector.]

3.12	4.75	6.20	3+	3+	v-1, 9	1, 27	46-10	Midway between tip of snout and base of caudal.
3	4.75	6.25	3.20	3.20	v-1, 8	1, 23	46-9	Do.
2.37	4.50	6	3	3	v-1, 9	1, 25	46-9	Slightly nearer tip of snout.
2.75	4.33	5.75	3.20	3.20	v-1, 10	1, 27	45-9	Do.
2.60	4.33	6.20	3	3	v-1, 10	1, 25	43-9	Do.
3.25	4.50	6+	3.25	3.25	v-1, 9	1, 27	49-12	
2.87	4.60	6.75	3.16	3.16	v-1, 8	1, 23	49-9	
2.12	4.60	6.50	3+	3+	v-1, 10	1, 29	47-10	
2	4.40	6.20	3.20	3.20	v-1, 9	1, 26	43-9	
2.50	4.50	6+	3.20	3.20	v-1, 8	1, 26	40-9	
2.25	4.50	6+	3+	3+	v-1, 9	1, 23	43-9	
2.50	4.40	5.75	3+	3+	v-1, 9	1, 26	48-9	
2.37	4.40	7+	3+	3+	v-1, 10	1, 27	48-9	
2.37	4.60	7.50	3+	3+	iv-1, 11	1, 25	48-9	

Comparative table of average measurements of *Menidia menidia* and *M. menidia notata*.

No. of specimens.	Locality.	Total length.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.
		<i>Inch.</i>							
7	Mouth of St. Johns River, Fla	3.37	4.47	4.75	3.13	3.13	IV-1, 8	1, 22	40-8
9	Tybee Roads, Ga.	3.20	4.27	5.72	3+	3+	IV-1, 8	1, 22	40-8
10	Scull Creek, S. C.	3.32		5.80				1, 22	40-8
6	Charleston, S. C.	3.66	4.38	5.03	3.31	3.31	V-1, 7	1, 22	42-8
2	Winyah Bay, S. C.	3		6.25				1, 22	41-8
8	Fort Macon, N. C.*	4.81	4.90	5.13	3.21	3.16	V-1, 8	1, 23	44-8
11	Chesapeake Bay*	3.03	4.40	5.27	3.20	3.22	IV-1, 8	1, 23	44-8
20	Woods Hole, Mass., and vicinity* . .	4.21	4.69	6.36	3.67	3.06	V-1, 9	1, 23	45-9
14	Gloucester, Mass.	2.72	4.50	6.39	3.09	3.09	V-1, 9	1, 25	46-9

*Mixed characters.

From St. Johns River, specimens present the following measurements: Total length 2.75 to 4.37 inches; head 4.25 to 4.66; depth 4.33 to 5.25; eye 3.33; snout 3+ to 3.33; D. IV to VI-1, 7 to 8; A. I, 20 to 24; scales 39 to 41-7 to 8.

From Tybee Roads, Ga.: Total length 2.75 to 3.75 inches; head 4 to 4.66; depth 5.25 to 6; eye 2.6 to 3.2; snout 2.83 to 3.2; D. IV to VI-1, 7 to 8; A. I, 21 to 23; scales 39 to 42-6 to 8.

From Scull Creek, S. C.: Total length 3 to 3.75 inches; depth 5.5 to 6; A. I, 21 to 22; scales 38 to 41.

From Charleston, S. C.: Total length 3.25 to 4 inches; head 4.25 to 4.5; depth 4.83 to 5.33; eye 3+ to 3.6; snout 3+ to 3.6; D. IV to V-1, 7 to 8; A. I, 21 to 24; scales 41 to 43-8.

From Fort Macon, N. C.: Total length 4.66 to 5 inches; head 4.66 to 5; depth 4.66 to 6—; eye 3.16 to 3.25; snout 3—to 3.25; D. IV to V-1, 7 to 9; A. I, 21 to 26; scales 40 to 45-7 to 9.

From Chesapeake Bay: Total length 2 to 4.5 inches; head 4+ to 5.2; depth 5 to 6; eye 2.83 to 3.25; snout 3 to 3.25; D. IV to V-1, 8 to 10; A. I, 20 to 27; scales 42 to 46-8 to 10.

Woods Hole and vicinity: Total length 2.5 to 5.75 inches; head 4.44 to 5; depth 5.5 to 7; eye 3.2 to 4.16; snout 2.8 to 3.33; D. IV to VI-1, 8 to 10; A. I, 22 to 25; scales 43 to 49-8 to 10.

From Gloucester, Mass.: Total length 2 to 3.25 inches; head 4.33 to 4.75; depth 5.75 to 7.5; eye 3 to 3.25; snout 3 to 3.25; D. IV to V-1, 8 to 11; A. I, 23 to 27; scales 43 to 49-9 to 12.